APPENDIX A-PAUSD1

Comment Letter A-PAUSD1 Attachment

ATTACHMENT A

DECISION INSITE

Enrollment Impact Specialists

Annual Enrollment Projection Report

Strategic Decision Support for School Districts

Student Enrollment Projections | Community Demographic Data | Consulting

ANALYSIS OF ENROLLMENT PROJECTIONS

FALL 2018

PREPARED FOR:
PALO ALTO UNIFIED SCHOOL DISTRICT

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SUBMITTED: JANUARY 10, 2018

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PALO ALTO UNIFIED SCHOOL DISTRICT

EXECUTIVE SUMMARY

ENROLLMENT PROJECTIONS - FALL 2018

DecisionInsite is pleased to present this report of findings to the Board of Education and Executive Staff of Palo Alto Unified School District. Both a Conservative and Moderate projection have been generated for the district. Assuming district revenue is generated on a per pupil basis, the Conservative projection is more suitable for budget planning purposes while the Moderate projection is more suitable for facilities planning purposes.

KINDERGARTEN ENROLLMENT

In general, Kindergarten enrollment over the past three years has been somewhat erratic. The data also show that the difference between the graduating cohort and the incoming cohort has been somewhat erratic. Note that both studies project an increase at the Kindergarten level.

COHORT PATTERNS

A typical student cohort ages from grade to grade relatively unchanged from the previous year. Historically, no cohorts show more than a 5% annual change.

NEW HOUSING DEVELOPMENT

Approximately 1,000 new residential units are projected to be occupied over the next 5 years. During that period, the annual impact in any given year, based on the Moderate Study, is estimated in peak years to be 326 students.

DISTRICT-WIDE ENROLLMENT PROJECTION

Overall the projections forecast a relatively stable trend across the 5-year period based upon the historical enrollment trends and any projected new residential development.

MORE INFORMATION

A richer and more comprehensive review of both studies is contained in the Final Report accompanying this Executive Summary. A wealth of more detailed information and analysis regarding both studies is also quickly and easily accessible online.

Respectfully Prepared and Submitted by:

The **DecisionInsite** Team

January 10, 2018

PALO ALTO UNIFIED SCHOOL DISTRICT

DISTRICT ENROLLMENT PROJECTIONS

RECENT CHANGES IN ENROLLMENT

Familiarity with recent historical enrollment patterns and trends establishes the foundation for understanding projected enrollment. Percentages in the table below compare the current year enrollment to that of three years ago.

4 Year History Change	
Kindergarten	87%
Gr K-5	90%
Gr 6-8	103%
Gr 9-12	105%
District	98%

[Kindergarten calculation based on a 12-month cohort equivalent.]

FIGURE 1

KINDERGARTEN IMPACT

Kindergarten enrollment is a significant driver of overall future district-wide enrollment. A trend at Kindergarten from year to year, or a trend in the difference between the district's graduating cohort in a given year and the Kindergarten cohort the subsequent year, will eventually be reflected in the total district enrollment count. (Note that these projections reflect changes in age eligibility for California Kindergarten. The result is a diminished Kindergarten cohort in years 2012-2014, with similar reductions in other grade levels as those cohorts age through the system.)

In general, Kindergarten enrollment over the past three years has been somewhat erratic. The data in the table below also show that the difference between the graduating cohort and the incoming cohort has been somewhat erratic.

[More details: Reports > History > District-wide > History Years Enrollment]

Percent Change of Previous Year			
	2015	2016	2017
Kindergarten	90%	93%	104%
Grade 12 to K	89%	78%	87%
Total K-12	99%	98%	100%

[Kindergarten calculations in first two rows based on a 12-month cohort equivalent.]

FIGURE 2

Transition K enrollment is forecast as a separate grade level. Transition K is projected to be as much as three times the enrollment of the first year of the program, but never to exceed 25% of the projected Kindergarten enrollment.

[All data in this report excludes Transition K unless specifically noted. More details: Reports > Projections > District-wide > Transition Kindergarten]

Live Birth Trends

Live birth trends have an impact in large geographies, and on long range projections. However, in smaller areas of study, such as a school district, population mobility is often a mitigating if not an overriding factor, thereby reducing the effectiveness of live births as a predictor of enrollment. Consequently, DecisionInsite has found that recent Kindergarten enrollment trends by sub-geographies to be a better, more reliable predictor of future Kindergarten enrollment.

Cohort Impact

A typical student cohort ages from grade to grade relatively unchanged from the previous year. By contrast, the cohort matriculating from Kindergarten to Grade 1 is a common example of a cohort increase, typically attributable to students returning from a private school.

In the following table, cohort changes with more than a 2% variance from static are marked accordingly. Those with more than a 5% changed are marked as 'Significant'.

Average Cohort Change Past Three Years			
Cohort	Percent	+/-	Significant
K > 1	99%		
1 > 2	102%	++++	
2 > 3	101%		
3 > 4	101%		
4 > 5	101%		
5 > 6	97%	----	
6 > 7	101%		
7 > 8	102%	++++	
8 > 9	103%	++++	
9 > 10	100%		
10 > 11	98%		
11 > 12	98%	----	

FIGURE 3

Incoming Out-of-District Transfer Impact

The number of students served from outside the district boundaries can impact enrollment. It is a factor over which the district may have some control. For the past two years, the number of out-of-district students served annually has been approximately 917, and has been relatively stable.

[More details: Reports > History > District-wide > Out of District]

Key Variables in Projecting District Enrollment

Both a Conservative and Moderate projection have been generated for the district. Assuming district revenue is generated on a per pupil basis, the Conservative projection is more suitable for budget planning purposes while the Moderate projection is more suitable for facilities planning purposes.

As a matter of standard practice, DecisionInsite does not typically include specialized schools or programs such as Home and Hospital Programs, Community Day Schools or Independent Study Programs in the Enrollment Projections. Our work is focused on projecting grade level enrollment for typical schools that are reported to the state.

The major variables that distinguish the Conservative projection from the Moderate are described in the table below.

Key Variables Controlling the Projections Algorithm	
Kindergarten Enrollment Change	Applies the lesser or greater of 3-4 year history trend in each studyblock to the appropriate study.
Cohort Change	Applies the lesser or greater of 3-4 year history trend in each studyblock to the appropriate study.
K Enrollment Change Cap	Restricts the effect of anomalous spikes in Kindergarten history
K Enrollment Change Floor	Restricts the effect of anomalous spikes in Kindergarten history
Incoming Out-of-District Transfers	For each grade level span, applies the lesser or greater of 1-2 year history to the lograde; ages through existing students.
Dwelling Units	Moderate study assumes developer's phasing calendar. Conservative study shifts the developer's calendar toward the out-years.
Student Generation Rates	Typical of recent history by product type.

FIGURE 4

Impact of Projected New Dwelling Units

Projected Occupancy

Approximately 1,000 new residential units are projected to be occupied over the next 5 years. The tables below show the mix of proposed units across the three dwelling unit types. The Moderate table summarizes the plans described by developers while the Conservative table estimates a more likely scenario based on anticipated market conditions. The most recent residential research was completed in January 2018 by Hayley Rigali.

[More details: Residential > Reports > Proposed Dwelling Units]

New Dwelling Units Projected to be Occupied by Year (Moderate)	2018	2019	2020	2021	2022
Multi-family	82	18	107		117
Attached	62	74	8	266	266
Detached		9	10		
Totals:	144	101	125	266	383

FIGURE 5

New Dwelling Units Projected to be Occupied by Year (Conservative)					
	2018	2019	2020	2021	2022
Multi-family	57	37	70	43	59
Attached	44	55	40	155	152
Detached		6	6	5	2
Totals:	101	98	116	203	213

FIGURE 6

The graph below depicts visually the differences between the phasing projected in the Moderate and Conservative studies.

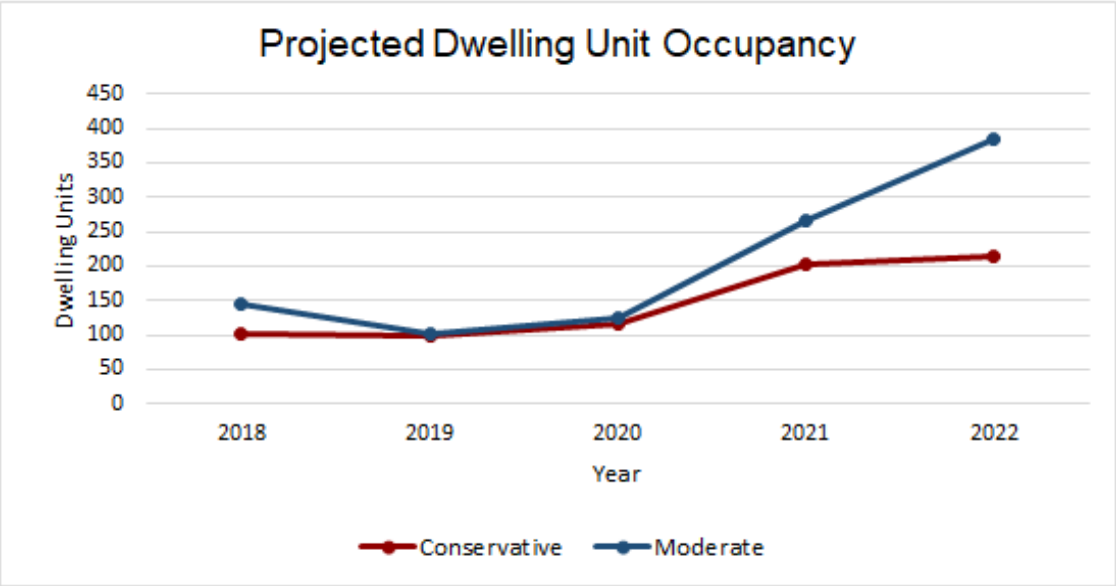

FIGURE 7

STUDENTS GENERATED

Over the period of years during which these units will become occupied, the impact, based on the Moderate scenario, is shown in the table below. The "Annual" row projects the number of students new to the district from these units, in a given year. The "Aggregate" row projects the accumulated increase in students served by the district through the year indicated.

Students Generated by Residential Development (Moderate)					
	2018	2019	2020	2021	2022
Aggregate		196	295	528	854
Annual	107	89	99	233	326

FIGURE 8

The table below reflects the students generated using the Conservative estimate of projected Dwelling Units.

Students Generated by Residential Development (Conservative)					
	2018	2019	2020	2021	2022
Aggregate		155	251	426	608
Annual	75	80	96	175	182

FIGURE 9

Student Generation Rates

Moderate student generation rates are typical of students enrolled from existing developments of similar product type. Conservative student generation rates, if different, are designed to anticipate a diminution in family size.

[More details: Residential > Reports > Student Generation Rates]

A complete report regarding new residential development is available online in the DI System under 'Reports > District Documents > Residential Research Summary xxxx' where xxxx is the projection year the report is associated with. This report includes a map of proposed dwelling unit projects, the phasing by dwelling unit type in each project, students generated by new development by studyblock, student generation rates. Additional individual reports can be found online in the DI system under 'Residential > Reports'.

Projected Enrollment Changes by Level

The tables below display the five-year district-wide projections by grade level and allow a comparison to enrollment in the current year.

Conservative 5 Year District-wide Projection by Grade Level

Grade	2017	2018	2019	2020	2021	2022
TK	46	42	42	42	43	43
K	785	778	776	779	791	795
1	756	784	772	770	781	794
2	829	785	813	802	808	811
3	858	848	801	831	827	828
4	869	871	860	813	850	844
5	920	870	872	864	821	860
6	940	905	854	845	846	807
7	1023	952	916	865	862	859
8	1025	1048	975	940	890	880
9	1068	1057	1077	999	972	918
10	1014	1071	1061	1081	1009	983
11	969	997	1052	1046	1069	1005
12	947	951	979	1033	1027	1056
Subtotals:	12049	11959	11850	11710	11596	11483
Pct Chg:	-0.5%	-0.7%	-0.9%	-1.2%	-1.0%	-1.0%

FIGURE 10

MODERATE 5 YEAR DISTRICT-WIDE PROJECTION BY GRADE LEVEL

Grade	2017	2018	2019	2020	2021	2022
TK	46	43	43	44	45	46
K	785	795	803	814	837	861
1	756	797	799	807	832	863
2	829	793	832	834	857	878
3	858	860	817	859	874	895
4	869	881	878	835	889	906
5	920	879	888	887	853	912
6	940	913	868	867	878	850
7	1023	959	930	884	892	904
8	1025	1055	987	959	917	920
9	1068	1069	1097	1024	1005	965
10	1014	1078	1078	1106	1042	1028
11	969	1004	1065	1068	1104	1051
12	947	958	991	1052	1057	1100
Subtotals:	12049	12084	12076	12040	12082	12179
Pct Chg:	-0.5%	0.3%	-0.1%	-0.3%	0.3%	0.8%

FIGURE 11

As the following graph illustrates, overall the projections forecast a relatively stable trend across the 5-year period based upon the historical enrollment trends and any projected new residential development.

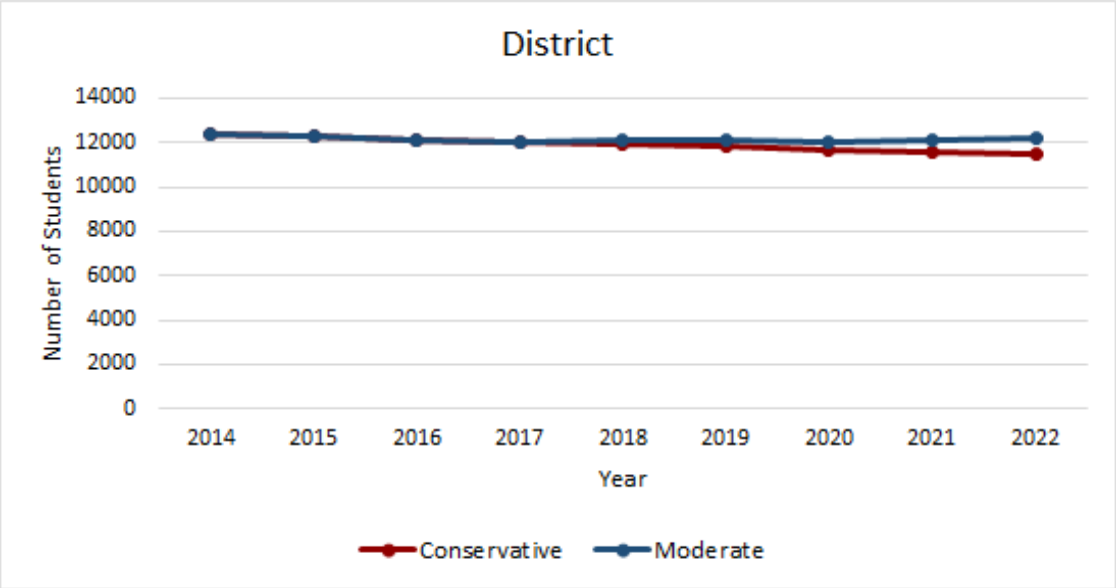

FIGURE 12

The tables below compare the Conservative and Moderate enrollment projections by key grade level groupings. Projected changes in enrollment at Kindergarten or lower grade level groupings will eventually impact total district enrollment.

5 Year Enrollment Trends: Moderate and Conservative Compared

Change by Level	Cnsv	Mod
Kindergarten	795	861
Change	101%	110%
Gr K-5	4932	5315
Change	98%	106%
Gr 6-8	2546	2674
Change	85%	89%
Gr 9-12	3962	4144
Change	99%	104%
District	11440	12133
Change	95%	101%

FIGURE 13

Note that an averaging of both studies project an increase at the Kindergarten level.

The graphs below compare the Conservative and Moderate enrollment projections by key grade level groupings.

Elementary School Level

The projected elementary school enrollment shows a slight increase.

[More details: Reports > Projections > Individual Schools > Projections > All Elementary Schools]

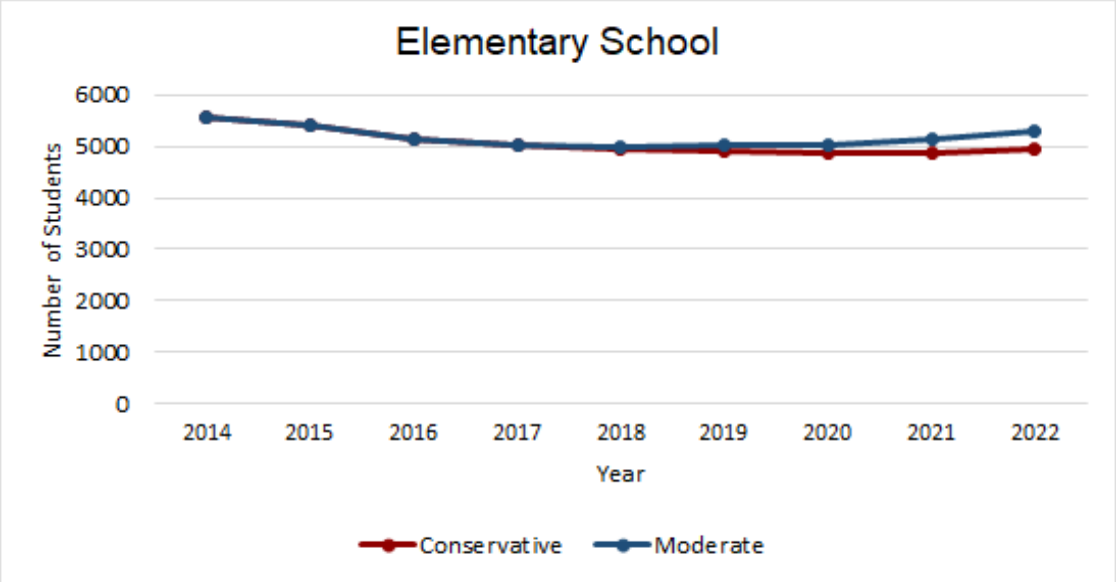

FIGURE 14

Middle School Level

The projected middle school enrollment shows a significant decline.

[More details: Reports > Projections > Selected Schools > All Middle Schools]

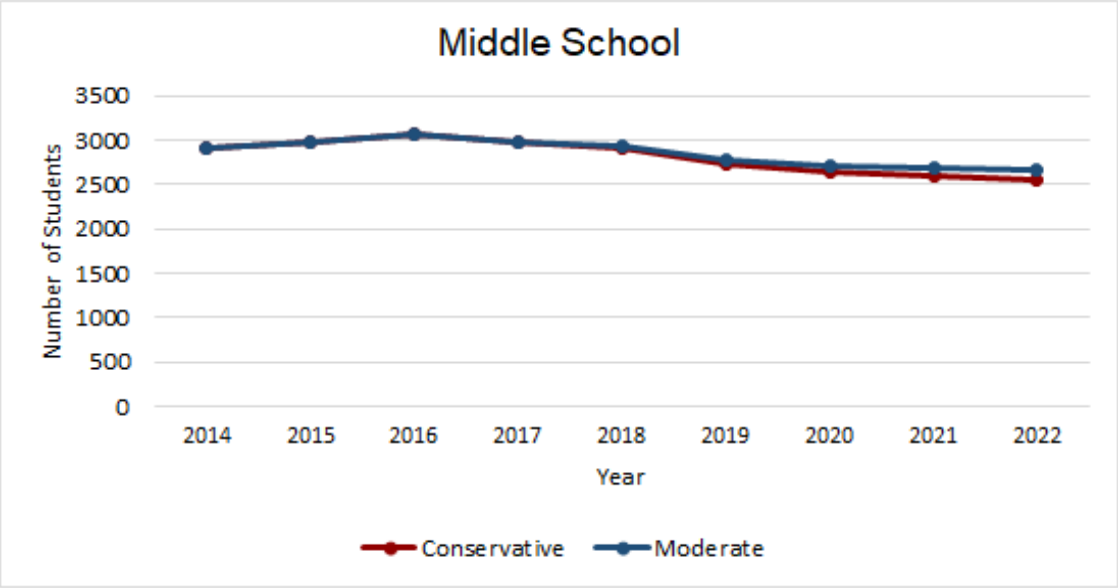

FIGURE 15

High School Level

The projected high school enrollment shows a relatively stable trend.

[More details: Reports > Projections > Selected Schools > All High Schools]

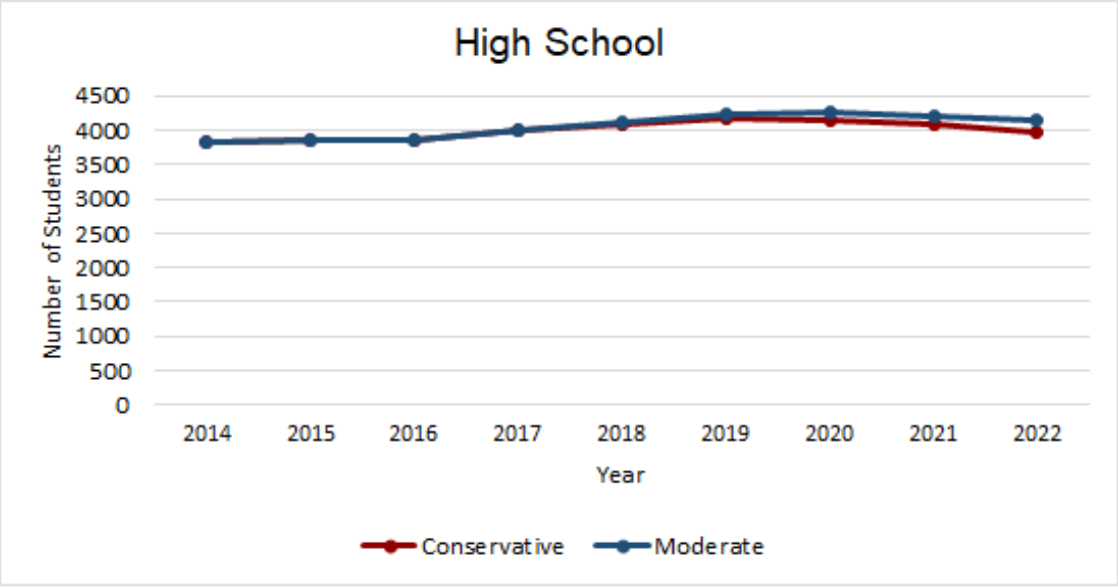

FIGURE 16

Summary of District Projections by Year

The complete district-wide projection table for each study is available online. Corresponding sets of individual School Projections are available online as well.

The tables below present a more detailed annual view of projected changes by grade level clusters for both projections. The "Pct Previous Year" row represents the percent of the previous year's enrollment in each grade cluster that is projected in the subsequent year. The "Five Year Change" row represents the percent change projected over the enrollment five years prior.

Conservative Projection

Change by Level	2017	2018	2019	2020	2021	2022
Kindergarten	785	778	776	779	791	795
Pct Prev Yr	104%	99%	100%	100%	102%	101%
5-Yr Change						101%
Gr K-5	5017	4936	4894	4859	4878	4932
Pct Prev Yr	98%	98%	99%	99%	100%	101%
5-Yr Change						98%
Gr 6-8	2988	2905	2745	2650	2598	2546
Pct Prev Yr	97%	97%	94%	97%	98%	98%
5-Yr Change						85%
Gr 9-12	3998	4076	4169	4159	4077	3962
Pct Prev Yr	104%	102%	102%	100%	98%	97%
5-Yr Change						99%
District	12003	11917	11808	11668	11553	11440
Pct Prev Yr	100%	99%	99%	99%	99%	99%
5-Yr Change						95%

NOTE: Gray column most recent history year.

FIGURE 17

MODERATE PROJECTION

Change by Level	2017	2018	2019	2020	2021	2022
Kindergarten	785	795	803	814	837	861
Pct Prev Yr	104%	101%	101%	101%	103%	103%
5-Yr Change						110%
Gr K-5	5017	5005	5017	5036	5142	5315
Pct Prev Yr	98%	100%	100%	100%	102%	103%
5-Yr Change						106%
Gr 6-8	2988	2927	2785	2710	2687	2674
Pct Prev Yr	97%	98%	95%	97%	99%	100%
5-Yr Change						89%
Gr 9-12	3998	4109	4231	4250	4208	4144
Pct Prev Yr	104%	103%	103%	100%	99%	98%
5-Yr Change						104%
District	12003	12041	12033	11996	12037	12133
Pct Prev Yr	100%	100%	100%	100%	100%	101%
5-Yr Change						101%

NOTE: Gray column most recent history year.

FIGURE 18

Grade Level Profile Comparison

Another view of grade level enrollment can be seen in the chart below. The current grade level enrollment profile is compared with the projected grade level profile in the five-year future.

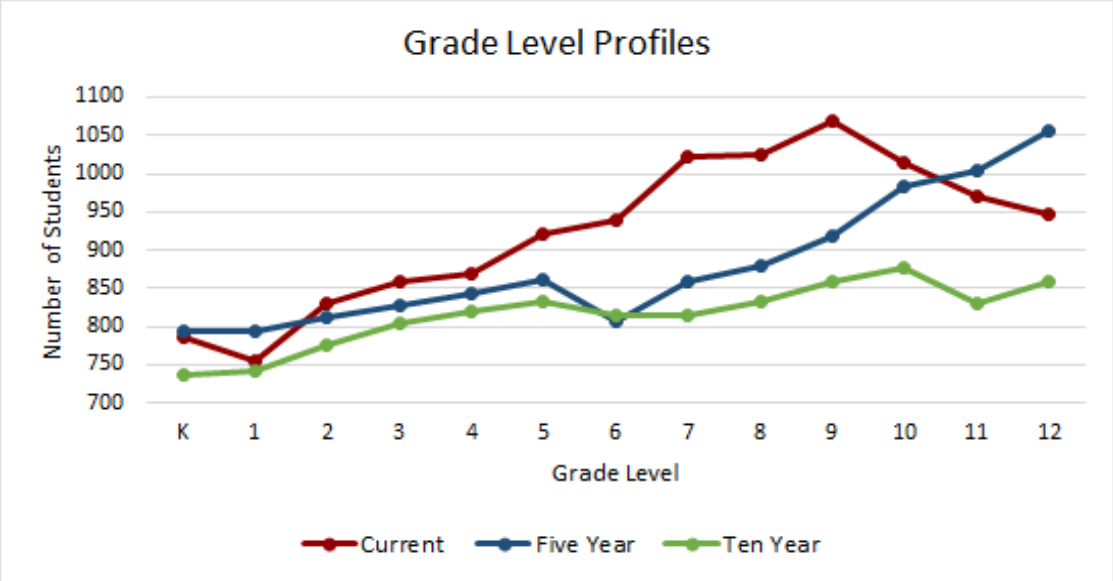

FIGURE 19

Projecting School Enrollment

School projections are primarily a function of the proportion of district students who enroll at a given school, modified by intra-district transfers within a given school level that may occur subsequent to initial enrollment, and augmented by inter-district transfer students.

School Draw Impact

A draw rate is the percentage of students who enroll at a particular grade level in a given school from a specified geographic area. Open enrollment among district schools is projected using this concept. Except for changes in school boundaries or other changes in policy, historical draw rates from a given geographic area to a specific school (including out-of-district students) are assumed in the projections.

Intra-district Transfers

Transfers within the district are incorporated into the projections in order to anticipate the movement of students from one district school to another within the same level, e.g., transfer from a neighborhood school to a special school. Recent historical transfer patterns are typically assumed in the projections.

[More details: Reports > History > All Schools > Open Enrollment]

Inter-district Transfers

Transfers into the district by out-of-district students, sometimes referred to as 'permit students', are an integral part of the district and school projections. Recent historical transfer patterns are typically assumed in the projections.

[More details: Reports > History > District-wide > Out of District]

Individual School Projection Tables

The complete set of individual school projection tables for each study is available online.

[More details: Reports > Projections > All Schools > Projections]

MySchoolLocator

MySchoolLocator is a web-based service accessible to DecisionInsite clients. This service allows Internet users to enter a residential address, and find out which district schools are assigned to serve them. Public access to MySchoolLocator is via a unique URL on the District's web site. The URL for integration into your district's website can be found by opening the appropriate Locator study from within the DI system. Once open, select "Run MySchoolLocator" from the District Admin menu. The MySchoolLocator app will open in a new browser window and the link can be copied from the address bar in the browser. Specialized district users have access to customize the messages seen by those using MySchoolLocator.

Impact of the Projections on School Capacity

Facility challenges, if any, may exist if projected numbers exceed the current school capacity data. These challenges may also manifest differently in a Moderate or Conservative projection. The Moderate projection shows 6 schools with a potential capacity challenge.

[More details: Reports > Projections > All Schools > Over Capacity]

The table below lists up to five schools that are projected to experience the most change in enrollment in the 5-year future based on the Conservative projection.

[More details: Reports > Projections > All Schools >Ten Percent Change]

School	5-Yr Pct Change
Juana Briones ES	20%
Fairmeadow ES	-20%
Jane Lathrop Stanford MS	-18%
David Starr Jordan MS	-18%
Addison ES	-17%

FIGURE 20

Impact of SDC Students on Capacity

Relative to the impact of SDC students on school capacity, note that SDC students are not included in the grade level counts, but are included in the capacity calculation as taking up one seat each.

Analyzing/Studying/Reviewing the Enrollment Projections

The projections of district and school enrollment are based on a complex mix of historical data, the projection of recent trends, and specific assumptions regarding the future. At DecisionInsite, we strongly encourage our clients to actively engage with the data with the aim of better understanding, further refining, and using the results to inform decisions about to be made. We believe increased effectiveness for both the district and DecisionInsite comes with increased and welcome dialogue.

Graphs or tables may be copied from the PDF version of this document using the Snapshot Tool inside PDF Reader.

Please do not hesitate to contact DecisionInsite regarding any questions or suggestions that may arise regarding these studies.

Respectfully Prepared and Submitted by:

The **DecisionInsite** Team

January 10, 2018

APPENDIX

ASSUMPTIONS AND METHODOLOGY

All projections are based on assumptions, and when read or shared are best prefaced with the phrase, "Based on these assumptions…", or "Based on these historical trends…". In general, "Enrollment Trend" is a far more accurate descriptor.

Three major factors drive district-wide student enrollment projections. These include:

1. recent kindergarten enrollment trends, modified by live birth data, if applicable,
2. changes in the grade level cohorts of students served as they age through, and
3. changes in the number of residential units within the district.

District-wide projections are disaggregated to school projections based on the historical patterns of:

1. the rates at which each school draws enrollment from various sections of the district, and
2. the pattern of transfers within the district at a given level from one school to another.

DISTRICT PROJECTIONS

Studyblocks

For enrollment projections the district is divided into studyblocks. A studyblock is a custom unit of geography created by DecisionInsite for the purpose of generating reliable projections. They are generally based on elementary boundaries or some portion thereof. A studyblock serves as the basis for the analysis of students served by the district and by schools. The objective is to do analysis with a small enough geographic unit to sense small area changes but large enough to allow for reliable projection. Studyblocks typically encompass 500–1000 students.

Kindergarten Enrollment

The projected Kindergarten enrollment is a key variable in projecting K–12 enrollment. The base Kindergarten projection is determined by the trend of Kindergartners served in each studyblock in the previous 3 or 4 years. Depending on the circumstances, a growth trend in Kindergarten enrollment may be capped. Steep straight-line trends are mathematically moderated to avoid unrealistic results.

School Capacities

School capacities provided by the district are compared to projected enrollments. Districts are invited to calculate school capacities in a manner that best serves the enrollment projection environment, and enter them into the DI System.

A Special Day Class (SDC) student at the elementary level is calculated by default as requiring 1 seat. This value, at district option, may be changed to 3, on the assumption that a class of 10 SDC students will occupy a typical classroom.

Students in the Projections

Enrollment projections are limited to typical K–12 students. SDC students are projected as a stable percentage of the typical population unless all SDC students are mainstreamed. Excluded from the projections are students enrolled in Non-Public School (NPS), Adult High School, Home School, Adult Ed, Independent Study programs and other special schools.

Attendance Boundaries

Attendance boundaries are assumed to remain constant, unless otherwise noted by the district.

Closed Schools
Opportunities for open enrollment (intra-district) are assumed to remain unchanged, unless otherwise noted by the district.

Inter-district Enrollment
Students enrolled from other school districts are treated in aggregate in separate studyblocks. Students in Kindergarten and the initial grade at each level are projected only to the extent they exist in recent years. Students enrolled in other grade level cohorts are aged through to the highest grade at each level. These defaults may be modified at district request.

Cohort Percent Change
Cohort percentage changes are calculated in order to assure sensitivity to perennial changes in students served by the district as they age from one grade level to the next. If every cohort were stable as it ages, the cohort percent change, from one grade to the next in each studyblock, would be calculated as 100%. For each studyblock, a cohort weighted average percent change over a defined number of years is calculated based on the change in the enrollment served as it ages from the previous grade level.

Average cohort percentages above 100% might, for example, reflect students returning from private schools. Cohort percentages below 100% might reflect drop-outs.

Growth studyblocks are those showing unusually high increases in enrollment and/or cohort percent change in recent years—due, typically, to new housing development. Once growth studyblocks are identified, their default cohort percent change rate is set to 100% so as not to over-project new residential growth. By default, growth is not predicted to continue unless new occupied dwelling units are projected.

Dwelling Unit Impact
The predicted impact of new dwelling units on school enrollment is based on three factors: 1) new dwelling units, 2) the student generation rate for each unit type, and 3) the grade level distribution of newly generated students.

1. Dwelling Units
New dwelling units are categorized into 3 housing types: Single Family Detached, Single Family Attached, and Multifamily. Developers and builders are contacted for information relative to their plans for occupancy of new dwelling units.

2. Student Generation
Student generation rates are determined for each product type for each level: elementary, middle school and high school. Student generation rates are based on similar products types where such exist; otherwise, a default generation rate is used.

3. Grade Level Distribution
For each level, students generated by new dwelling units are distributed across grade levels. These percentages are based on historical patterns where they exist; otherwise, default percentages are used.

SCHOOL PROJECTIONS

Projecting enrollment at the school level is based on the concept of a school draw rate, i.e., the percent of students from a given studyblock who enroll in a given school at its lowest grade. Draw rates reflect the impact of open enrollment within a district. For example, if one-half the sixth-graders from a given studyblock enroll in a particular 6–8 middle school, that school has a draw rate of 50% from that studyblock.

The draw rate for the most recent year is applied by default to the projected district enrollment for that grade from a given studyblock. The draw rate ages with the cohort. In this way, if the underlying cohort changes, the number of students enrolled at the school will change accordingly.

Draw rates can be adjusted if necessary. Manipulation of draw rates is used, for example, to project the impact of changes in attendance boundaries, or the impact of closing a school to open enrollment.

Intra-district Transfers

Grade-level transfers within or across schools are included in the projections to accommodate fluctuations like retention, transfer to continuation school, or any other special programs a district may offer that result in students changing schools at other than the typical grade configuration shifts. Transfers are calculated by applying the percent of a grade level population at one school that is transferred in the following year to another school, or continued at the same grade level at a given school in the following year.

CAVEATS ON PROJECTIONS AND METHODOLOGY

On Projections

Enrollment projections are based upon two critical factors: the student and school data from the school district and the mathematical formulas that are applied to those data. Projections fundamentally look at recent history as reflected in the student data and assume that past patterns and trends will continue into the future. The calculations assume that the historical data provided is at one year intervals based on enrollment at the beginning of each school year.

DecisionInsite takes great care in preparing a district's projections. A range of unpredicted anomalies, however, can cause reality to vary from the historical patterns. These include, but are not limited to, rapid changes in the economy, mortgage interest rates, the housing market, the job market, residential development plans, rental rates, etc. Anomalous changes that occur between the last set of student data and the first projection are not reflected in the projections unless the district works with DecisionInsite to amend the projections.

In the projections, calculations are mathematically precise. Each result is rounded to a whole number for ease of reading. This rounding sometimes results in the displayed whole numbers in a column not adding exactly to the displayed total of the column. This phenomenon, which is a result of rounding and not of any inaccuracy in the calculations, occurs both in the enrollment projections and in the community demographics.

On Student Data

DecisionInsite obtains historical student data files from the district. To the extent that the student data files are internally inconsistent from year to year, or the count of students in the files does not reflect the count of actual enrollees, errors are introduced to the projection calculations. For optimum results, the student data files must also consistently capture the same categories of students annually.

The calculations assume that the historical data provided is at one year intervals based on enrollment at the beginning of each school year. It is important that the student files obtained from the district are close to a common date each year, typically near the beginning of the school year. The snapshot of historical data near the beginning of the school year is best suited to our goal of projecting enrollment for the beginning of subsequent school years. To the extent the historical student data provided is not at one year intervals, or is not at a common date near the beginning of the school year, projections may reflect monthly fluctuations in enrollment that will diminish the accuracy of the projections.

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Enrollment Impact Specialists

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RESIDENTIAL RESEARCH SUMMARY

Winter 2018

Prepared for:

Palo Alto Unified School District

Prepared by:

DECISION INSITE
Enrollment Impact Specialists

101 Pacifica, Suite 380
Irvine, CA

Submitted: January 3, 2018

Palo Alto Unified School District

Residential Research Summary for 2018 Projections

Executive Summary

This Residential Research Summary report has been prepared for the Palo Alto Unified School District based on information obtained from the local planning departments, as well as conversations with developers and sales offices in the area. (Please refer to the district map on the following page.) DecisionInsite had compiled this research on January 3, 2018, when it had been anticipated that the district could potentially experience the construction of 1,019 new dwelling units over the next five years.

When putting together our list of future developments, we are typically interested only in the active, non-senior residential projects larger than 10 units. We believe this to be the most efficient way to build a picture of the district's future residential changes, since smaller projects generally have a negligible impact on the district. These active projects would include developments either currently under construction, those with active entitlements, or any proposed future projects.

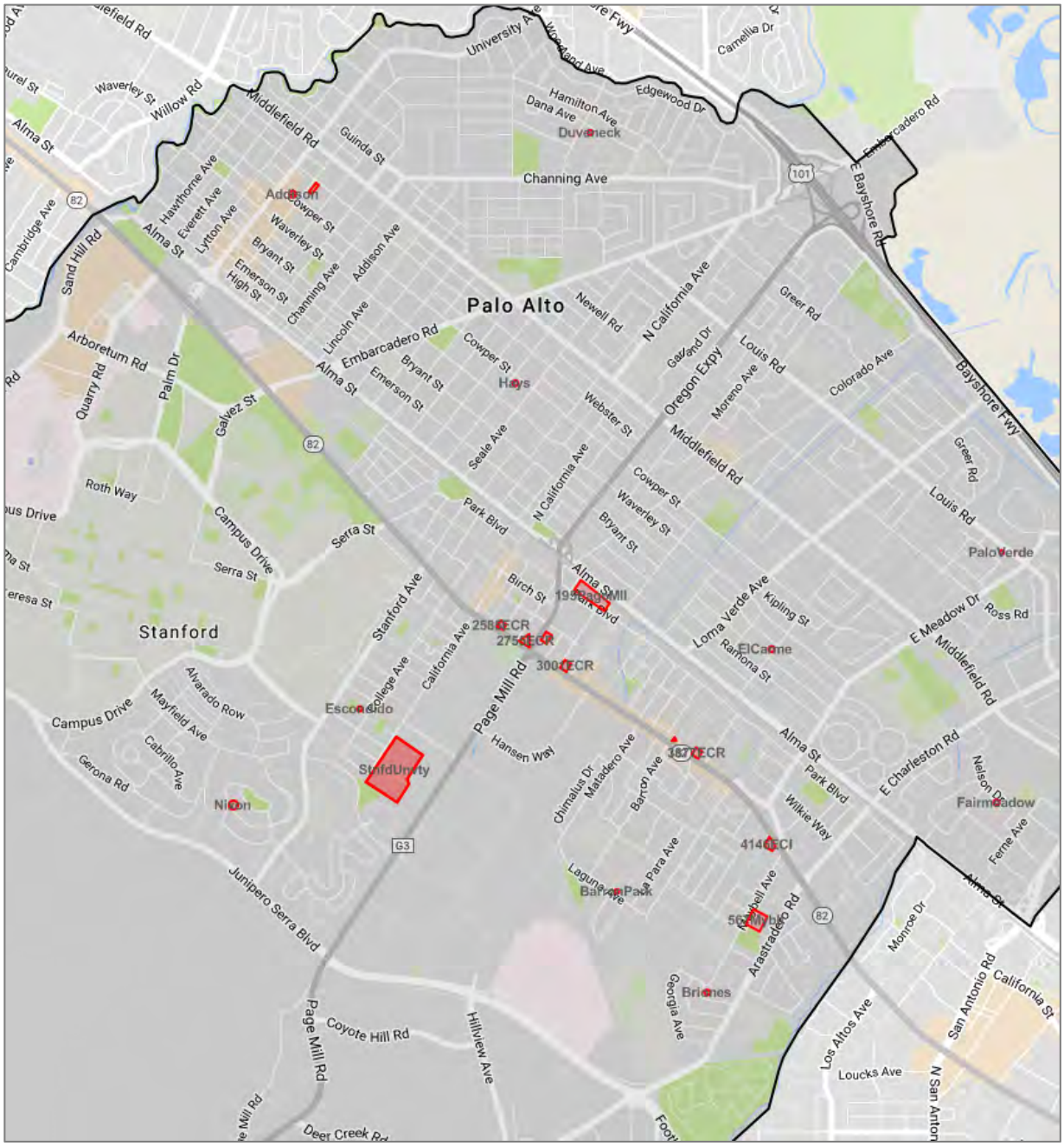
Please note that in addition to the list of actual planned future developments, DecisionInsite has included estimates to represent possible projects spread across the district in years 2021 and 2022. These supplementary projects are speculative in nature and their estimates were provided to DecisionInsite by district staff. The exact location of these new development projects will be refined as additional information is made available to the district.

Although they are not included in our list of future developments, DecisionInsite is also monitoring the progress of two additional projects: 1) Stanford University's new on-campus graduate housing proposed for Escondido Village, and 2) the redevelopment of the Fry's Electronics store at 340 Portage Avenue. The new graduate housing proposed for Escondido Village is still in its early conceptual stages, but if eventually approved would replace a number of current two-story buildings located off Serra Street between El Camino Real and Campus Drive, for a net addition of about 2,000 graduate students. This new on-campus housing project would be solely house graduate students and would not be intended for families with children. According to a recently adopted Housing Element, the redevelopment of the Fry's Electronics store could eventually allow for 221 new housing units on the site. However, since Fry's has recently extended its lease until 2019 it is still undetermined whether this site would be redeveloped and when new homes could start impacting the district. For the reasons described above, these two projects have been excluded from DecisionInsite's assumptions in our 2018 Projection Studies.

New dwelling units are categorized into the following three (3) housing types:

- **Single Family Detached ("SFD")** – Units are stand-alone structures on their own lot with a unique Assessor's parcel number.
- **Single Family Attached ("SFA")** – Units share common walls, usually on both sides of the property, where each is assigned a unique Assessor's parcel number (e.g., townhomes, condominiums, duplexes).
- **Multifamily ("MF")** – Units share common walls in a building or structure designed to house several families in separate housing units. All units are on the same lot with one Assessor's parcel number (e.g., apartments).

Map 1
New Residential Development Projects within
Palo Alto Unified School District


Palo Alto
Stanford
Channing Ave
Embarcadero Rd
Middlefield Rd
Page Mill Rd
Oregon Expy
Bayshore Fwy
Arboretum Rd
Campus Drive
Serra St
Coyote Hill Rd
Junipero Serra Blvd
Arastradero Rd
Loucks Ave
Los Altos Ave
Hillview Ave
Deer Creek Rd
Alma St
Park Blvd
Loma Verde Ave
E Charleston Rd
Fairmeadow
Palo Verde
Greer Rd
Louis Rd
Colorado Ave
Newell Rd
N California Ave
Webster St
Waverley St
Bryant St
Cowper St
Addison Ave
Lincoln Ave
Sand Hill Rd
Quarry Rd
Palm Dr
Galvez St
Roth Way
Stanford Ave
California Ave
College Ave
Mayfield Ave
Alvarado Row
Gerona Rd
Cabrillo Ave
Hansen Way
Matadero Ave
Barron Ave
Wilkie Way
Ferne Ave
Monroe Dr
San Antonio Rd
California St
Georgia Ave
Laguna Para Ave
Nelson Dr
Ross Rd
E Meadow Dr
Kipling St
Ramona St
Middlefield Rd
Willow Rd
Waverley St
Everett Ave
Hawthorne Ave
Lytton Ave
Guinda St
Dana Ave
Hamilton Ave
Edgewood Dr
Camellia Dr
Woodland Ave
University Ave
Embarcadero Rd
E Bayshore Rd
Cambridge Ave
Alma St
Emerson St
High St
Channing Ave
Addison Ave
Embarcadero Rd
Cowper St
Bryant St
Emerson St
Webster St
Seale Ave
N California Ave
Park Blvd
Waverley St
Bryant St
Birch St
Alma St
Serra St
Campus Drive
Stanford Ave
Page Mill Rd
Hansen Way
Matadero Ave
Barron Ave
Park Blvd
Wilkie Way
Loma Verde Ave
Kipling St
Ramona St
E Meadow Dr
Ross Rd
Middlefield Rd
E Charleston Rd
Fairmeadow
Ferne Ave
Monroe Dr
San Antonio Rd
California St
Los Altos Ave
Loucks Ave
Arastradero Rd
Georgia Ave
Coyote Hill Rd
Hillview Ave
Deer Creek Rd
Junipero Serra Blvd
Page Mill Rd
Alma St
Park Blvd
Wilkie Way
Laguna Para Ave
Barron Ave
Matadero Ave
Chimalus Dr
Hansen Way
Page Mill Rd
Alma St
Park Blvd

The following table distinguishes the proposed and potential new dwelling units over the next five years by unit type. These totals are applied to the Moderate enrollment projections, and are based on the planner and developer's estimated phasing and occupancy information. The totals applied to the Conservative enrollment projections are derived from the Moderate's by assuming occupancies will occur over a longer period, which sometimes decreases the number of units anticipated to be occupied over the next five years. Please refer to Appendix A for more detailed information on the absorption of these units in the Moderate and Conservative Scenarios.

Table 1
New Dwelling Units by Unit Type

Unit Type	Total New Dwelling Units
Single Family Detached	19
Single Family Attached	676
Multifamily	324
Total	**1,019**

Student generation rates are determined for each product type for each school level: elementary, middle, and high school. The Moderate student generation rates are based on factors calculated from recent housing projects of similar product types within the district. For more information regarding these calculations, please refer to Appendix B. Table 2 below shows the Moderate student generation rates by unit type.

Table 2
Moderate Student Generation Rates by Unit Type

School Level	SFD Units	SFA Units	MF Units
Elementary School (K-5)	0.59	0.48	0.37
Middle School (6-8)	0.16	0.16	0.15
High School (9-12)	0.23	0.19	0.15
Total	**0.98**	**0.83**	**0.66**

Typically, the Conservative rates are calculated as a slight adjustment down from the Moderate rates to anticipate a diminution in family size over an extended period of time. A full list of the student generation rates applied over the next five years within the Conservative and Moderate Scenarios is shown in Appendix B.

To calculate the projected student enrollment from these new dwelling units, the number of each unit type was multiplied by the appropriate student generation rates for each of the next five years. Furthermore, student matriculation is considered to accurately model the student impact over the Studies' five-year timeframe. The results of these operations for both the Moderate and Conservative Studies are shown in Tables 3 and 4, respectively.

Table 3
Students Generated by Proposed Residential Development (Moderate)

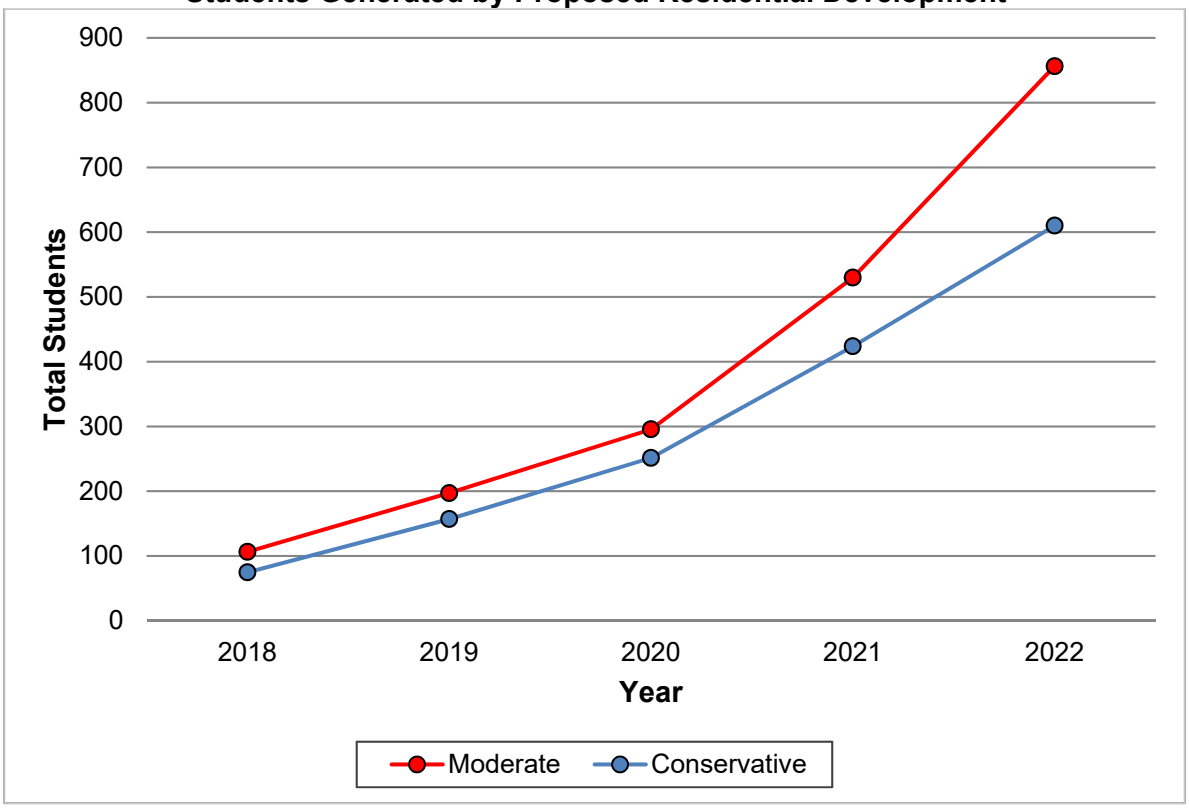
Grade	2018	2019	2020	2021	2022
K	11	19	28	51	82
1	11	19	28	51	82
2	11	19	28	51	82
3	10	19	28	50	80
4	10	18	27	48	77
5	8	16	24	43	70
6	8	13	22	39	64
7	8	13	20	37	60
8	7	13	19	33	55
9	7	12	19	34	53
10	7	13	18	34	55
11	7	13	19	33	54
12	2	9	15	24	40
Elementary:	60	111	164	295	474
Middle:	22	39	61	109	180
High:	24	47	71	125	202
Total:	**106**	**197**	**295**	**530**	**856**

Table 4
Students Generated by Proposed Residential Development (Conservative)

Grade	2018	2019	2020	2021	2022
K	8	15	24	41	57
1	8	15	24	41	57
2	8	15	24	41	57
3	7	15	24	40	57
4	7	14	23	38	55
5	5	12	20	35	50
6	5	11	19	32	46
7	5	11	17	30	43
8	5	10	16	27	40
9	5	10	16	27	38
10	5	10	16	27	39
11	5	10	16	27	38
12	2	7	12	20	31
Elementary:	42	88	139	234	334
Middle:	16	32	52	88	130
High:	17	37	60	101	146
Total:	**75**	**157**	**251**	**424**	**610**

The students generated by proposed dwelling units within the Moderate and Conservative scenarios is shown in Graph 1 below. Furthermore, the projected numbers of students generated by project and studyblock are shown in Appendices C and D, respectively.

Graph 1
Students Generated by Proposed Residential Development



Appendix A
Absorption Information for Proposed Dwelling Units

Proposed Dwelling Units within Palo Alto Unified School District
Residential Research Summary for 2018_MAK

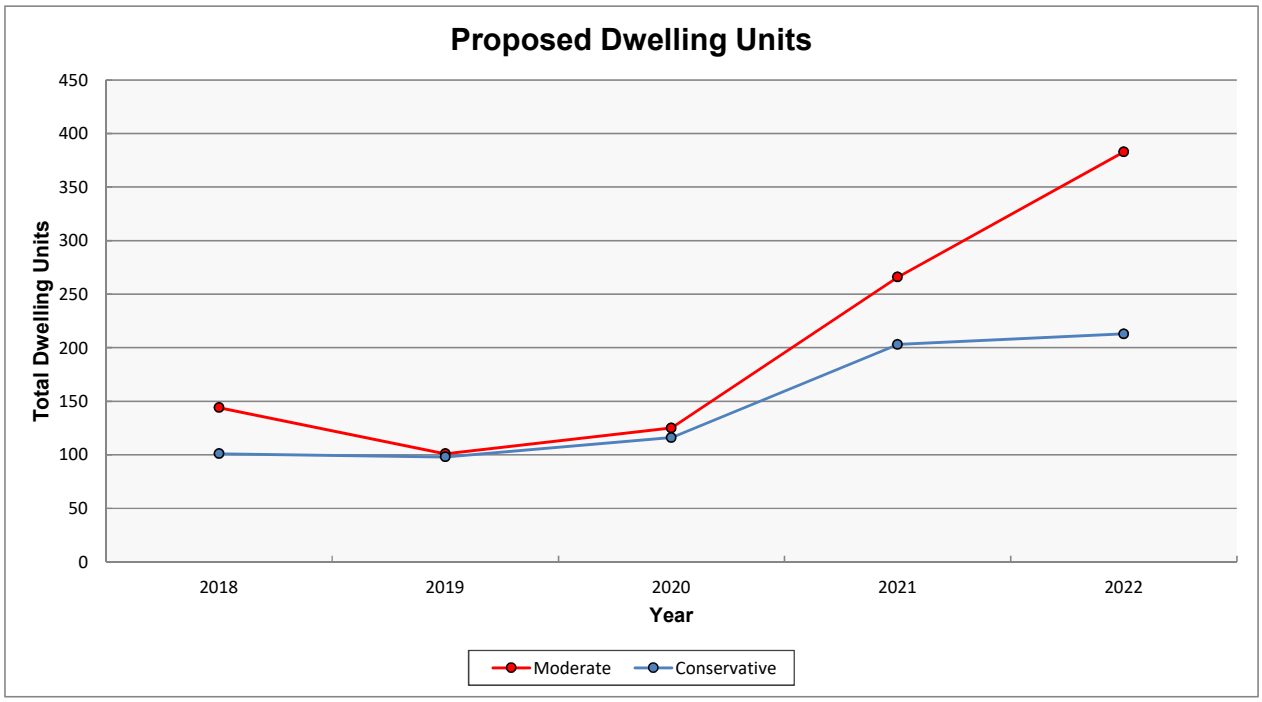
Moderate Dwelling Unit Scenario

Project Name	DI System Label	Unit Type	Year (Expected Occupany by October 1 of Year Indicated)				
			2018	2019	2020	2021	2022
*Addison	Addison	SFA	0	0	0	27	27
*Barron Park	BarronPark	SFA	0	0	0	27	27
*Briones	Briones	SFA	0	0	0	27	27
*Duveneck	Duveneck	SFA	0	0	0	27	27
*El Carmelo	ElCarmelo	SFA	0	0	0	27	27
*Escondido	Escondido	SFA	0	0	0	27	27
*Fairmeadow	Fairmeadow	SFA	0	0	0	26	26
*Hays	Hays	SFA	0	0	0	26	26
*Nixon	Nixon	SFA	0	0	0	26	26
*Palo Verde	PaloVerde	SFA	0	0	0	26	26
195 Page Mill	195PageMll	MF	82	0	0	0	0
2585 El Camino Real	2585ECR	SFA	0	5	8	0	0
2755 El Camino Real	2755ECR	MF	0	0	57	0	0
3001 El Camino Real	3001ECR	MF	0	0	50	0	0
3709 El Camino Real	3709ECR	MF	0	0	0	0	67
3877 El Camino Real	3877ECR	MF	0	18	0	0	0
4146 El Camino Real	4146ECR	SFA	0	21	0	0	0
423-451 Page Mill	423PageMll	SFA	12	0	0	0	0
550 Hamilton Ave	550Hamlton	MF	0	0	0	0	50
567-595 Maybell Ave	567Mybll	SFD	0	9	10	0	0
Stanford Housing University Terrace (SFA Units)	StnfdUnvty	SFA	25	20	0	0	0
Stanford Housing University Terrace (SFD Units)	StnfdUnvty	SFA	25	28	0	0	0
		Total:	144	101	125	266	383

Conservative Dwelling Unit Scenario

Project Name	DI System Label	Unit Type	Year (Expected Occupany by October 1 of Year Indicated)				
			2018	2019	2020	2021	2022
*Addison	Addison	SFA	0	0	0	16	16
*Barron Park	BarronPark	SFA	0	0	0	15	15
*Briones	Briones	SFA	0	0	0	15	15
*Duveneck	Duveneck	SFA	0	0	0	15	15
*El Carmelo	ElCarmelo	SFA	0	0	0	15	15
*Escondido	Escondido	SFA	0	0	0	15	15
*Fairmeadow	Fairmeadow	SFA	0	0	0	15	15
*Hays	Hays	SFA	0	0	0	15	15
*Nixon	Nixon	SFA	0	0	0	15	15
*Palo Verde	PaloVerde	SFA	0	0	0	15	15
195 Page Mill	195PageMll	MF	57	25	0	0	0
2585 El Camino Real	2585ECR	SFA	0	3	5	4	1
2755 El Camino Real	2755ECR	MF	0	0	34	23	0
3001 El Camino Real	3001ECR	MF	0	0	30	20	0
3709 El Camino Real	3709ECR	MF	0	0	0	0	34
3877 El Camino Real	3877ECR	MF	0	12	6	0	0
4146 El Camino Real	4146ECR	SFA	0	14	7	0	0
423-451 Page Mill	423PageMll	SFA	8	4	0	0	0
550 Hamilton Ave	550Hamlton	MF	0	0	0	0	25
567-595 Maybell Ave	567Mybll	SFD	0	6	6	5	2
Stanford Housing University Terrace (SFA Units)	StnfdUnvty	SFA	18	16	11	0	0
Stanford Housing University Terrace (SFD Units)	StnfdUnvty	SFA	18	18	17	0	0
		Total:	101	98	116	203	213

Proposed Dwelling Units within Palo Alto Unified School District
Residential Research Summary for 2018_MAK



Note:

The Moderate Scenario's unit absorption and totals are based on information garnered from developers and/or planning agency approvals. The data shown in the Conservative Scenario are derived from the Moderate's by assuming occupancies will occur over a longer period of time. Because of this, the unit totals in the Conservative Scenario may be less than those of the Moderate if they are pushed out beyond the next five years. Similarly because of these adjustments, it may also be possible for the annual number totals of the Conservative Scenario to exceed those of the Moderate.

Appendix B
Student Generation Rates Assumptions

Palo Alto Unified School District

Student Generation Rate Analysis of Recently-Constructed Housing

Enrollment and Student Yields in Housing Constructed since 2006

	Product Description	Year Built	Total # Units	# Student Residents	Student Yield[1]
SINGLE FAMILY UNITS					
Arbor Real - SFU	Lg SFU	2007	11	10	0.91
Arbor Real - Small SFUs	Small SFU	2007-08	31	50	1.61
Classics at Sterling Park - SFU	Lg SFU	2011	28	22	0.79
Olmsted Terrace (Stanford U)	SFU	2012	39	33	0.85
Redwood Gate	SFU	2011	45	46	1.02
Alma Plaza	SFU	2015	37	28	0.76
Edgewood Plaza	SFU, "high-end"	2016	10	7	0.70
Subtotal			**201**	**196**	**0.98**
TOWNHOUSE-STYLE UNITS					
Arbor Real - TH-style Condos	TH-style	2007-09	105	90	0.86
Vantage of Palo Alto - Market Rate		2008-10	64	45	0.70
Altaire		2011	103	90	0.87
Classics at Sterling Park - TH-style	TH-style	2011	68	56	0.82
Subtotal			**340**	**281**	**0.83**
CONDOMINIUM-STYLE UNITS					
800 High Street - Market Rate	Condos	2006	50	7	0.14
TOWNHOUSE/CONDOMINIUM-STYLE UNITS					
Echelon		2008-10	64	35	0.55
BELOW MARKET RATE UNITS					
Opportunity Center	100% BMR	2006	18	10	0.56
800 High Street - BMR	100% BMR	2006	10	4	0.40
Arbor Real - Condos - BMR	100% BMR	2008	24	21	0.88
Arbor Real - Smaller SFUs - BMR		2008	10	4	0.40
Vantage of Palo Alto - BMR	100% BMR	2008	12	12	1.00
Echelon - BMR	100% BMR	2008-10	11	4	0.36
Tree House - BMR Apt	Low-income housing	2013	35	4	0.11
Alma Plaza - BMR Apt	Low-income housing	2015	14	7	0.50
Alma Housing/Eden Housing - BMR Apt	100% BMR	2015	50	55	1.10
Stanford Housing Mayfield Place - BMR Apt[2]		2017	70	27	0.39
Subtotal[2]			**184**	**121**	**0.66**

NOTE:

[1] Student yield calculations for housing units constructed before 2011 had been previously calculated by Lapkoff & Gobalet Demographic Research, Inc in the District's Fall 2010 forecast, and is based on the district's 2010 student data; student yields calculations for housing units constructed in 2011 and after have been calculated by dividing the 2017 K-12 student residents by the project's total number of units.

[2] Mayfield Place - BMR Apt is displayed for information only. It is not included in the Student Yield calculation because the project is less than a year old and the student enrollment from the project is not at its maturity.

Palo Alto Unified School District
Student Generation Rate Assumptions

Moderate Student Generation Rates

Type	Level	Year				
		2018	2019	2020	2021	2022
SFD	E	0.59	0.59	0.59	0.59	0.59
SFD	M	0.16	0.16	0.16	0.16	0.16
SFD	H	0.23	0.23	0.23	0.23	0.23
SFA	E	0.48	0.48	0.48	0.48	0.48
SFA	M	0.16	0.16	0.16	0.16	0.16
SFA	H	0.19	0.19	0.19	0.19	0.19
MF	E	0.37	0.37	0.37	0.37	0.37
MF	M	0.15	0.15	0.15	0.15	0.15
MF	H	0.15	0.15	0.15	0.15	0.15

Conservative Student Generation Rates

Type	Level	Year				
		2018	2019	2020	2021	2022
SFD	E	0.59	0.58	0.58	0.58	0.58
SFD	M	0.16	0.16	0.16	0.16	0.16
SFD	H	0.23	0.23	0.23	0.23	0.23
SFA	E	0.48	0.48	0.48	0.47	0.47
SFA	M	0.16	0.16	0.16	0.16	0.16
SFA	H	0.19	0.19	0.19	0.19	0.19
MF	E	0.37	0.37	0.37	0.36	0.36
MF	M	0.15	0.15	0.15	0.15	0.15
MF	H	0.15	0.15	0.15	0.15	0.15

Note:
The Conservative rates are calculated as a slight adjustment down from the Moderate rates to anticipate a diminution in family size over an extended period of time.

Appendix C
Students Generated by Project

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

*Addison (230104 Addsn)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

*Barron Park (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

*Briones (230098 Brion)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

Conservative Dwelling Unit Scenario

*Addison (230104 Addsn)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	3
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	8	15
Middle	0	0	0	3	5
High	0	0	0	3	7
Total	**0**	**0**	**0**	**13**	**27**

*Barron Park (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

*Briones (230098 Brion)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

*Duveneck (230103 Dvnck)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

*El Carmelo (230096 ElCrml)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

*Escondido (230100 Escndd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

Conservative Dwelling Unit Scenario

*Duveneck (230103 Dvnck)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

*El Carmelo (230096 ElCrml)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

*Escondido (230100 Escndd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

*Fairmeadow (230097 Frmdw)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

*Hays (230102 Hays)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

*Nixon (230101 Nxn)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

Conservative Dwelling Unit Scenario

*Fairmeadow (230097 Frmdw)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

*Hays (230102 Hays)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

*Nixon (230101 Nxn)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

*Palo Verde (230095 PaloVrd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

195 Page Mill (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	5	5	5	5	5
1	5	5	5	5	5
2	5	5	5	5	5
3	5	5	5	5	5
4	5	5	5	5	5
5	4	5	5	5	5
6	4	4	5	5	5
7	4	4	4	5	5
8	4	4	4	4	5
9	4	4	4	4	4
10	4	4	4	4	4
11	4	4	4	4	4
12	1	4	4	4	4
Elementary	30	32	32	33	33
Middle	12	13	13	14	15
High	12	15	15	16	16
Total	**55**	**59**	**61**	**63**	**64**

2585 El Camino Real (230100 Escndd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	1	1	1
1	0	0	1	1	1
2	0	0	1	1	1
3	0	0	1	1	1
4	0	0	1	1	1
5	0	0	1	1	1
6	0	0	1	1	1
7	0	0	1	1	1
8	0	0	1	1	1
9	0	0	1	1	1
10	0	0	1	1	1
11	0	0	1	1	1
12	0	0	0	1	1
Elementary	0	2	6	7	7
Middle	0	1	2	2	3
High	0	1	3	3	3
Total	**0**	**4**	**11**	**12**	**12**

Conservative Dwelling Unit Scenario

*Palo Verde (230095 PaloVrd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

195 Page Mill (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	4	5	5	5	5
1	4	5	5	5	5
2	4	5	5	5	5
3	4	5	5	5	5
4	3	5	5	5	5
5	3	5	5	5	5
6	3	4	5	5	5
7	3	4	4	5	5
8	3	4	4	4	5
9	3	4	4	4	4
10	3	4	4	4	4
11	3	4	4	4	4
12	1	3	4	4	4
Elementary	21	31	32	33	33
Middle	9	12	13	14	15
High	9	14	15	16	16
Total	**38**	**58**	**60**	**62**	**64**

2585 El Camino Real (230100 Escndd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	1	1	1
1	0	0	1	1	1
2	0	0	1	1	1
3	0	0	1	1	1
4	0	0	1	1	1
5	0	0	1	1	1
6	0	0	0	1	1
7	0	0	0	1	1
8	0	0	0	1	1
9	0	0	0	1	1
10	0	0	0	1	1
11	0	0	0	1	1
12	0	0	0	1	1
Elementary	0	1	4	6	7
Middle	0	0	1	2	2
High	0	1	2	3	3
Total	**0**	**2**	**7**	**11**	**12**

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

2755 El Camino Real (230100 Escndd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	4	4	4
1	0	0	4	4	4
2	0	0	4	4	4
3	0	0	4	4	4
4	0	0	3	4	4
5	0	0	3	3	4
6	0	0	3	3	3
7	0	0	3	3	3
8	0	0	3	3	3
9	0	0	3	3	3
10	0	0	3	3	3
11	0	0	3	3	3
12	0	0	1	3	3
Elementary	0	0	21	22	23
Middle	0	0	9	9	9
High	0	0	9	10	11
Total	**0**	**0**	**38**	**41**	**42**

3001 El Camino Real (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	3	3	3
1	0	0	3	3	3
2	0	0	3	3	3
3	0	0	3	3	3
4	0	0	3	3	3
5	0	0	2	3	3
6	0	0	3	2	3
7	0	0	3	3	2
8	0	0	2	3	3
9	0	0	2	2	3
10	0	0	2	2	2
11	0	0	2	2	2
12	0	0	1	2	2
Elementary	0	0	19	19	20
Middle	0	0	8	8	8
High	0	0	8	9	9
Total	**0**	**0**	**34**	**36**	**37**

3709 El Camino Real (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	0	4
1	0	0	0	0	4
2	0	0	0	0	4
3	0	0	0	0	4
4	0	0	0	0	4
5	0	0	0	0	3
6	0	0	0	0	4
7	0	0	0	0	4
8	0	0	0	0	3
9	0	0	0	0	3
10	0	0	0	0	3
11	0	0	0	0	3
12	0	0	0	0	1
Elementary	0	0	0	0	25
Middle	0	0	0	0	10
High	0	0	0	0	10
Total	**0**	**0**	**0**	**0**	**45**

Conservative Dwelling Unit Scenario

2755 El Camino Real (230100 Escndd)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	2	4	4
1	0	0	2	4	4
2	0	0	2	4	4
3	0	0	2	4	4
4	0	0	2	3	4
5	0	0	2	3	3
6	0	0	2	3	3
7	0	0	2	3	3
8	0	0	2	3	3
9	0	0	2	3	3
10	0	0	2	3	3
11	0	0	2	3	3
12	0	0	1	2	3
Elementary	0	0	13	21	22
Middle	0	0	5	9	9
High	0	0	5	10	11
Total	**0**	**0**	**23**	**40**	**42**

3001 El Camino Real (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	2	3	3
1	0	0	2	3	3
2	0	0	2	3	3
3	0	0	2	3	3
4	0	0	2	3	3
5	0	0	1	3	3
6	0	0	2	2	3
7	0	0	2	3	2
8	0	0	1	2	3
9	0	0	1	2	2
10	0	0	1	2	2
11	0	0	1	2	2
12	0	0	0	2	2
Elementary	0	0	11	19	19
Middle	0	0	5	8	8
High	0	0	5	8	9
Total	**0**	**0**	**20**	**35**	**36**

3709 El Camino Real (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	0	2
1	0	0	0	0	2
2	0	0	0	0	2
3	0	0	0	0	2
4	0	0	0	0	2
5	0	0	0	0	2
6	0	0	0	0	2
7	0	0	0	0	2
8	0	0	0	0	2
9	0	0	0	0	2
10	0	0	0	0	2
11	0	0	0	0	2
12	0	0	0	0	1
Elementary	0	0	0	0	12
Middle	0	0	0	0	5
High	0	0	0	0	5
Total	**0**	**0**	**0**	**0**	**22**

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

3877 El Camino Real (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	1	1	1	1
1	0	1	1	1	1
2	0	1	1	1	1
3	0	1	1	1	1
4	0	1	1	1	1
5	0	1	1	1	1
6	0	1	1	1	1
7	0	1	1	1	1
8	0	1	1	1	1
9	0	1	1	1	1
10	0	1	1	1	1
11	0	1	1	1	1
12	0	0	1	1	1
Elementary	0	7	7	7	7
Middle	0	3	3	3	3
High	0	3	3	3	4
Total	**0**	**12**	**13**	**13**	**14**

4146 El Camino Real (230098 Brion)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	2	2	2	2
1	0	2	2	2	2
2	0	2	2	2	2
3	0	2	2	2	2
4	0	2	2	2	2
5	0	1	2	2	2
6	0	1	1	2	2
7	0	1	1	1	2
8	0	1	1	1	1
9	0	1	1	1	1
10	0	1	1	1	1
11	0	1	1	1	1
12	0	0	1	1	1
Elementary	0	10	11	11	11
Middle	0	3	4	4	5
High	0	4	5	5	5
Total	**0**	**17**	**19**	**19**	**20**

423-451 Page Mill (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	1	1	1	1	1
1	1	1	1	1	1
2	1	1	1	1	1
3	1	1	1	1	1
4	1	1	1	1	1
5	1	1	1	1	1
6	1	1	1	1	1
7	1	1	1	1	1
8	1	1	1	1	1
9	1	1	1	1	1
10	1	1	1	1	1
11	1	1	1	1	1
12	0	1	1	1	1
Elementary	6	6	6	6	6
Middle	2	2	2	3	3
High	2	3	3	3	3
Total	**10**	**11**	**11**	**11**	**12**

Conservative Dwelling Unit Scenario

3877 El Camino Real (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	1	1	1	1
1	0	1	1	1	1
2	0	1	1	1	1
3	0	1	1	1	1
4	0	1	1	1	1
5	0	1	1	1	1
6	0	1	1	1	1
7	0	1	1	1	1
8	0	1	1	1	1
9	0	1	1	1	1
10	0	1	1	1	1
11	0	1	1	1	1
12	0	0	1	1	1
Elementary	0	4	7	7	7
Middle	0	2	3	3	3
High	0	2	3	3	3
Total	**0**	**8**	**13**	**13**	**14**

4146 El Camino Real (230098 Brion)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	1	2	2	2
1	0	1	2	2	2
2	0	1	2	2	2
3	0	1	2	2	2
4	0	1	2	2	2
5	0	1	2	2	2
6	0	1	1	2	2
7	0	1	1	1	2
8	0	1	1	1	1
9	0	1	1	1	1
10	0	1	1	1	1
11	0	1	1	1	1
12	0	0	1	1	1
Elementary	0	7	10	11	11
Middle	0	2	4	4	4
High	0	3	4	5	5
Total	**0**	**12**	**18**	**19**	**20**

423-451 Page Mill (230099 BarronP)

Grade	Year				
	2018	2019	2020	2021	2022
K	1	1	1	1	1
1	1	1	1	1	1
2	1	1	1	1	1
3	1	1	1	1	1
4	1	1	1	1	1
5	0	1	1	1	1
6	0	1	1	1	1
7	0	1	1	1	1
8	0	1	1	1	1
9	0	1	1	1	1
10	0	1	1	1	1
11	0	1	1	1	1
12	0	1	1	1	1
Elementary	4	6	6	6	6
Middle	1	2	2	3	3
High	2	3	3	3	3
Total	**7**	**10**	**11**	**11**	**12**

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

550 Hamilton Ave (230104 Addsn)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	0	3
1	0	0	0	0	3
2	0	0	0	0	3
3	0	0	0	0	3
4	0	0	0	0	3
5	0	0	0	0	2
6	0	0	0	0	3
7	0	0	0	0	3
8	0	0	0	0	2
9	0	0	0	0	2
10	0	0	0	0	2
11	0	0	0	0	2
12	0	0	0	0	1
Elementary	0	0	0	0	19
Middle	0	0	0	0	8
High	0	0	0	0	8
Total	**0**	**0**	**0**	**0**	**34**

567-595 Maybell Ave (230098 Brion)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	1	2	2	2
1	0	1	2	2	2
2	0	1	2	2	2
3	0	1	2	2	2
4	0	1	2	2	2
5	0	1	2	2	2
6	0	1	1	2	2
7	0	1	1	1	2
8	0	0	1	1	1
9	0	1	1	1	1
10	0	1	1	1	1
11	0	1	1	1	1
12	0	0	1	1	1
Elementary	0	5	11	12	12
Middle	0	1	3	4	5
High	0	2	5	5	4
Total	**0**	**9**	**19**	**21**	**21**

Stanford Housing University Terrace (SFA Units) (230106 StnMfld)

Grade	Year				
	2018	2019	2020	2021	2022
K	2	4	4	4	4
1	2	4	4	4	4
2	2	4	4	4	4
3	2	4	4	4	4
4	2	4	4	4	4
5	2	3	4	4	4
6	1	3	3	4	4
7	1	3	3	3	4
8	1	2	3	3	3
9	1	2	2	3	3
10	1	3	2	2	3
11	1	3	3	2	2
12	0	2	3	3	2
Elementary	12	22	23	23	23
Middle	4	8	8	9	11
High	5	9	10	10	10
Total	**21**	**39**	**41**	**42**	**44**

Conservative Dwelling Unit Scenario

550 Hamilton Ave (230104 Addsn)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	0	2
1	0	0	0	0	2
2	0	0	0	0	2
3	0	0	0	0	2
4	0	0	0	0	1
5	0	0	0	0	1
6	0	0	0	0	1
7	0	0	0	0	1
8	0	0	0	0	1
9	0	0	0	0	1
10	0	0	0	0	1
11	0	0	0	0	1
12	0	0	0	0	0
Elementary	0	0	0	0	9
Middle	0	0	0	0	4
High	0	0	0	0	4
Total	**0**	**0**	**0**	**0**	**17**

567-595 Maybell Ave (230098 Brion)

Grade	Year				
	2018	2019	2020	2021	2022
K	0	1	1	2	2
1	0	1	1	2	2
2	0	1	1	2	2
3	0	1	1	2	2
4	0	1	1	2	2
5	0	0	1	2	2
6	0	0	1	1	2
7	0	0	1	1	1
8	0	0	1	1	1
9	0	0	1	1	1
10	0	0	1	1	1
11	0	0	1	1	1
12	0	0	1	1	1
Elementary	0	3	7	10	12
Middle	0	1	2	3	4
High	0	1	3	4	5
Total	**0**	**6**	**12**	**18**	**20**

Stanford Housing University Terrace (SFA Units) (230106 Stnl

Grade	Year				
	2018	2019	2020	2021	2022
K	2	3	4	4	4
1	2	3	4	4	4
2	2	3	4	4	4
3	1	3	4	4	4
4	1	3	4	4	4
5	1	2	3	4	4
6	1	2	3	3	4
7	1	2	3	3	3
8	1	2	2	3	3
9	1	2	2	2	3
10	1	2	2	2	2
11	1	2	3	2	2
12	0	1	2	3	2
Elementary	9	17	23	23	23
Middle	3	6	8	9	10
High	3	7	10	10	10
Total	**15**	**29**	**40**	**42**	**43**

Palo Alto Unified School District
Students Generated by Project

Moderate Dwelling Unit Scenario

Stanford Housing University Terrace (SFD Units) (230106 StnMfld)

	Year				
Grade	**2018**	**2019**	**2020**	**2021**	**2022**
K	2	5	5	5	5
1	2	5	5	5	5
2	2	5	5	5	5
3	2	4	5	5	5
4	2	4	4	5	5
5	2	4	4	4	5
6	1	3	4	4	4
7	1	3	3	4	4
8	1	3	3	3	4
9	1	3	3	3	3
10	1	3	3	3	3
11	1	3	3	3	3
12	0	2	3	3	3
Elementary	12	26	27	27	27
Middle	4	9	10	11	12
High	5	11	12	12	12
Total	**21**	**46**	**48**	**50**	**51**

Conservative Dwelling Unit Scenario

Stanford Housing University Terrace (SFD Units) (230106 Stn

	Year				
Grade	**2018**	**2019**	**2020**	**2021**	**2022**
K	2	3	5	5	5
1	2	3	5	5	5
2	2	3	5	5	5
3	1	3	4	5	5
4	1	3	4	4	5
5	1	3	4	4	4
6	1	2	3	4	4
7	1	2	3	3	4
8	1	2	3	3	3
9	1	2	3	3	3
10	1	2	3	3	3
11	1	2	3	3	3
12	0	1	2	3	3
Elementary	9	18	26	27	27
Middle	3	6	9	10	12
High	3	7	11	12	12
Total	**15**	**31**	**47**	**49**	**51**

Appendix D
Students Generated by Studyblock

Palo Alto Unified School District
Students Generated by Studyblock

Moderate Dwelling Unit Scenario

230104 Addsn

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	8
1	0	0	0	2	8
2	0	0	0	2	8
3	0	0	0	2	8
4	0	0	0	2	7
5	0	0	0	2	6
6	0	0	0	2	6
7	0	0	0	2	6
8	0	0	0	1	5
9	0	0	0	2	5
10	0	0	0	2	5
11	0	0	0	2	5
12	0	0	0	1	3
Elementary	0	0	0	13	45
Middle	0	0	0	4	17
High	0	0	0	5	19
Total	**0**	**0**	**0**	**22**	**80**

230099 BarronP

Grade	Year				
	2018	2019	2020	2021	2022
K	6	8	11	13	20
1	6	8	11	13	20
2	6	8	11	13	20
3	6	8	11	13	20
4	6	7	11	13	19
5	5	7	10	12	18
6	5	6	9	11	17
7	5	6	8	11	16
8	4	6	8	10	15
9	4	5	8	10	14
10	4	5	7	10	14
11	4	5	7	9	14
12	1	5	6	8	10
Elementary	36	45	64	78	117
Middle	14	17	26	31	49
High	15	20	29	36	53
Total	**65**	**82**	**119**	**146**	**219**

230098 Brion

Grade	Year				
	2018	2019	2020	2021	2022
K	0	3	4	6	8
1	0	3	4	6	8
2	0	3	4	6	8
3	0	3	4	6	8
4	0	2	4	6	8
5	0	2	3	5	8
6	0	2	3	5	7
7	0	2	2	4	6
8	0	1	2	4	5
9	0	2	2	4	5
10	0	2	3	4	5
11	0	2	3	4	5
12	0	1	2	3	5
Elementary	0	15	22	36	50
Middle	0	5	7	12	18
High	0	6	9	14	20
Total	**0**	**26**	**38**	**62**	**88**

Conservative Dwelling Unit Scenario

230104 Addsn

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	4
1	0	0	0	1	4
2	0	0	0	1	4
3	0	0	0	1	4
4	0	0	0	1	4
5	0	0	0	1	3
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	8	24
Middle	0	0	0	3	9
High	0	0	0	3	10
Total	**0**	**0**	**0**	**13**	**44**

230099 BarronP

Grade	Year				
	2018	2019	2020	2021	2022
K	4	7	10	12	16
1	4	7	10	12	16
2	4	7	10	12	16
3	4	7	10	12	16
4	4	7	9	12	15
5	3	6	8	11	14
6	3	5	8	10	14
7	3	6	7	10	13
8	3	5	7	9	12
9	3	5	7	9	11
10	3	5	6	9	11
11	3	5	7	8	11
12	1	4	5	7	9
Elementary	25	42	56	72	92
Middle	10	16	22	29	39
High	10	18	25	33	43
Total	**45**	**76**	**104**	**134**	**174**

230098 Brion

Grade	Year				
	2018	2019	2020	2021	2022
K	0	2	3	5	6
1	0	2	3	5	6
2	0	2	3	5	6
3	0	2	3	5	6
4	0	2	3	5	6
5	0	1	3	4	6
6	0	1	2	4	5
7	0	1	2	3	5
8	0	1	2	3	4
9	0	1	2	3	4
10	0	1	2	3	4
11	0	1	2	3	4
12	0	0	1	2	4
Elementary	0	10	18	28	37
Middle	0	3	6	10	14
High	0	4	7	12	15
Total	**0**	**17**	**31**	**49**	**66**

Palo Alto Unified School District
Students Generated by Studyblock

Moderate Dwelling Unit Scenario

230103 Dvnck

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

230096 ElCrml

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	5
1	0	0	0	2	5
2	0	0	0	2	5
3	0	0	0	2	5
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	2	3
7	0	0	0	2	3
8	0	0	0	1	3
9	0	0	0	2	3
10	0	0	0	2	3
11	0	0	0	2	3
12	0	0	0	1	2
Elementary	0	0	0	13	27
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**47**

230100 Escndd

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	5	7	10
1	0	0	5	7	10
2	0	0	5	7	10
3	0	0	5	7	9
4	0	0	4	7	9
5	0	0	4	6	8
6	0	0	4	5	8
7	0	0	4	5	7
8	0	0	3	5	7
9	0	0	3	5	7
10	0	0	3	5	6
11	0	0	3	5	6
12	0	0	1	4	5
Elementary	0	2	27	42	56
Middle	0	1	11	15	21
High	0	1	11	18	25
Total	**0**	**4**	**49**	**75**	**101**

Conservative Dwelling Unit Scenario

230103 Dvnck

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

230096 ElCrml

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

230100 Escndd

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	3	6	7
1	0	0	3	6	7
2	0	0	3	6	7
3	0	0	3	6	7
4	0	0	3	6	7
5	0	0	2	5	7
6	0	0	2	4	6
7	0	0	2	5	5
8	0	0	2	4	5
9	0	0	2	4	5
10	0	0	2	4	5
11	0	0	2	4	5
12	0	0	1	3	4
Elementary	0	1	16	34	43
Middle	0	0	6	13	16
High	0	1	7	15	19
Total	**0**	**2**	**30**	**63**	**79**

Palo Alto Unified School District
Students Generated by Studyblock

Moderate Dwelling Unit Scenario

230097 Frmdw

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

230102 Hays

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

230101 Nxn

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

Conservative Dwelling Unit Scenario

230097 Frmdw

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

230102 Hays

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

230101 Nxn

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

Palo Alto Unified School District
Students Generated by Studyblock

Moderate Dwelling Unit Scenario

230095 PaloVrd

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	2	4
1	0	0	0	2	4
2	0	0	0	2	4
3	0	0	0	2	4
4	0	0	0	2	4
5	0	0	0	2	4
6	0	0	0	1	3
7	0	0	0	1	3
8	0	0	0	1	3
9	0	0	0	1	3
10	0	0	0	1	3
11	0	0	0	1	3
12	0	0	0	0	2
Elementary	0	0	0	12	26
Middle	0	0	0	4	9
High	0	0	0	5	11
Total	**0**	**0**	**0**	**22**	**45**

230106 StnMfld

Grade	Year				
	2018	2019	2020	2021	2022
K	4	8	8	8	8
1	4	8	8	8	8
2	4	8	8	8	8
3	4	8	8	8	8
4	4	8	8	8	8
5	3	7	8	8	8
6	3	6	7	8	8
7	3	5	6	7	8
8	2	5	5	6	7
9	3	5	5	5	6
10	3	6	5	5	5
11	3	6	6	5	5
12	1	4	6	6	5
Elementary	24	48	50	51	51
Middle	8	16	18	20	23
High	10	20	21	21	22
Total	**42**	**85**	**89**	**92**	**95**

Conservative Dwelling Unit Scenario

230095 PaloVrd

Grade	Year				
	2018	2019	2020	2021	2022
K	0	0	0	1	3
1	0	0	0	1	3
2	0	0	0	1	3
3	0	0	0	1	2
4	0	0	0	1	2
5	0	0	0	1	2
6	0	0	0	1	2
7	0	0	0	1	2
8	0	0	0	1	2
9	0	0	0	1	2
10	0	0	0	1	2
11	0	0	0	1	2
12	0	0	0	0	1
Elementary	0	0	0	7	14
Middle	0	0	0	2	5
High	0	0	0	3	6
Total	**0**	**0**	**0**	**12**	**26**

230106 StnMfld

Grade	Year				
	2018	2019	2020	2021	2022
K	3	6	8	8	8
1	3	6	8	8	8
2	3	6	8	8	8
3	3	6	8	8	8
4	3	6	8	8	8
5	2	5	7	8	8
6	2	4	6	7	8
7	2	4	6	6	7
8	2	4	5	6	6
9	2	4	5	5	6
10	2	4	5	5	5
11	2	4	6	5	5
12	1	3	5	6	5
Elementary	17	34	49	50	51
Middle	6	12	17	19	22
High	7	14	21	21	21
Total	**30**	**61**	**87**	**91**	**94**

APPENDIX O-CAARD

Comment Letter O-CAARD Attachments

Attachment A

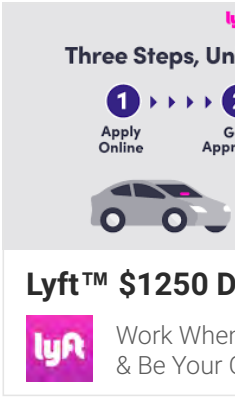
MITSloan Management Review

The Multiplier Effect of Innovat Jobs

Blog • June 06, 2012 • Reading Time: 3 min

Leslie Brokaw

Because of a multiplier effect, each new high-tech job in creates five additional jobs in the service economy, says economist Enrico Moretti.



"An unprecedented redistribution of jobs, population, and wealth is under way in America, and it's likely to accelerate in the decades to come," argues Enrico Moretti **(http://emlab.berkeley.edu/~moretti/)** in his new book *The New Geography of Jobs* **(http://www.amazon.com/The-Geography-Jobs-Enrico-Moretti/dp/0547750110)** (Houghton Mifflin Harcourt, 2012).

Moretti's research gives form to a nagging sense that Americans who live in sluggish cities already know in their gut: Technological progress doesn't affect American cities in the same way.

Instead, what Moretti terms a "Great Divergence" is developing between cities such as Seatt Austin, the "new innovation hubs" that are "poised to become the new engines of prosperity everywhere else.

A professor of economics at the University of California, Berkeley, Moretti writes that "the difference among communities in the United States is bigger than it has been in a century." Workers in hot cities are making two to three times what identical workers make in cities that are losing ground.

Because of a mu
new high-tech jo
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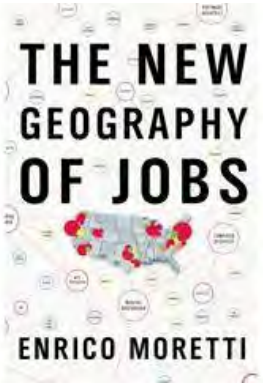
economy, says e
Moretti.

Some highlights of Moretti's research:

Job generation happens in clusters. "A handful of cities with the 'right' industries and a solid base of human capital keep attracting good employers and offering high wages, while those at the other extreme, cities with the 'wrong' industries and a limited human capital base, are stuck with dead-end average wages," Moretti writes. Ecosystems form in these hot cities, complete with innovati funding sources, highly educated workers and a strong service economy.



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Hot companies generate five times as many indirect jobs as direct jobs. Apple, Moretti says, employs 13,000 directly in Cupertino but has spurred 70,000 indirect jobs in the region. Two-thirds of American jobs are in the local service sector, he writes, and "the almost magical economics of job creation" are that "for each new high-tech job in a city, five additional jobs are ultimately created outside of the high-tech sector in that city, both in skilled occupations (lawyers, teachers, nurses) and in unskilled ones (waiters, hairdressers, carpenters)." What's more, innovation "has a dispropo on the economy of American communities. Most sectors have a multiplier effect, but the inn has the largest multiplier of all: about three times larger than that of manufacturing."

Even though governments wish it were otherwise, there's no turn-key solution energetic job hubs. Moretti writes that the multiplier effect means that "the best way for generate jobs for less skilled workers is to attract high-tech companies that hire highly skille says in a radio interview **(http://hereandnow.wbur.org/2012/05/23/moretti-geogr** that it's "really hard to engineer an innovation cluster; we talk about Seattle, but if you look clusters, they were all born in very random, and often serendipitous, ways."

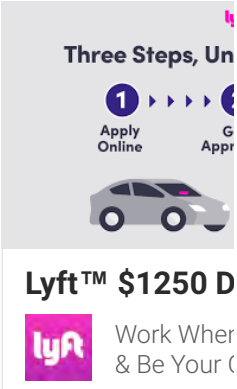
Since it's so difficult to bring job hubs to the unemployed, governments should unemployed to job hubs — in the form of relocation assistance. In a recent *Wall S* essay (http://online.wsj.com/article/SB10001424052702303610504577420701942 fb_ref=wsj_share_FB&fb_source=home_multiline) adapted from his book, Moret "Relocating is like an investment: You spend money up front — to cover the costs of a move expenses until a job becomes available — in exchange for a better job later. But because of li and access to credit, many low-skilled unemployed workers are unable to make this investm to Detroit, which has experienced crushing job losses: "An unemployed worker in Detroit ha incentives to move to, say, Chicago, a more expensive city but one where the labor market is

Moretti's proposal: "Unemployed individuals living in areas with above-average unemploym should receive part of their unemployment insurance check in the form of a relocation vouc voucher would cover some of the costs of moving to a different area. Instead of encouraging residents to remain in Detroit, in other words, the federal government could help them relo city with financial support that covers part of their moving expenses."

It's a bold vision: first, to point out that having a lot of college-educated residents "changes t economy in profound ways, affecting both the kinds of jobs available and the productivity of who lives there, including the less skilled." Second, to note that the result is higher wages fo and less skilled jobs alike. And third, to then posit that if you can't get more college-educate struggling cities, the best way to assist people who can't find work is to help them move to w already is.

ABOUT THE AUTHOR

Leslie Brokaw is a contributing editor to *MIT Sloan Management Review*.



Attachment A-2

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Introduction

Stanford Community Plan Issues and Policies

Stanford University is a private university located in the northwest corner of Santa Clara County adjacent to San Mateo County. Founded in 1891, Stanford has grown over time to become a highly respected institution of higher learning and research. It contains over 4,000 acres of land within the jurisdictional boundaries of Santa Clara County, the area addressed under this Community Plan. Stanford also owns lands in other jurisdictions, including Palo Alto, Menlo Park, San Mateo County, Woodside, and Portola Valley.

The unincorporated lands of Stanford within Santa Clara County are subject to the land use jurisdiction and regulatory authority of the County. The 1995 Santa Clara County General Plan serves as the principal means of setting goals and overall policy direction for physical development and use of lands within the unincorporated area. The Stanford Community Plan refines the policies of the General Plan as they apply to Stanford lands within the County.

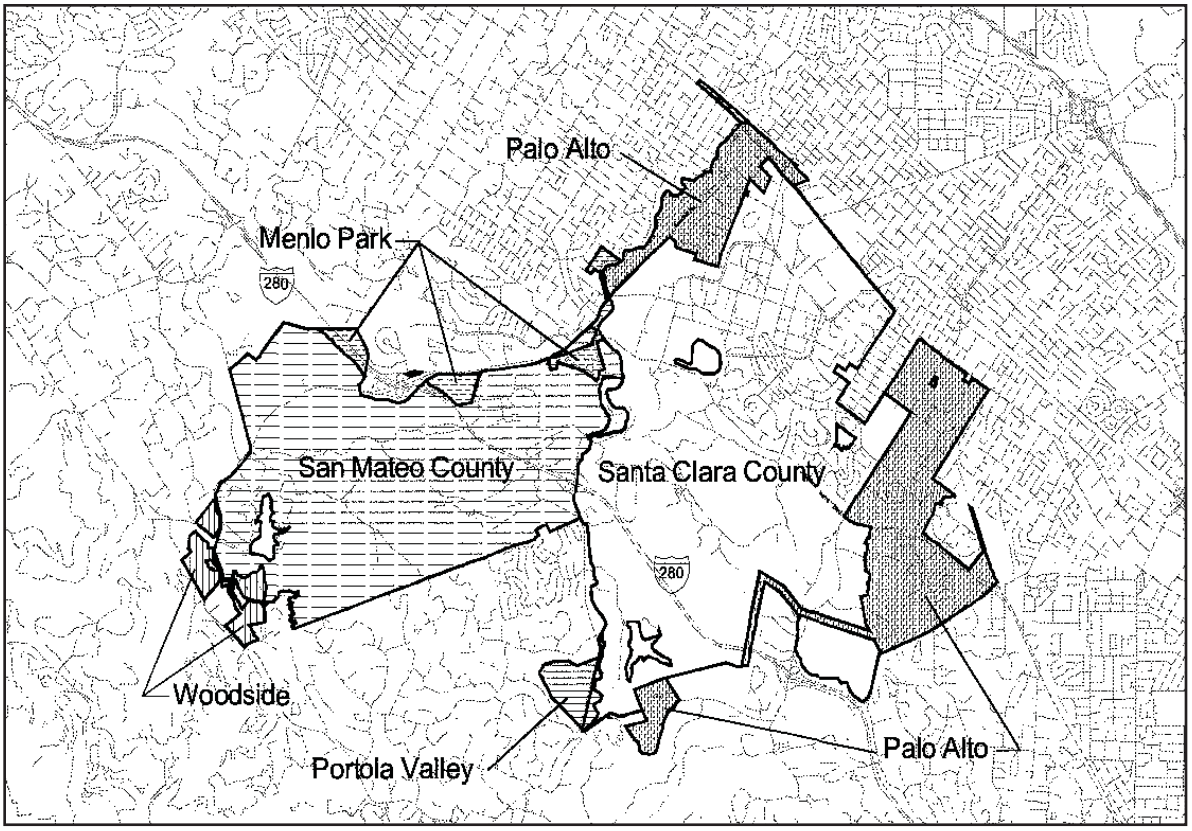


Figure Intro.1: Governmental Jurisdiction on Stanford Land

Purpose of the Community Plan and Relation to General Plan

Community Plans focus on a particular region or community within the overall general plan area of a jurisdiction. As an integral part of the overall General Plan, a community plan must be consistent with the General Plan, in keeping with the general requirement of state law that general plans be internally-consistent. To facilitate consistency, the Stanford Community Plan builds upon the basic strategies and policy framework for each element of the General Plan, tailoring the treatment of each subject to those aspects of an element most applicable and pertinent to Stanford. The Community Plan is also consistent with and furthers the implementation of associated planning instruments, such as the 1985 Land Use Policy Agreement. (For more information, refer to the Growth and Development Chapter).

The primary purpose of the Community Plan is to guide future use and development of Stanford lands in a manner that incorporates key General Plan principles of compact urban development, open space preservation, and resource conservation. Growth and development in general can have both benefits and disadvantages. The Community Plan attempts to achieve the appropriate balance between the reasonable expectations of the University to use and develop its land with the interests of the public to responsibly manage such growth.

The Community Plan is adopted as an amendment of the General Plan in the manner set forth by Government Code §65350 et seq. Any and all revisions to the Community Plan considered in the future must also be made according to the provisions of State law for adopting and amending general plans.

Organization of the Community Plan

Community Plan issues and policies are organized into seven chapters:

- Growth and Development,
- Land Use,
- Open Space,
- Housing,
- Circulation,
- Resource Conservation, and
- Health and Safety.

Each of these chapters addresses issues and policies as they pertain to Stanford lands and its regional setting. They are not intended to duplicate all aspects of the General Plan chapters or "elements" on which they are based. Instead, each chapter provides the additional focus and context beyond that provided in the General Plan in order to provide policy direction and guide decision-making for Stanford lands.

Each chapter of the Community Plan uses the same organizational structure. Within each chapter, a summary is provided, indicating the basic strategies set forth in the chapter. These strategies are overall policy approaches to various issues, and they form the framework for more detailed policies and implementation recommendations on the particular subjects which are articulated in the chapter. Strategy statements correspond with those of the relevant General Plan chapters, with modifications to reflect the particular circumstances, issues, and policies as they relate to Stanford. Following the chapter summary, each chapter contains relevant background information, followed by discussion for each strategy and its associated policies and implementation recommendations.

Implementation of the Community Plan

Prior to the adoption of the Community Plan, the principal means of guiding land use and development for Stanford lands was the "General Use Permit," or GUP. The GUP served as a form of master use permit under which Stanford received approvals for development, consistent with the provisions of the County's Zoning Ordinance. The General Use Permit will remain as the principal means for implementing the Community Plan. The GUP will contain conditions regarding review of individual projects, as well as provisions requiring certain actions, such as regular monitoring and reporting. The Community Plan also contains implementation recommendations to enact and apply zoning districts appropriate to the land use designations specified in the plan for the purpose of more specifically regulating the land use and development.

Individual projects allowed under the Community Plan and General Use Permit are also subject to the County's Architecture and Site Approval (ASA) permitting process. As such, the Community Plan is further implemented by the review and conditioning procedures of ASA. In particular, certain conditions of development approval may be employed specifically to carry out environmental mitigations required under the Environmental Impact Report prepared for the adoption of the Community Plan and GUP.

Major Policy Directions of the Community Plan

The major policy directions of the Community Plan are expressed within each chapter's major Strategies. In more general terms, the major policy directions include the following concepts and principles:

a. promote compact urban development together with conservation of natural resources;

b. allow Stanford flexibility to develop its lands within a framework that minimizes potential negative effects ("flexibility with accountability");

c. accommodate development for academic uses and housing on lands only within an Academic Growth Boundary, or AGB, while limiting the uses and development potential for lands outside the AGB to conserve open space and natural resources;

d. differentiate the major land uses within the plan area according to areas in academic use, housing for faculty I staff, and open space outside the AGB;

e. plan for and ensure that substantial new housing development occurs concurrently with approval for increases in academic space and facilities;

f. meet mobility and access needs primarily though means other than major road improvements, including appropriate integration of land use, transit services, transportation demand management, and management of the number of net new commute trips which may be generated; and,

g. achieve the various conservation, public health and safety goals by emphasizing preventive measures or avoidance of impacts, requiring mitigation for impacts that may occur, and promoting resource restoration.

In conclusion, the Community Plan represents a major evolutionary change from the development decision-making processes previously employed by the County for Stanford. It reflects a more proactive than reactive approach to land use planning for Stanford. Furthermore, it is intended to provide significantly more useful background information and policy guidance than was previously available to serve as a guide to future land use and development decision-making for Stanford University.

The Community Plan supersedes the previous Stanford Chapter contained within Part 4, Book B of the General Plan for Urban Unincorporated Area Issues and Policies, as well as the land use policies for Stanford University Lands - Campus and Stanford University Lands -Academic Reserve and Open Space in Part 3, Book B of the General Plan. As needed, the Community Plan may be amended over time to improve its usefulness and effectiveness to decision-makers, Stanford, and the general public.

Growth and Development

Stanford Community Plan Issues and Policies

Chapter Summary

This chapter of the Community Plan articulates the fundamental approach that the County will pursue when considering future growth of the University.

This plan considers Stanford lands in Santa Clara County in their entirety and identifies the portion of those lands which are most appropriate for future development. The County's intent is to channel development to achieve the primary General Plan policy directions of compact urban development and resource conservation. The primary mechanism to direct growth is the establishment of an Academic Growth Boundary that is to remain in place until a defined level of development intensity has been achieved on lands within the growth boundary.

An important aspect of overseeing growth at Stanford is the coordination of land use decision making, consultation, and policies regarding annexation. This chapter reinforces agreements which have been in place among the County, the City of Palo Alto, and Stanford since 1985 relating to the delivery of services, governmental organization and cooperation. Finally, this chapter provides a basis for continued monitoring of Stanford's development activities and mitigation of environmental impacts associated with growth and development.

Community Plan strategies for growth and development are:

Strategy # 1: Promote compact development and conservation of natural resources through use of an Academic Growth Boundary.

Strategy # 2: Maintain Co-operative Planning Agreements and Implementation.

Strategy # 3: Mitigate and Monitor the Impacts of Growth.

Background

Location and Setting

Governmental Jurisdictions

Stanford University is located in Santa Clara and San Mateo counties, approximately 35 mile south of San Francisco and 20 miles north of San Jose California. Stanford's lands, totaling approximately 8,180 acres are located in six jurisdictions: unincorporated Santa Clara and San Mateo counties, the cities of Palo Alto and Menlo Park, and the towns of Portola Valley and Woodside (see Figure 1.1- Government Jurisdictions). Approximately 4,000 acres containing Stanford's academic, open space and agricultural lands are located within unincorporated Santa Clara County.

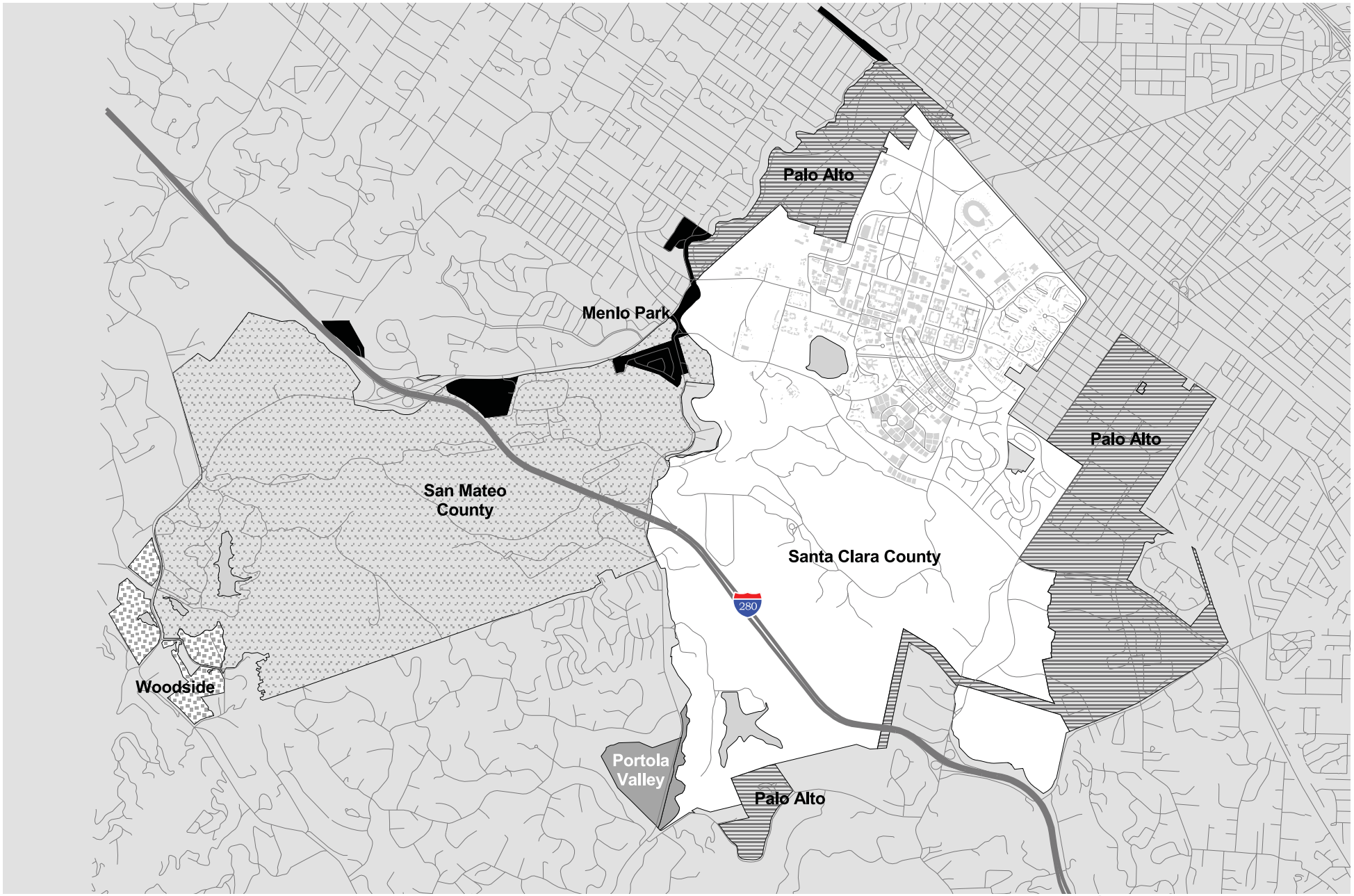
Table 1.1 – Distribution of Stanford Lands across Jurisdictions

Santa Clara County	**Acres**	**Percent of Total**
Unincorporated	4,017	49%
Palo Alto	1,161	14%
San Mateo County		
Unincorporated	2,701	33%
Woodside	114	1%
Menlo Park	111	1%
Portola Valley	76	1%
Total	8,180	

Source: Stanford University

Unincorporated Stanford lands in both Santa Clara and San Mateo Counties are within different spheres of influence. Some portions of Stanford lands are within the City of Palo Alto's urban service area and sphere of influence. All unincorporated San Mateo County lands are within a city sphere of influence. Due to the unique nature of Stanford, the rules, regulations and policy agreements relating to urban service areas are applied differently for Stanford than for other areas of the County.

Government Jurisdictions



Menlo Park
Palo Alto
Portola Valley
San Mateo County
Santa Clara County
Woodside

Scale
1:48,000

N

0 1 2 Miles

Figure 1.1

Stanford University Community Plan Adopted December 2000

In some cases, the uses on Stanford lands differ sharply between jurisdictions, most notably for those areas that are within the City of Palo Alto. These lands are expressly intended for interim non-academic uses that support the operation of the University (see Policy Context, below). Land uses within the City of Palo Alto include the Stanford University Medical Center, Stanford Shopping Center, Stanford Research Park, and apartment complexes. Lands in the San Mateo County jurisdictions are largely undeveloped, with the exception of the Stanford Linear Accelerator Center in unincorporated San Mateo County.

Community Plan Area Physical Setting

Both developed and undeveloped areas of the Stanford campus are distinctive. Stanford is a complex and active place with a wide variety of activities taking place throughout the campus. With an array of academic buildings, housing, academic and student support services, and cultural and athletic facilities the campus has been compared by many to a fully-functional city.

The clearest geographic distinction on the Stanford campus is between the central campus, where essentially all development is concentrated, and the foothills which have remained basically undeveloped. Of the 4,017 acres of land in unincorporated Santa Clara County, approximately 1,800 acres are north of Junipero Serra Boulevard and approximately 2,200 acres are located south of the roadway.

Within these two primary areas there are several important geographic areas and sites addressed throughout the Community Plan. These locations are defined on Figure 1.2 - Community Plan Locations.

Policy Context for the Community Plan

Policies for Stanford are addressed in the Santa Clara County General Plan under the portion of the plan concerning urban unincorporated areas, recognizing the nature of the activities which take place at Stanford. However, Stanford is not subject to the General Plan strategies and policies for other urban unincorporated areas, which are "pockets" of unincorporated lands that are intended for future annexation. The Stanford University campus lands are unlike all other urban unincorporated lands in Santa Clara County in a number of significant respects in that they:

- Are used for academic and related purposes;
- Are entirely under the ownership of a single landowner that
    - is both a major employer and a major provider of housing,
    - provides many of its own urban services and facilities, and
    - has its own land use planning staff;

Community Plan Locations

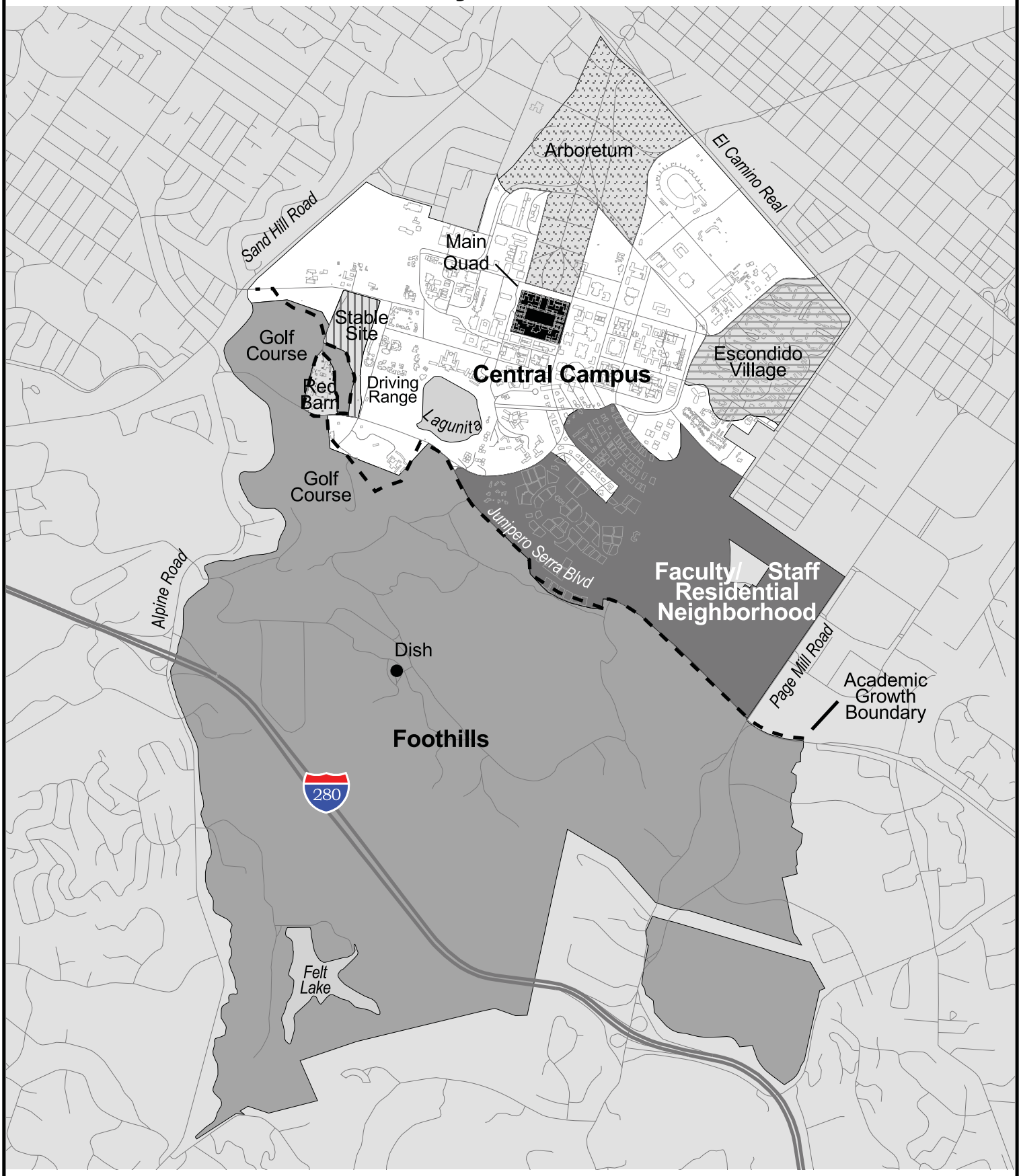


Figure 1.2

Stanford University Community Plan Adopted December 2000

- Have limitations on their sale (due to restrictions in the Founding Grant);
- Are the subject of unique interjurisdictional agreements involving the County, Palo Alto, and the University; and,
- Encompass a unique integrated community whose members are all related, in one way or another, to the University.

Prior to the Community Plan, Stanford's policy framework was composed of:

- Santa Clara County General Plan Land Use Map designations and policies for Stanford;
- The 1985 Land Use Policy Agreement between Stanford, the City of Palo Alto, and the County; and,
- The 1989 General Use Permit, which stipulated the allowable amount of new development on Stanford lands and the conditions under which that development could occur.

Due to Stanford's multijurisdictional setting and the need to consider issues concerning annexation as they specifically apply to Stanford, the County of Santa Clara, the City of Palo Alto and Stanford University are parties to an agreement entitled the 1985 Land Use Policy Agreement. This agreement sets forth the policies regarding land use, annexation, planning, and development of Stanford lands in Santa Clara County (see sidebar), and defines what uses may remain in the unincorporated County and what uses must be annexed to the City of Palo Alto. In essence, the Land Use Policy Agreement augments the sphere of influence by affording Palo Alto review opportunity for projects on all unincorporated Stanford lands (not just those within the delineated sphere of influence north of Junipero Serra Boulevard), and by identifying what types of uses are to remain unincorporated (see sidebar).

The Land Use Policy Agreement states that the County, the City of Palo Alto, and Stanford agree that Stanford lands " ... are held in perpetual trust for educational purposes ... " (Policy la).

The 1985 Land Use Policy Agreement also calls for maintenance of a document known as the Protocol, which outlines all adopted land use designations, regulation, restrictions, and review and referral procedures for land use and development on the Stanford campus.

This Community Plan intends to maintain and enhance the 1985 Land Use Policy Agreement. The Protocol will need to be amended according to this policy agreement to reflect the strategies and policies of the Community Plan.

In light of the multijurisdictional agreements, unincorporated Stanford lands are exempted by the County of Santa Clara and the Land Use Policy agreement from the following two major General Plan strategies generally applicable to urban unincorporated area:

1985 Land Use Policy Agreement General Policies

The general policies of the 1985 Land Use Policy Agreement outline Stanford University's uniqueness and document the agreement that all academic, open space, and agricultural uses should remain unincorporated while non-academic uses on University land should be subject to city annexation. there is an acknowledgement that the University holds its lands in perpetual trust for educational purposes and is responsible for providing its own municiple services. These policies also include agreements regarding mulit-jurisdictional review procedures, which are to occur prior to any project or proposal.

Specific Policies Governing Academic Use of Stanford Lands

The Stanford Board of Trustees holds all Stanford lands for ultimate academic use. Unincorporated Stanford lands in Santa Clara County are subject to the County General Plan and Zoning Ordinance as well as other land use approvals granted by the County. Both Palo Alto and Stanford agree that neither seek annexation to Palo Alto of parcels designated for academic use.

Specific Policies Governing Non-Academic Use of Stanford Lands

The Trustees allow non-academic use of certain designated parcels to produce income to support the University and its programs. These policies define "non-academic uses," state Stanford;s intent to request annexation for parcels on which any non-academic use is proposed, and describe the City of Pale Alto's review and approval procedure.

Implementation of the Policies by the Protocol

The staffs of the three parties, incooperation, will maintain an informational document know as a Protocol. The staffs will continue to refer development applications to each other. Revisions to the Protocol are to be made by the three staffs, to reflect any adopted changes in the County land use and development regulations, and administrative practices and procedures.

- Unincorporated lands within city urban service areas should be annexed to the cities in whose urban service areas they are located.
- Land uses for unincorporated lands within city urban service areas should conform to the general plan of the city in whose urban service area they are located.

The needs and issues which are commonly addressed through the mechanisms of annexation, sphere of influence, and urban service area are instead addressed at Stanford through the Land Use Policy Agreement. The County normally requires most forms of new development in urban unincorporated areas to conform to the land use and density requirements of the applicable city's General Plan, with the expectation that these areas will be annexed at some point in the future. Since academic uses at Stanford are not intended for future annexation, they are not required to conform to the requirements of the City of Palo Alto. Dispensation from the Palo Alto Comprehensive Plan through the Land Use Policy Agreement also applies to the Palo Alto Urban Service Area. By agreement of all parties, it is the County General Plan which defines the extent of urban growth at Stanford.

The creation of the Community Plan for Stanford University marks a major milestone in more than 100 years of cooperative planning between the County of Santa Clara and Stanford University. This Community Plan reflects an unprecedented level of shared commitment to the principles of quality land use planning, environmental studies, and public involvement in the planning process. Furthermore, the Community Plan represents a commitment to stewardship of a unique regional asset.

The County determined in 2000, when faced with regional growth pressures impacting the quality of life in local communities, that a more deliberate planning instrument was needed to provide the County with a policy framework for decisions regarding development at Stanford. The Community Plan identifies policies and establishes land use designations that reflect the character and resources of the various Stanford lands in unincorporated Santa Clara County. No portion of the Community Plan may be modified without the approval of a majority of members of the Santa Clara County Board of Supervisors, and modification of the AGB requires a 4/5 vote of the Board. The Community Plan offers local communities a greater specificity in the planning and decision making processes of both Stanford and ultimately the County. The General Use Permit serves within this framework as the general approval for a specified amount of development at Stanford.

The Community Plan is based on the County's analysis of Stanford's development needs in the context of the County's priorities for land use, growth and development, and other planning issues as expressed in the General Plan. This Community Plan is not intended to define the long-term development potential of Stanford's unincorporated lands, with regard to either the amount of or the location of development for the period beyond the intended planning horizon. However, the County and Stanford recognize that such an understanding may be needed in the future to provide an opportunity for serious consideration of trade-offs in the future location of development.

General Plan Policy Direction

This Community Plan is a part of and a supplement to the Santa Clara County General Plan. It is meant to be consistent with the General Plan and refine its strategies, policies, and implementation recommendations as they apply to Stanford. The Community Plan particularly emphasizes and is based upon two fundamental and complementary principles expressed in the General Plan:

- Compact and efficient urban development; and,
- Conservation of natural resources.

Stanford University Development Trends

Ongoing expansion of academic programs and research opportunities at Stanford has also engendered a corresponding increase in building area on the campus. New development attributable to growth in academic buildings, support services, and student housing has mostly occurred since World War II; total square feet of building area on the campus (excluding faculty housing) increased almost threefold from 1960 to 2000, as shown in Table 1.2.

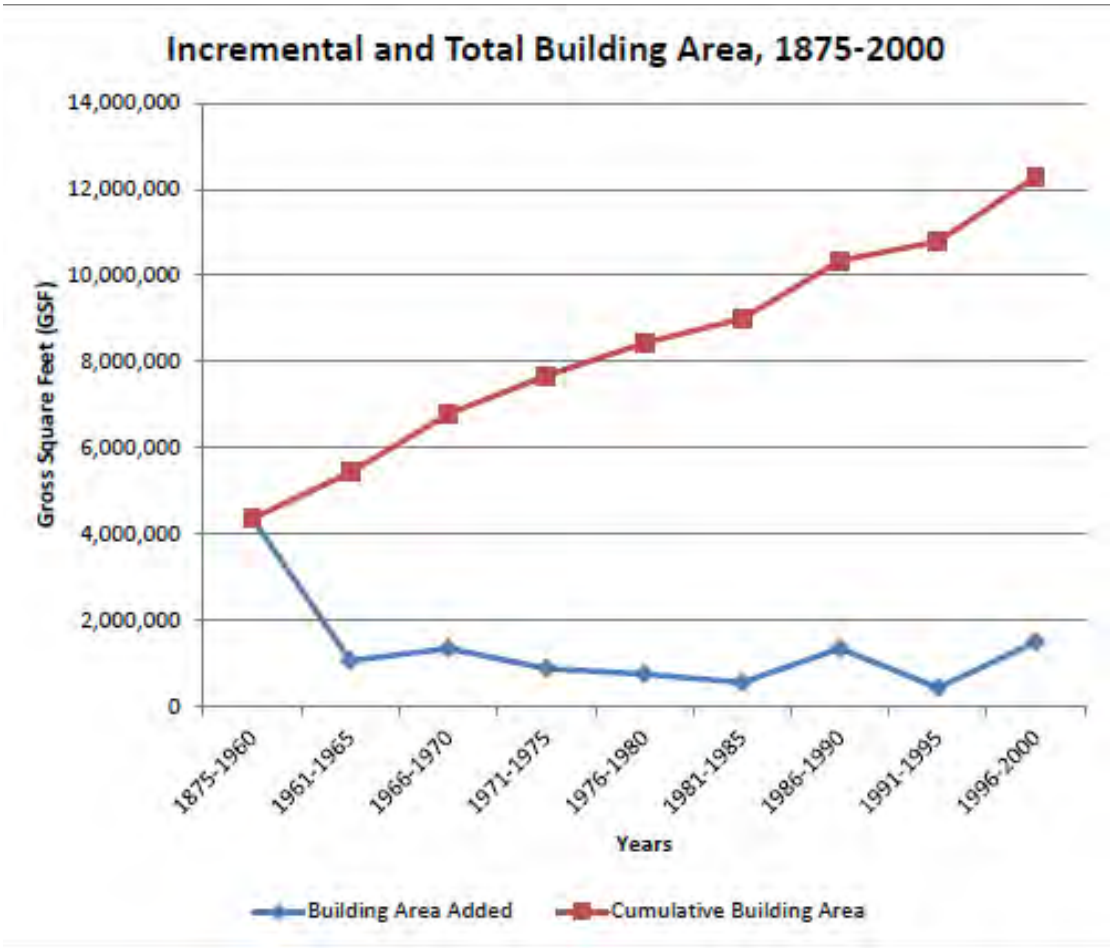
Table 1.2 – Building Area at Stanford, 1875-2000

Time Period	Building Area Added (gross square feet)	Cumulative Building Area
1875-1960	4,363,375	4,363,375
1961-1965	1,069,406	5,432,781
1966-1970	1,353,405	6,786,186
1971-1975	890,496	7,676,682
1976-1980	758,805	8,435,487
1981-1985	562,736	8,998,223
1986-1990	1,348,841	10,347,064
1991-1995	439,840	10,786,904
1996-2000	1,507,326	12,294,230
Total	**12,294,230**	

Source: Stanford University Planning Office

The existing building area on the Stanford campus includes approximately 5,900 units of undergraduate housing and 3,860 units of graduate student housing. Housing for faculty and staff, which is not included in the building area total, comprises 989 units, most of which are single family homes.

The growth rate since 1960 has represented an average annual addition of 198,200 square feet of academic uses, support facilities, and student housing. While the amount of growth on an annual or 5-year basis has fluctuated over the last 40 years the rate of increase in cumulative building area has occurred at a relatively constant rate of approximately 200,000 square feet per year, as shown in the chart below.



While it would be infeasible to accommodate an additional 200,000 square feet annually in perpetuity, it is unclear how much additional development is appropriate. It is also unclear whether, when and to what extent Stanford may propose to develop the foothills.

Zoning and General Use Permit

The Al zoning district applied to Stanford University requires that a use permit be granted for development and operation of academic activities at Stanford. Since the 1960s, this use permit has been in the form of a General Use Permit for the University rather than a separate permit for each building.

In 1989, the General Use Permit approved for Stanford allowed for 2,100,300 square feet of new development on the campus, including both academic uses and student housing. Since 1989 Stanford has averaged 177,450 additional gross square feet per year, with approximately 76% of this annual development devoted to academic, athletic and support facilities and 24% for student housing.

Strategies, Policies and Implementation

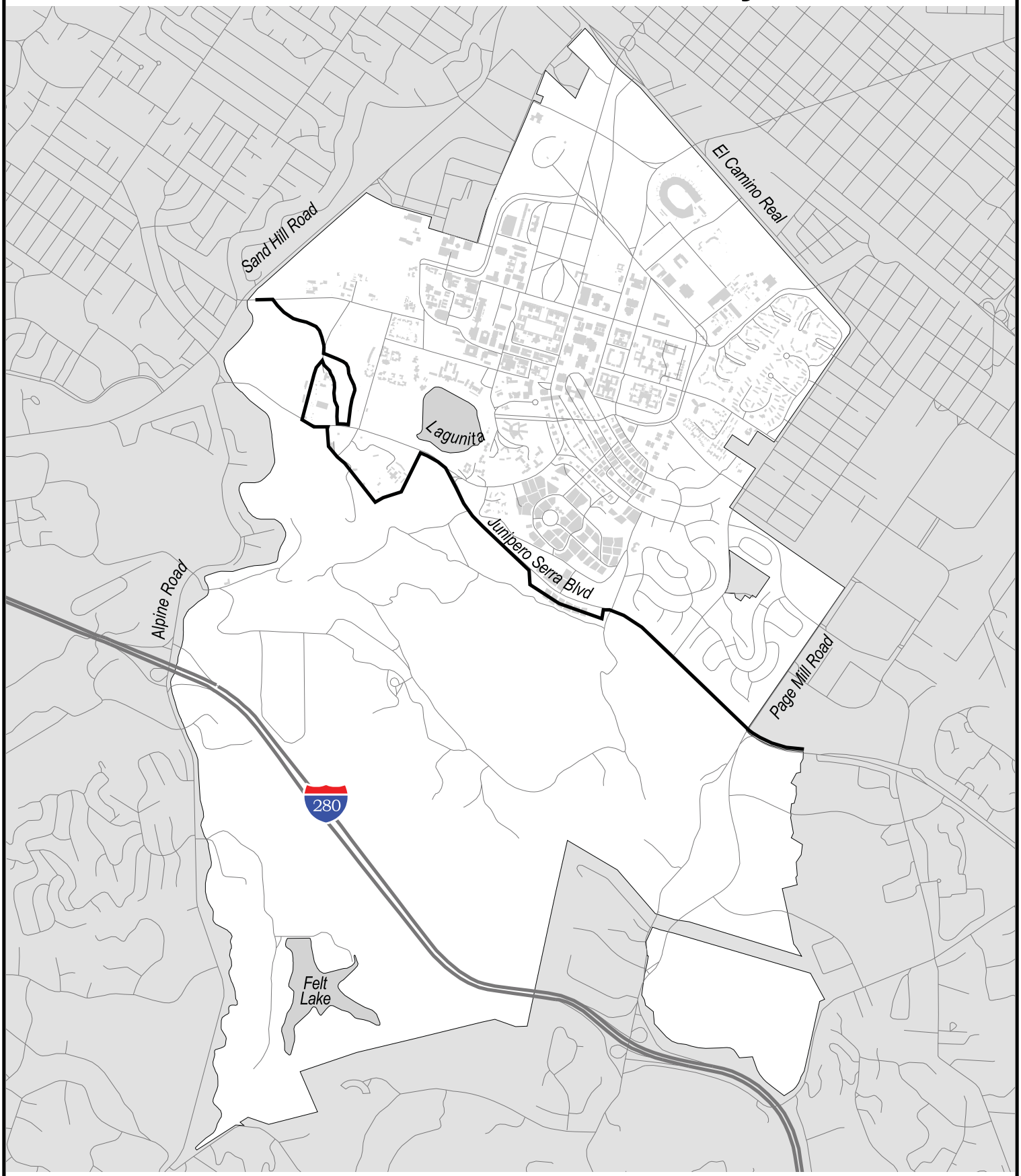
Strategy #1: Promote compact development and conservation of natural resources through use of an Academic Growth Boundary

The County General Plan promotes the use of long-term urban growth boundaries by cities to delineate areas intended for future urbanization from those not intended for future urban use. Unlike an Urban Service Area boundary, which typically indicates the areas in which a city is able and willing to provide urban services in the short term (5 years), an urban growth boundary is meant to provide adequate land to accommodate urban development for a significantly longer time period of approximately 20 years. The delineation of urban growth boundaries can promote compact urban development and conservation of natural resources by (a) channeling development within existing urban areas and (b) excluding important habitat, hazard, or open space areas from the urban growth boundary area.

The General Plan identifies considerations for the establishment and periodic review of urban growth boundaries between the County and incorporated cities.

The Community Plan applies the concept of an urban growth boundary to Stanford in the form of an "Academic Growth Boundary" (AGB). The concept of the growth boundary as it applies to Stanford is a basic one: development must occur within the AGB, with lands outside the AGB remaining in open space. The AGB is the primary mechanism for promoting compact urban development and resource conservation in the Community Plan, and it serves as the basis for associated policies throughout the plan that reinforce this basic demarcation line.

Academic Growth Boundary



— Academic Growth Boundary

Scale 1:30,000

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Figure 1.3

Stanford University Community Plan Adopted December 2000

Academic Growth Boundary Location

The Academic Growth Boundary generally parallels existing developed areas (see Figure 1.3 -Academic Growth Boundary). The purpose of this selected location is to direct all new development to infill sites rather than expansion areas, allowing for a compact form of urban development that promotes use of non-auto transportation modes and that conserves land and other natural resources. Over time, this location will primarily result in a central campus at Stanford that is developed more intensively than the campus today. The location of the AGB also allows for a variety of settings to meet different academic and research needs.

Throughout the Community Plan, areas within the AGB (generally north of Junipero Serra Boulevard) are considered "central campus" and the areas outside the AGB (generally south of Junipero Serra Boulevard) are considered "foothills" (see' Figure 1.2 - Community Plan Locations).

Development Policies

Allowable development for areas within and outside the Academic Growth Boundary is defined in the Land Use chapter of the Community Plan. Different land use designations are applied in those areas that direct development to land inside the growth boundary. Essentially all uses associated with the educational and residential function of the campus are directed inside the boundary, while areas outside the boundary are reserved for open space and academic activities that require the foothill setting for their basic functioning. A major existing use which is outside the AGB is the Stanford Golf Course, which is considered an open space use under the Community Plan.

Academic Growth Boundary Timing

The Academic Growth Boundary is not meant to be a permanent planning boundary, but it does need to remain in place for a long enough period of time to ensure that development will be directed toward the central campus over the long term. The AGB will remain in the established location for a period of at least 25 years. The Community Plan requires a vote of four-fifths of all members of the Board of Supervisors to modify the AGB location during this 25 year time period, in contrast to the simple Board majority required for other General Plan amendments.

Based on the historic growth rate of approximately 200,000 square feet of additional development per year for the past 40 years, 25 years of development would total an additional 5 million square feet, excluding faculty I staff housing which is separately regulated. Adding 5 million square feet to the current total would result in a central campus building area of approximately 17,300,000 square feet, excluding faculty and staff housing. In addition to the time limitation, this amount of cumulative development is a prerequisite or "trigger" for possible modification of the AGB. No modification of the growth boundary may be proposed or approved prior to 25 years from approval of the Community Plan and total building area on the central campus reaches 17,300,000 square feet.

The land area in which this development would be located is 1,370 acres, which is the area of the central campus excluding the current and proposed future faculty/ staff residential area.

This AGE threshold serves several purposes:

- It defines the point at which expansion of the portion of the campus designated for academic and related development may be considered.
- It defines the development intensity level for the Academic Campus land use .designation (see Land Use Chapter) under the Community Plan.
- It provides for an adequate amount of additional building area to serve Stanford's needs over the long term.
- It specifically aims to provide a concentration of people and activity conducive to use of transit and non-automobile trips.

It is important to distinguish that the AGB modification threshold in no way serves as an approval by the County of this amount of development. Actual development and population growth proposals by Stanford, both in the form of General Use Permit applications and as applications for individual building projects under the CUP, will continue to be evaluated for their environmental and policy impacts by County staff, the Planning Commission, and the Board of Supervisors.

Accommodating all future additional development within the AGB may require exploration of new areas for development in the future, such as the area of the west campus currently expected to remain undeveloped according to the development agreement between the City of Palo Alto and Stanford for the Sand Hill Road Corridor Projects. A higher level of building intensity through increased building height may also be needed.

Concurrent with their application for a General Plan amendment in the form of a Community Plan, Stanford University filed an application with the County for a new General Use Permit, requesting 2,035,000 additional square feet of academic and support space, 2,000 housing units for students, 350 units for postdoctoral fellows, and up to 668 housing units for faculty and staff. Excluding faculty and staff housing and assuming 550 square feet per unit of student housing and 1,000 square feet per unit of postdoctoral fellow housing, this development application requests an additional 3,485,000 square feet of new building area on the campus over the next 10 years. Despite this accelerated rate of new development compared to past years, the AGB will remain in place for 25 years, indicating that growth rates would need to decline in the future. The calculations for the AGB threshold are summarized in Table 1.3:

Table 1.3 – AGB Threshold Calculations	
Land area (excluding faculty/staff residential areas)	1,370 acres
Current building area	12,300,000 square feet
Current building intensity ratio (building area/land area)	0.21
40-year annual growth rate	200,000 square feet per year
25-year growth allocation (growth rate * 25 years)	5,000,000 square feet
AGB threshold building area	17,300,000 square feet
AGB threshold building intensity {AGB threshold building area/land area)	0.29
Proposed General Use Permit development	3,485,000 square feet
Amount remaining in AGB threshold after GUP development	1,515,000 square feet

Calculations of current and future on-campus building area do not include faculty I staff housing. Development in residential areas is regulated in the Community Plan under a different land use designation that defines allowable residential density for these areas, consistent with the historical practice of excluding faculty I staff housing from the General Use Permit.

Community Plan Policies Supporting Academic Growth Boundary

The following table describes some means by which the Academic Growth Boundary, and the associated concepts of compact urban development and resource conservation, are reinforced in other chapters of the Community Plan.

Table 1.4 – Community Plan reinforcement of AGB	
Chapter	**AGB Reinforcement**
Land Use	Land Use designations within and outside the AGB
Housing	Identification of housing sites within the AGB; promotion of higher density housing
Open Space	Protection of open space outside the AGB; promotion of balance between high intensity development and open space inside the AGB
Circulation	"No net new commute trips" standard, which promotes compact development to allow for use of transit, bikes and walking

Policies

SCP-GD 1
Establish and maintain an Academic Growth Boundary (AGB) as shown on Figure 1.3. Direct future development on Stanford lands within the AGB, consistent with the Community Plan land use designations.

SCP-GD 2
Retain the location of the AGB as shown in Figure 1.3 for at least 25 years, and until the building area of academic and support facilities and student housing reaches 17,300,000 square feet.

SCP-GD 3
Allow modification of the location of the AGB within 25 years of its initial approval only upon a four-fifths vote of the Board of Supervisors.

SCP-GD 4
The design and intensity of growth within the AGB should facilitate transit usage. There should be a mixture of uses to allow for a high degree of pedestrian and bike trips. The location of uses should facilitate non-auto trips.

SCP-GD 5
The design and intensity of development outside the AGB should be very low intensity supporting academic field research, research needing remote locations, agricultural and recreational uses.

SCP-GD 6
Incremental additional development within the AGB may only be permitted through a General Use Permit approved by the County.

Strategy #2: Engage in Co-operative Planning and Implementation

The policies associated with this strategy articulate and reinforce the decision making and co-operative arrangements among Stanford, the City of Palo Alto and the County of Santa Clara which have been in place for several decades. These policies clearly articulate a departure from General Plan policies for other urban unincorporated areas of the county; however, because the County's intentions regarding annexation, use regulation, and service provision differ from other urban areas it is appropriate that specialized policies and consultation procedures apply to Stanford.

The 1985 Land Use Policy agreement stipulates that Stanford will provide all municipal services to unincorporated portions of Stanford lands, including contractual arrangements for services as needed. The Community Plan and new General Use Permit create a need to ensure that service use by Stanford residents and Stanford's provision or contracting of services are consistent with one another.

The policies also reflect the County's desire to understand the University's long-term development plans so that such development may accomplish the University's academic mission in a manner consistent with quality planning practices and the County's planning objectives. The Community Plan represents a commitment to quality stewardship of a unique regional asset.

To provide for consideration of these issues, Stanford will be required prepare, at its own expense and in cooperation with the County Planning Office, a Sustainable Development Study covering all of its unincorporated lands in Santa Clara County. This study will be required to be completed during the time that the 2000 General Use Permit is in effect to ensure that both growth under the 2000 General Use Permit and future growth patterns are consistent with the recommendations of the study regarding the appropriate location and manner of development.

The Sustainable Development Study shall be based upon and meet planning principles and criteria established by the Board of Supervisors in the Community Plan and 2000 General Use Permit, as supplemented by the County Planning Office. These principles and criteria will include, but not be limited to, recognition, protection and avoidance of important natural resources including sensitive plant and animal species and their habitats, creeks and riparian areas, drainage areas, watersheds, scenic viewsheds, and geologic features such as steep or unstable slopes, and faults. The Sustainable Development Study shall identify the maximum planned buildout potential for all of Stanford's unincorporated Santa Clara County land, demonstrate how development will be sited to prevent sprawl into the hillsides, contain development in clustered areas, and provide long-term assurance of compact urban development. In the interest of maintaining hillside views, developable areas should generally be limited to those with an elevation lower than 200 feet. Coupled with new zoning that promotes clustering of development, the Sustainable Development Study will address issues of resource protection with a view beyond the 25-year time frame of the AGB.

The County may, at Stanford's expense, choose to conduct a parallel study to the Sustainable Development Study prepared by Stanford, or may choose to do additional work to supplement Stanford's study. The Sustainable Development Study will be submitted to the Board of Supervisors for approval.

Policies

SCP-GD 7
The use and development of Stanford lands in the unincorporated area of Santa Clara County shall be consistent with:

- the County General Plan, including this Community Plan;
- the County Zoning Ordinance;
- a conditional use permit known as the Stanford University General Use Permit;
- other use permits and approvals as required, granted by the County within the parameters of the Zoning Ordinance and the General Use Permit; and,
- the Land Use Policy Agreement among the County, the City of Palo Alto, and Stanford.

SCP-GD 8
Academic and related development on unincorporated lands of Stanford University within Palo Alto's urban service area shall not be required to conform to the City of Palo Alto's Comprehensive Plan.

SCP-GD 9
The provision of urban services to the academic lands of Stanford University shall be the responsibility of the University. This may be accomplished through direct provision of such services by Stanford, payment of in-lieu fees, or appropriate contractual relationships with local jurisdictions.

SCP-GD 10
Annexation of Stanford lands shall be in accordance with the 1985 Land Use Policy Agreement:

- Academic land uses, for which the University provides or obtains its own services, will not be required to annex to a city.
- Open space and agricultural uses of land will remain unincorporated.
- Other non-academic uses of University land should be subject, in appropriate cases, to city annexation, as agreed to in the Land Use Policy Agreement.

SCP-GD 11
In accordance with the adopted Land Use Policy Agreement and Protocol, provide opportunities for the City of Palo Alto to review and comment upon projects and proposals involving Stanford University that may affect the City.

SCP-GD 12

Determine and define the long-term incremental growth potential for Stanford lands, and identify the maximum planned buildout potential and all appropriate areas of potential development through completion of a Sustainable Development Study. The Sustainable Development Study shall accomplish the following:

- Demonstrate how future development will be sited to prevent sprawl into the hillsides, contain development in clustered areas, and provide long-term assurance of compact urban development; and
- Provide for protection and/ or avoidance of sensitive plant and animal species and their habitats, creeks and riparian areas, drainage areas, watersheds, scenic viewsheds, and geologic features such as steep or unstable slopes, and faults.

Implementation Recommendations

SCP-GD (i) 1

Revise the Protocol, which is maintained under the stipulations of the 1985 Land Use Policy Agreement, to reflect changes in land use policies and review procedures resulting from adoption of the Community Plan and the 2000 General Use Permit.

SCP-GD (i) 2

Identify urban service levels and service needs of Stanford residents. If Stanford is not providing an appropriate level of urban services to its residents, require that Stanford either provide any needed municipal services, pay in-lieu fees, or contract with the appropriate agencies to provide them. Contractual agreements or services required by the County will recognize that individuals commonly use services independent of jurisdictional boundaries, that jurisdictions may employ policies that give priority to their residents for service use, and that service levels differ among jurisdictions.

SCP-GD (i) 3

Require that Stanford prepare and submit to the Board of Supervisors for approval a Sustainable Development Study to determine the maximum appropriate buildout and development location potential for all of Stanford's unincorporated lands. The Sustainable Development Study shall be completed and approved prior to acceptance of applications for the second 50% of the academic development allowed under the 2000 GUP. Further, the County shall not accept any further use permit applications until the Sustainable Development Study is completed. If appropriate, the County Planning Office may conduct additional work related to the Sustainable Development Study. All work associated with the study shall be conducted at Stanford's expense. The County's approval of the Sustainable Development Study shall in no way be construed as the County's agreement to or approval of the amount, type, or location of development proposed in the Study.

SCP-GD (i) 4

With respect to the foothills, the Sustainable Development Study shall identify all area(s) of potential future development. The potential development area(s) shall be consistent with the Community Plan strategies and policies, which include but are not limited to the strategies and policies relating to compact urban development, conservation of natural resources, open space protection, maintenance of scenic values, and avoidance of hazards.

Strategy #3: Mitigate and Monitor the Impacts of Growth

Growth under the Community Plan has the potential to result in impacts to the campus, surrounding communities and the natural environment. These impacts have been and will continue to be analyzed in accordance with the requirements of the California Environmental Quality Act (CEQA), and mitigation measures for those impacts have been identified. The policies and implementation recommendations in the Community Plan and the conditions of the General Use Permit incorporate both mitigation measures for environmental impacts and other policy-level considerations.

Under the General Use Permit, Stanford will be required to obtain additional approval for each individual building or project proposed. Depending on the nature of the project, each approval may require additional environmental review. Additional conditions will be required on a project-specific basis that are consistent with the conditions of the General Use Permit.

Stanford's compliance with the 1989 General Use Permit was monitored through an annual report process. The County intends to continue the requirement of an annual report. However, the County intends to prepare that report under its own direction rather than requiring Stanford to prepare and submit the report as occurred in the past. The preparation of the report shall be funded by Stanford. This report will need to track Stanford's compliance with each of the individual conditions of the General Use Permit, for topics such as transportation, building area, housing, population growth, and habitat protection. It is important that future monitoring and reporting procedures be both verifiable and understandable.

An additional aspect of monitoring will be ongoing communication between the County Planning Office and the local community regarding development at Stanford.

Policies

SCP-GD 13
Stanford University will mitigate environmental impacts of its growth and development in accordance with the conditions of the General Use Permit and mitigation monitoring program for the Community Plan and General Use Permit.

SCP-GD 14
Review Stanford's compliance with mitigation requirements and conditions of the General Use Permit through an independent, verifiable, and understandable monitoring and reporting procedure.

SCP-GD 15
Promote ongoing exchange of information between the County and the local community regarding development activity at Stanford through the creation of a Community Resource Group (CRG).

Implementation Recommendation

SCP-GD (i) 5
Prepare annual reports to evaluate Stanford's compliance with the conditions of the General Use Permit and progress towards meeting the implementation recommendations of the Community Plan. Preparation of the report shall be funded by Stanford. The annual report shall be presented to the CRG at its first quarterly meeting each year, and shall then be submitted to the Planning Commission no later than June of each year.

SCP-GD (i) 6

Review and evaluate applications for individual building projects under the General Use Permit, and any other use permit applications, for consistency with the Community Plan, the conditions of the General Use Permit, and all other relevant County policies and requirements.

SCP-GD (i) 7
Create a CRG comprised of 8-12 persons. The CRG members shall be selected by the County Planning Office in consultation with the County Supervisor for the Fifth Supervisorial District. The CRG would meet at least quarterly and would serve as a mechanism for exchange of information and perspectives on Stanford development issues, but would have no formal role as an advisory body.

Land Use

Stanford Community Plan Issues and Policies

Chapter Summary

Land use, and the policies that govern it, contribute fundamentally to the character and form of a community. At Stanford, the combination and arrangement of land uses form a complete community that is self-contained for many of its functions, but which is also part of a larger regional setting.

At the countywide level, institutions like Stanford are designated as "Major Educational and Institutional Uses" on the General Plan Land Use Map. This Land Use Plan designation differentiates universities and similar institutions from other major categories or classifications of land use. Policy R-LU 63 of the County's General Plan states the description and intent of the institutional designation:

The Major Educational and Institutional Uses designation is applied to lands belonging to a university, religious order, or private institution, used as a place of learning, an academic reserve for future university use, a seminary, or a research facility.

With the establishment of the Community Plan, Stanford lands are further divided into a set of sub-categories of land use. Designations applied to lands within the Academic Growth Boundary (AGB) include:

- Academic Campus,
- Campus Open Space,
- Campus Residential - Low Density,
- Campus Residential - Medium Density, and
- Public School.

Two additional designations have been established to apply to lands outside the Academic Growth Boundary:

- Open Space/Field Research, and
- Special Conservation Area.

Consistent with the format of the General Plan's Land Use Chapter, the policies in this chapter provide basic descriptions of the purpose of each land use designation, policy statements indicating the range of allowable uses, and development-related policies. Other strategies and policies for the overall form and extent of campus growth are contained in the Growth and Development chapter.

Stanford was founded as and remains a residential university, with academic, residential, athletic, commercial, and a variety of other land uses. Maintaining appropriate arrangements and inter-relationships between these uses, correlated with the transportation network, is as essential to the function and well-being of the University as an entity as it is to the function of any city. Furthermore, the built and open space environments of the campus lands complement each other and function together to define the campus' unique sense of place. As Stanford grows and changes over time and campus land use intensifies, it is important to maintain these inter-relationships and guide development in such a way that the most appropriate and optimal development locations are selected without sacrificing those qualities and areas which contribute to the quality of life on Stanford University land.

Background

Academic buildings and land uses, student and faculty I staff residences, student and community services, and other types of land uses are closely integrated on the Stanford campus. Nevertheless, Stanford does exhibit a definite land use pattern, based upon the original layout for the overall campus design (see Figure 2.1 - Generalized Campus Land Use Pattern).

- The developed portion of the campus is primarily contained between Junipero Serra Boulevard and El Camino Real.
- Uses within the central campus are in a generally concentric arrangement of residences around a core of academic buildings.
- Uses with a close relationship to one another, such as athletic facilities or science and medical buildings, are clustered together.
- Faculty and staff housing is highly concentrated in the southeastern corner of the central campus.
- Despite the intensely developed nature of most of the central campus, important and extensive open space or undeveloped areas remain.

Generalized Campus Land Use Pattern

- Academic Core
- Faculty Staff/Housing
- Student Residences
- Golf Course
- Foothills
- Open Space
- Undeveloped/Lightly Developed

Scale 1:30,000

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0 0.5 1 Miles

Figure 2.1

Stanford University Community Plan Adopted December 2000

The clearest land use distinction on unincorporated Stanford land in Santa Clara County is between the developed central campus and the largely undeveloped foothills. Historically, these two areas were assigned separate land use designations, or subcategories of the Major Educational and Institutional Uses designation, which previously served as the only differentiation in land use policy for the campus at the General Plan level. This approach provided extensive flexibility for Stanford to arrange and integrate different land uses, particularly in the central campus, but it did not recognize the many different land uses which do exist at Stanford. Nor did it necessarily provide much certainty or future guidance regarding long term land use patterns, which is the principal purpose of land use elements in general plans.

The concept contained in the Community Plan builds upon the former approach by establishing an Academic Growth Boundary (AGB) to reinforce the distinction between the urbanized campus area and the undeveloped portions of the foothill lands, while maintaining a significant amount of flexibility for the use of lands within the AGB.

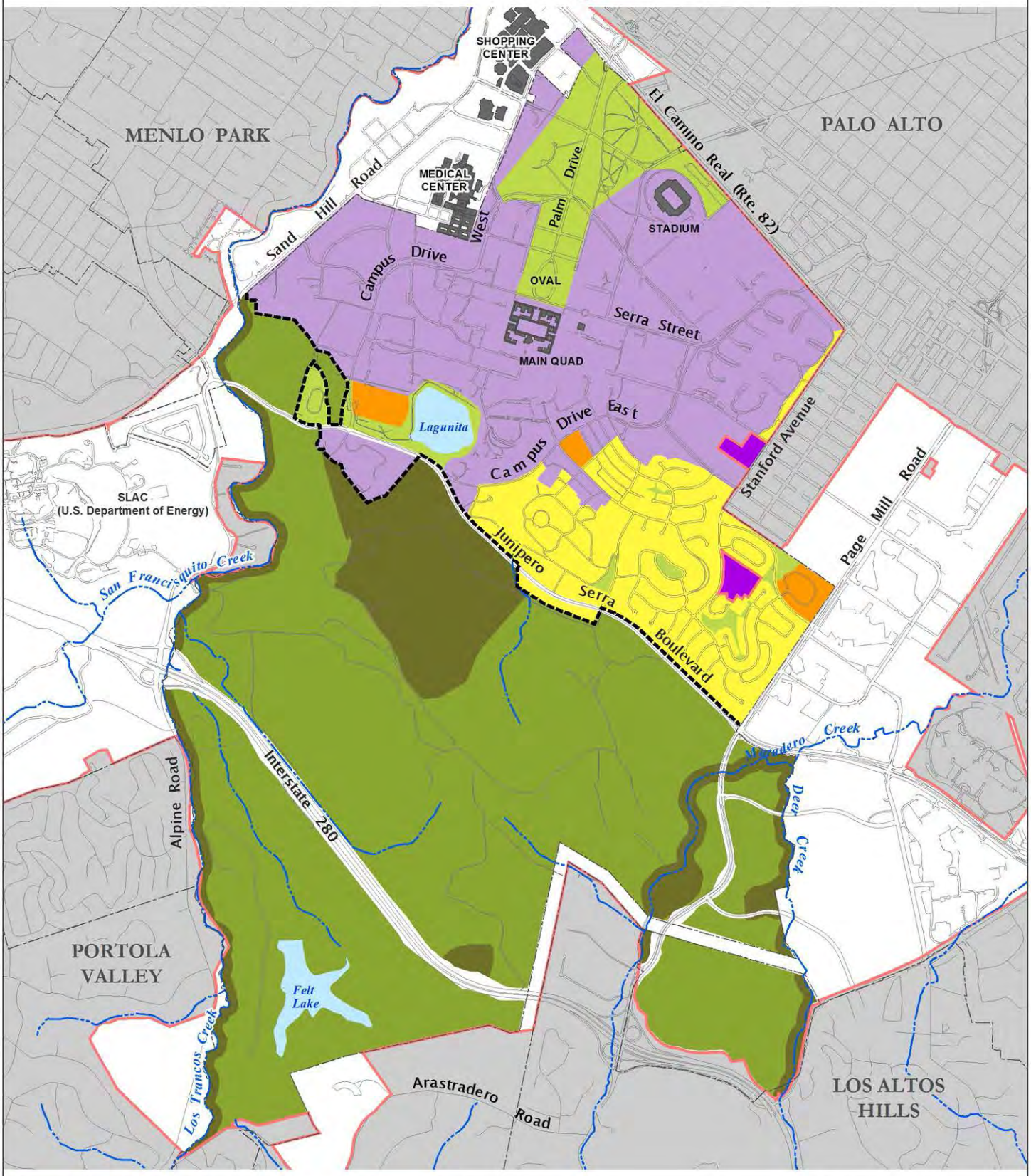
The Land Use Diagram indicating the locations of the land use designations is included as Figure 2.2 - Land Use Designations.

Lands inside the AGB

Within the AGB, the land use designations balance the need to maintain the proximity of related uses with the desire to conserve the character of some individual land uses and areas. Consequently, the concept of an "Academic Campus" land use designation, which encompasses areas with academic buildings, student housing, and student and academic support services, is retained from the previous designations. Additional designations for faculty I staff housing and for protected central campus open space are also established. A residential population density for faculty I staff housing is provide, based on an assumed household size of 2.4 persons per household as projected by ABAG. On-campus public schools are recognized as a separate land use.

Statement of standards of population density and building intensity for lands inside the AGB: As discussed in the Growth and Development chapter, the current cumulative building area on campus is approximately 12.3 million gross square feet (gsf). An additional 2,035,000 gsf of academic and academic support space and 3,018 additional housing units may be constructed through the year 2010. Population density inside the AGB is indirectly controlled through limits on academic and residential development. The current campus daytime population is approximately 21,000 and is expected to increase by 2,201 persons (1,266 graduate/postgraduate and 935 faculty I staff) over the 2000 to 2010 period. Residential population increases in the Academic Campus area (graduate students and postgraduates) are included in these totals. In faculty I staff residential areas, residential population densities are provided through the Campus Residential-Low Density and Campus Residential-Medium Density land use designations. It is not possible for the County to predict development levels or population increases beyond 2010 because no additional development proposals have been submitted by Stanford and it is unknown whether the County would approve such proposals.

Land Use Designations



- Academic Campus
- Public School
- Campus Residential - Low Density
- Campus Residential - Medium Density
- Academic Growth Boundary
- Lake
- Campus Open Space
- Open Space and Field Research
- Special Conservation
- Stanford University - All Lands

Figure 2.2

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Stanford University Community Plan, Adopted: December 2000
Revised: April 2013, S: Fig2-2Landuse_CP2000.mxd, JR

Lands outside the AGB

In the past, the land use designation established for this portion of Stanford lands reflected its general open space character but also provided some potential for future academic use, as well as housing. In keeping with the concept of the Academic Growth Boundary and the Community Plan Growth and Development policies, the future use of this area is limited to field research-related activities and open space uses. Greater emphasis is placed on conserving the open space character of the land, and an additional designation, Special Conservation Areas, provides even greater protection to the most environmentally sensitive areas.

The individual land use plan designations that follow describe the uses that are allowed on Stanford lands. The designations correspond to those depicted on Figure 2.2, Land Use Designations. All allowable uses are consistent with the policies of the 1985 Land Use Policy Agreement between the County, the City of Palo Alto, and Stanford.

Statement of standards of population density and building intensity for lands outside the AGB: For lands outside the AGB, the population density and building intensity are expected to be quite low due to the nature of the uses allowed in the Open Space/Field Research and Special Conservation Area designations. The maximum allowable development on these lands through the year 2010 is 15,000 gsf. Any additional population in these land use designations is included in the population totals for lands inside the AGB.

Lands Within the Academic Growth Boundary

Academic Campus (AC)

Description and Intent

SCP-LU 1

The Academic Campus designation applies to lands in current or intended academic use. Academic use includes both facilities used for teaching or research activities and the wide range of uses which support academic activity, such as administrative offices, athletic facilities, student housing, and student and administrative support services. This designation is meant to provide Stanford with the opportunity to locate these uses in relation to one another according to the University's programmatic needs.

Allowable Uses

SCP-LU 2
Allowable academic uses include:

1. instruction and research (including teaching hospital facilities);
2. administrative facilities;
3. housing intended for students, postgraduate fellows, and other designated personnel;
4. high density housing for faculty and staff;
5. athletics, physical education, and recreation facilities;
6. support services (such as child care facilities, the bookstore, and the post office);
7. infrastructure, storage, and maintenance facilities;
8. cultural facilities associated with the University; and,
9. non-profit research institutions with close academic ties to the University.

Development Policies

SCP-LU 3
Development intensity of individual facilities may vary with the type of allowed use. Maximum cumulative development amounts are permitted through the Stanford General Use Permit, consistent with the AGB threshold amount of development (See Growth and Development Chapter). Housing for faculty and staff at densities above 15 units per acre may be developed.

SCP-LU 4
Development must be consistent with the 1985 Land Use Policy Agreement, amended as needed, with regard to allowable uses and provision of services.

Implementation Recommendations

SCP-LU (i) 1
Maintain the use of the County's Al, General Use Zoning District for areas under the Academic Campus land use designation, with allowable uses, development intensity, and conditions governed further through the General Use Permit.

Campus Residential - Low Density (CR-L)

Description and Intent

SCP-LU 5
The Campus Residential-Low Density designation applies to lands immediately adjacent to the Academic Campus area that have a low-density residential character and are used for housing University faculty and staff. These areas are an important housing resource that allows faculty and staff to live in close proximity to the academic portions of the campus. This designation applies to existing low density residential neighborhoods and to new residential areas where lower density of development is desired for compatibility with adjacent development.

Allowable Uses

SCP-LU 6
Uses within this designation shall be primarily residential, with some provision for limited commercial services oriented to the residential neighborhood. Allowable uses include:

a. Single-family housing, duplexes, and townhouses available as residences for University faculty and staff.

b. Residential support services such as child care or convenience commercial facilities at a neighborhood-serving level.

Development Policies

SCP-LU 8
Residential density up to 8 units per acre is permitted, with potential for clustering individual units to provide public or private open space. This residential density yields a population density up to 19 persons per acre.

SCP-LU 9
Residential support uses shall be of a scale consistent with and appropriate to the surrounding neighborhood.

Implementation Recommendation

SCP-LU (i) 2
Enact and apply appropriate zoning consistent with the allowable uses and development policies of this designation.

Campus Residential - Medium Density (CR-M)

Description and Intent

SCP-LU 10
The Campus Residential-Medium Density designation applies to lands immediately adjacent to the Academic Campus area that have a higher density residential character and are used for housing University faculty and staff. These areas are an important housing resource that provides housing opportunities for faculty and staff and which promote the more efficient use of land for residential development. This designation applies primarily to new residential areas which provide opportunities for a more compact development pattern than the existing single-family residential neighborhoods.

Allowable Uses

SCP-LU 11
Uses in this designation shall primarily be residential, supplemented by services oriented to the residential neighborhood. Allowable uses include:

a. Single-family housing, duplexes, townhouses, condominiums, flats, and apartments available to University faculty and staff.

b. Residential support services such as child care, recreation services, or convenience commercial facilities.

Development Policies

SCP-LU 12
Residential density between 8 and 15 units per acre is permitted, with potential for clustering individual units to provide public or private open space. This residential density yields a population density between 19 and 36 persons per acre.

SCP-LU 13
Residential support uses shall be of a scale consistent with and appropriate to the surrounding neighborhood.

Implementation Recommendation

SCP-LU (i) 3
Enact and apply appropriate zoning consistent with the allowable uses and development policies of this designation.

Campus Open Space (COS)

Description and Intent

SCP-LU 14
The Campus Open Space designation applies to open spaces essential to the historic form and character of the campus (including Palm Drive, the Oval, the Arboretum, the Red Barn area, and Lake Lagunita). It also applies to designated parks within faculty I staff residential neighborhoods and to important and substantial resource conservation areas such as wetlands or habitat conservation areas within the central campus.

Allowable Uses

SCP-LU 15
Uses must retain land in open space, and must be consistent with the individual character of each area included in this designation. These areas shall be maintained as park-like areas, unimproved open space, landscape buffers, riparian corridors, and conservation areas. Temporary activities of a limited nature that are in keeping with the open space character are also permitted. Examples include limited duration special events or general recreational activities, such as those regularly occurring in the Oval area.

Development Policies

SCP-LU 16
No new permanent, above ground buildings or structures for occupancy are permitted. Landscaping structures or features, such as walls, fences, arbors, fountains, and statues or other forms of public art, are allowed.

SCP-LU 17
Temporary structures associated with appropriate temporary activities may be allowed, such as concession stands, tents, or similar structures. However, no temporary use which results in the degradation of biological resources is permitted.

Public School (PS)

Description and Intent

SCP-LU 18
This designation applies to land intended for use as a public school.

Allowable Uses

SCP-LU 19
The use of these lands is limited to public school facilities, including appropriate buildings, parking, playgrounds, and athletics fields.

Development Policies

SCP-LU 20
Stanford and the appropriate school district shall make every effort to develop school sites in an efficient manner consistent with the environmental setting of the site.

SCP-LU 21
Stanford and each school district shall seek and promote opportunities for cooperative use of facilities, as appropriate.

SCP-LU 22
If Stanford land used for a public school is no longer required for school use at any time in the future, it may be converted to another use by the University if redesignated for the intended use through the General Plan amendment process.

Lands Outside the Academic Growth Boundary

Open Space and Field Research (OS/FR)

Description and Intent

SCP-LU 23
The Open Space and Field Research designation applies to undeveloped lands outside the Academic Growth Boundary. These lands are important for their environmental resources and for their role in creating an open space setting for the campus and the region. They also serve as a resource for field research and research related activities dependent on the undeveloped foothill environment.

SCP-LU 24
Lands within the Open Space and Field Research designation are not eligible for uses other than those permitted under the policies of this land use designation except through a General Plan amendment to change the land use designation of the property. If any lands are proposed for a land designation which is intended to be applied only to lands within the Academic Growth Boundary, the proposed amendment must include a modification of the AGB. Proposals to modify the AGB must be in accordance with the applicable policies governing its amendment contained within the Growth and Development Chapter; therefore, no such General Plan amendment may be considered within 25 years of approval of the Community Plan and cumulative development of at least 17.3 million square feet within the AGB.

SCP-LU 25
This designation does not include lands in which special biological resources or hazards exist and which are inappropriate for development under County, State, or Federal laws, regulations, or policies (see Special Conservation Areas designation).

Allowable Uses

SCP-LU 26
Allowable land uses within the Open Space and Field Research designation include:

a. field study activities;

b. utility infrastructure in keeping with the predominantly natural appearance of the foothill setting;

c. grazing and other agricultural uses;

d. recreational activities which are consistent with protection of environmental resources (e.g., not construction or operation of a new golf course) and with appropriate policies regarding foothill access;

e. specialized facilities and installations that by their nature require a remote or natural setting, such as astronomical or other antennae installations or structures accessory to field study activities; and,

f. environmental restoration.

Development Policies

SCP-LU 27

No permanent buildings or structures are allowed, other than utility infrastructure and a limited number of small, specialized facilities or installations that support permitted or existing activities, or require a remote, natural setting and cannot be feasibly located within the AGB.

SCP-LU 28

Existing non-conforming uses within this designation, such as the golf course, may continue indefinitely. Remodeling or reconstruction of existing facilities after a natural disaster may be allowed, but no further expansion is permitted. Modification of the configuration of the golf course generally within its existing boundaries is permitted.

SCP-LU 29

Allowable development shall be clustered as feasible, primarily in areas with low environmental sensitivity, to preserve expanses of open space, environmentally sensitive areas, and scenic vistas.

Implementation Recommendation

SCP-LU (i) 4

Enact and apply appropriate zoning consistent with the allowable uses and development policies of this designation. Incorporate the clustering model of the County's Hillsides General Plan designation and Hillside zoning district in the development standards for this new zoning district.

Special Conservation Areas (SCA)

Description and Intent

SCP-LU 30
The Special Conservation Areas designation applies to lands south of Junipero Serra Boulevard which is deemed unsuitable for development due to natural resource constraints. Accordingly, no physical development other than that which supports conservation efforts may occur in these areas. It may include areas with the following environmental constraints:

a. Steep or unstable slopes;

b. Seismic or other geologic hazard zones;

c. Riparian areas extending 150 feet from the top of creek banks; and,

d. Sensitive habitat areas, particularly for special status species.

Allowable Uses

SCP-LU 31
The use of these areas is limited to conservation activities and habitat management, field environmental studies, and appropriate agricultural uses. Recreational use may be allowed if it is consistent with the particular environmental constraints of an area. Access for recreational use may be restricted.

Development Policies

SCP-LU 32
No new permanent development in the form of buildings or structures is allowed, other than construction, modification, and maintenance of improvements to support conservation efforts. Existing non-conforming uses are allowed to remain, in accordance with the County's requirements for non-conforming structures.

SCP-LU 33
Stanford shall prepare a Special Conservation Plan for the Special Conservation Areas. The Special Conservation Plan shall be submitted to the County Planning Office for approval. The plan will provide management guidelines addressing the following goals:

- habitat management within the area for 25 years;
- control of invasive, non-native species;

- control of erosion;
- avoidance of undisturbed areas;
- public safety;
- appropriate access; and
- minimization of human-caused impacts.

The plan will contain measures specific to California tiger salamander, red-legged frog, and steelhead habitat; riparian habitat; and geologic and seismic hazard areas. The plan will consider such activities as resource conservation, construction of facilities to support conservation activities, access, vegetation management, and best management practices for Stanford lessees located in the Special Conservation Areas.

Implementation Recommendation

SCP-LU (i) 5
The County Planning Office will review and comment on any proposed program or policy for recreational access to lands within the Special Conservation Areas designation.

SCP-LU (i) 6
Review planned activities in Special Conservation Areas in a manner consistent with the provisions of the Special Conservation Plan.

SCP-LU (i) 7
Enact and apply appropriate zoning consistent with the allowable uses and development policies of this designation.

Housing

Stanford Community Plan Issues and Policies

Chapter Summary

Housing is a countywide issue of concern that has taken on particular importance in the northern portion of Santa Clara County, where Stanford University is located. Countywide, housing supply and affordability issues have been of paramount importance for decades. The housing situation in the area surrounding Stanford has somewhat different implications for the University and its students, faculty and staff than it does for other area residents. The effect of the housing market on Stanford is of particular concern to the County and the University for several reasons.

- The University has a large population of graduate students with very limited incomes who are at a severe disadvantage in the local rental market. Hospital residents and postdoctoral fellows also have incomes substantially lower than the area's median income.

- Faculty and staff must compete for rental and ownership housing with other area residents. Unlike other Santa Clara County industries, where an individual employer is likely to compete with other local employers for workers, Stanford is competing for its faculty and staff with other universities which are generally located in areas with more affordable housing markets. Stanford considers the housing market as a primary obstacle in its recruiting and retention efforts for graduate students, faculty and staff.

- Students, faculty, and administrative staff must often commute very long distances to their classes and jobs at Stanford if they cannot find affordable housing close to the campus.

In the century since its inception, Stanford University has taken steps to address the housing needs of its students and faculty many times, due to the limitations of the housing market and Stanford's nature as a residential university. However, as housing supply and affordability trends within Santa Clara County and the Stanford area worsen, it is in the interest of both Stanford University and the public to ensure balance between housing demand and supply as it pertains to Stanford University's development.

Stanford lands represent one of the most important opportunities in the County to improve the balance between jobs and housing, due to the potential to provide housing on Stanford lands for designated University populations. While this housing is directly accessible only to Stanford students, faculty and staff, it also benefits the wider community by augmenting the local housing supply. To that end, development of additional housing on the campus is a fundamental policy direction of this Community Plan.

One of the primary means of expediting the construction of needed housing identified in the Community Plan is a linkage policy that requires housing to be developed concurrent with or prior to further academic development. The linkage policy is essential for mitigating housing impacts of anticipated development as well as meeting transportation-related goals for net trip generation described in the Circulation Chapter.

The following strategies are included in the Stanford Community Plan to address Stanford's housing needs and to indicate the overall policy direction for Stanford with respect to housing issues:

Strategy # 1: Increase the Supply and Affordability of Housing

Sub-Strategy 1A: Plan for a More Adequate and Balanced Housing Supply

Sub-Strategy 1B: Facilitate and Expedite Needed Residential Development

Sub-Strategy 1C: Augment Affordability Programs and Funding

Strategy # 2: Balance Housing Needs with Neighborhood Conservation

Background

Housing Demand and Supply - Regional and Historical Context

The issues of housing supply and affordability at the countywide level are discussed extensively in the Housing Chapter of Book A of the General Plan. Housing issues have been at the forefront of the county's planning issues for decades. At the heart of this issue is the matter of jobs/housing imbalance, a multi-faceted problem which involves inadequate numbers of dwelling units to serve all those who work and wish to reside in the county, housing which is not affordable to many households, and significant and increasing distances between housing and job locations at a countywide and regional level. These problems are particularly acute in the northern portion of the county and the southern portion of San Mateo County, which have long been particularly job-rich areas. The adverse social, economic, and environmental effects of this general imbalance are well-recognized, and are compounded with each cycle of major economic growth.

Housing in the Stanford Area

Stanford students, faculty, and staff who seek housing in the Stanford area encounter some common themes: high housing costs and relatively few housing units available for sale or for rent. The communities that surround Stanford include Palo Alto, Menlo Park, Atherton, Woodside, Portola Valley, Los Altos Hills, Los Altos, and Mountain View. High household incomes, good school districts, climate and geographic location, amenities, and other factors make the Stanford area one of the most desirable and in-demand locations of any in the Bay Area.

Within this general area, the jobs/housing imbalance that is characteristic of Silicon Valley and Santa Clara County generally is most acute. When the last Census was conducted in 1990, Santa Clara County had 861,000 jobs and 540,000 housing units. In very rough terms, assuming 1.56 workers per household, the County estimated there was a gross deficit of 12,220 units. By 1999, that deficit increased to approximately 20,000 units (California Department of Finance and California Employment Development Department).

The Midpeninsula subregion as a whole has a substantial imbalance between jobs and housing. According to the Association of Bay Area Governments Projects 2000, incorporated cities from Redwood City in the north to Mountain View in the south are estimated to have 2.33 jobs for every household. The two cities in this area with the highest ratio of jobs to households are Palo Alto (3.92 jobs per household) and Menlo Park (2.52 jobs per household), followed closely by Mountain View (2.42 jobs per household). This imbalance between jobs and housing acutely affects both the local housing market and traffic congestion.

These basic calculations are intended to convey only an approximate indication of the severity of the jobs/housing imbalance. They address only those units needed by those employed in the county, not including students and retirees. Even as the Silicon Valley economy experiences certain fluctuations in growth trends, vacancy rates in the county remain low. Furthermore, availability of for sale housing remains far below demand.

Since the mid-1990s, Silicon Valley has seen one of its most impressive economic growth cycles in the last 50 years. For example, in Palo Alto and Menlo Park, the number of jobs increased by approximately 12,000 between 1990 and 1999, while the number of housing units increased by only 1,060 during this time, with new jobs outnumbering new housing units by a factor of almost 12:1 (California Department of Finance, ABAG Projections 2000). Furthermore, the incomes and wealth creation associated with the high technology industries in the area have resulted in unprecedented ability and willingness to pay what the market will bear for housing prices in these highly desirable communities. Collectively, scarcity of housing, prosperity, and desirability have been and will continue to be potent factors in the housing situation for the Stanford area.

All of the aforementioned factors have contributed to a decline in overall affordability of housing over time. Median advertised rents in local newspapers in the Stanford area in 1999 ranged from $650 for a studio or rented room to $2,500 for a 3-bedroom apartment or home. The median advertised rent for two-bedroom units was $2,400 per month. Median prices of for sale housing are also higher in Palo Alto than for Santa Clara County overall, and the same is true for Menlo Park relative to San Mateo County's median home price.

The housing supply and affordability concerns that are experienced countywide have a particularly strong effect at Stanford due to the high housing prices in the area around Stanford, the large population of students with relatively low income, and Stanford's need to compete for faculty with universities in more affordable parts of the country. Additional housing on the campus not only provides housing near jobs and augments regional supply, it also contributes to regional commute trip reduction and enables Stanford to meet trip generation goals.

To help mitigate the impacts associated with the high cost of housing on the Midpeninsula, the City of Palo Alto has implemented an inclusionary zoning ordinance that requires new housing developments to offer a specific number of units at below market rates or make a cash payment in lieu of developing the units. In addition, Palo Alto has instituted a program that requires developers of new nonresidential projects to make affordable housing impact payments based on square footage to a fund used to develop below market rate housing. All development on Stanford lands that occurs within the City of Palo Alto is subject to these requirements unless otherwise exempt.

Current Campus Housing Types

There are currently two main types of housing on the Stanford campus: student housing and faculty/staff housing. Student housing for undergraduates and graduate students is closely integrated with the campus core, reflecting the University's programmatic emphasis on an educational environment that extends to the residences. The student housing is comprised of dormitories and apartments. Undergraduates primarily live in dormitories, and remain on campus only during the academic year.

Graduate students live primarily in apartments, and often occupy their apartments year-round for multiple years while they obtain their degrees. Graduate student housing is mostly concentrated on the east side of campus, primarily in the 3,200 person Escondido Village. Approximately 75% of graduate student residents are single students, while the remainder are couples or students with children.

The number of students residing on campus has increased since the 1989 General Use Permit was issued. Some of the increase was due to the addition of housing units, and some was due to increasing the number of students housed in existing facilities.

Table 3.1: Number of Students Residing on Campus

Students	1988-1989	1998-1999	Net Change	% change
Undergraduate	5,492	5,839	347	6%
Graduate	2,930	3,515	585	20%

Source: Stanford General Use Permit Annual Report #11

Stanford guarantees on-campus housing for all of its approximately 6,500 undergraduates who wish to live on campus. Ninety-three percent of undergraduates currently choose to live on-campus. The University also currently provides graduate student housing for 46% of graduate students. With the addition of 483 units in Escondido Village in 2000-01, this percentage will increase to fifty percent.

On-campus housing opportunities are also available to active faculty, retired faculty, surviving faculty spouses, and senior staff. Currently, 989 on-campus units are available to faculty and staff. Most of these homes are on long term ground leases, whereby the occupants lease the land from the University but own the home itself. Twenty-five percent of the campus homes are multiple-family dwellings and 3 percent are attached townhomes.

The Community Plan provides for a substantial increase in the supply of faculty and staff housing eligible to University employees. In addition, a new rental housing complex of 628 apartments at Stanford West, with priority for Stanford faculty and staff, is now under construction on Sand Hill Road in Palo Alto. A senior housing complex with over 388 units has also been approved. Detailed Stanford priority criteria have been developed for the Stanford West Apartments and seniors projects in order to address Stanford's housing needs. Stanford has also identified several other potential residential development sites on its lands in other jurisdictions.

The coordinating mechanism for faculty and staff housing is a full-time faculty/staff housing office that is responsible for counseling and assistance in locating housing, developing and implementing loan assistance and subsidy programs, and facilitating sales of on-campus homes to eligible faculty and staff. Stanford establishes eligibility requirements for such programs after consultation with the Faculty Senate and approval of the Board of Trustees.

Although Stanford provides opportunities for a substantial number of faculty and senior staff to live on the campus, there is a growing imbalance between the number of senior and retired faculty residing on campus and the number of their more junior colleagues who live on the campus. In 1989, 22% of the residents of faculty/staff housing were emeriti. By 1999, that percentage had increased to 34% of the total. In 1999, 50% of emeriti and 40% of full professors lived on campus, but only 14% of assistant professors and 25% of associate professors were campus residents (Faculty Housing Development Proposals, January 1999). As housing in the faculty

subdivision is increasingly occupied by senior and retired faculty, less housing is available for new and junior faculty.

Housing Affordability Programs

The University has a variety of housing assistance loan programs intended to address the difference in the cost of home ownership in the Stanford area and areas in proximity to other major research universities. The programs are currently made available to over 2,900 Stanford employees. There are 964 loans outstanding with a balance of $135.8 million. Three hundred and twenty-seven new loans were initiated in 1998-1999, and individuals may obtain more than one type of loan.

Despite the assistance programs, housing in the Stanford area remains unaffordable to many eligible faculty and staff. According to the Faculty Staff Housing Office in January 1999, an associate professor earning the median salary who has a working spouse and who takes advantage of all of the available assistance programs can afford a house that costs approximately $575,000. This amount exceeds the current median price in Santa Clara county, but it is significantly less than the median housing price for homes on the campus and in the surrounding area. Stanford has recently provided special housing supplements and loans to faculty for recruitment and retention, totaling $9 million in 1997-98, when the assistance programs have been insufficient. In 2000, the Provost initiated a faculty task force to consider housing affordability issues and the effectiveness of the current assistance programs.

Housing Supply and Needs

As a residential university, Stanford provides a substantial amount of housing and housing assistance compared to other employers in the County. The following is a general assessment of the extent of housing supply and assistance provided. Stanford's housing programs meet the needs of the different campus populations to varying degrees.

- **Undergraduates**. Stanford's commitment is to provide four years of on campus housing to undergraduates who choose to live on campus. Approximately 93% of the undergraduates choose to live on campus, all of whom are provided with housing.
- **Graduate students**. Stanford currently houses 46% of its approximately 7,000 graduate students on campus, which will increase to 50% with the completion of the housing in Escondido Village. An additional 700 students are housed in subsidized off-campus apartments, with planned increases for 2000-2001. There is substantial demand for additional on-campus graduate student housing, as evidenced by the growing number of students who cannot be assigned on-campus housing in a given year. For example, in 1999, over 1,071 students were denied opportunity for on campus housing through the allocation system referred to as the "lottery." In 2000, despite the addition of 480 new units, the number of unassigned students decreased only slightly, to

985. In addition, many graduate student rooms and apartments are accommodating more students than they have in the past. Stanford intends to construct 1,900 additional graduate student housing units under this Community Plan.

- **Medical residents/postdoctoral fellows.** This group is largely not addressed by current housing programs and, due to low salaries, is at a significant disadvantage in the local housing market. The University currently provides 72 units for medical residents at the Welch Road apartments in Palo Alto. It proposes to construct several hundred additional units for residents and postdoctoral fellows under the Community Plan.
- **Faculty/senior staff.** Currently, 30% of active faculty live on the campus, with many more taking advantage of the various housing assistance programs. Recruitment of faculty is a very strong force behind Stanford's interest in developing substantial amounts of additional faculty housing. The Community Plan creates the opportunity for up to 668 additional units of faculty and staff housing.
- **Other staff**. Of Stanford's approximately 7,000 staff members (including Medical Center and Stanford Linear Accelerator Center (SLAC), approximately 650 are eligible for on-campus housing or for housing assistance programs at this time (Faculty Staff Housing Office). When completed, the Stanford West housing project will provide 628 rental units for faculty and staff on a priority basis.

Planned New Campus Housing

Under the General Use Permit associated with the Community Plan, the University intends to add 2,200 students, faculty and staff to its overall population. The Community Plan identifies locations for residential development that would allow between 2,655 and 3,022 additional housing units to be constructed on Stanford land. At this ratio, Stanford will add 1.36 housing units for every additional person added to the campus. This ratio represents an improvement in housing supply for new population compared to the 1989 General Use Permit. Under the 1989 General Use Permit, Stanford housed 1.03 additional people for every person added to the campus population. This rate of housing production stands in strong contrast to that of the region, where one housing unit was created for every 9 jobs in northwest Santa Clara County and for every 7 jobs in southern San Mateo County during the 1990s (Silicon Valley Manufacturers Group Housing Solutions report, 1999).

Strategies, Policies and Implementation

Strategy #1: Increase the Supply and Affordability of Housing

The Stanford campus provides one of the most significant opportunities for substantial amounts of new housing development in Santa Clara County. This strategy expresses the fundamental objective of the Community Plan to increase the general supply of housing on campus. Sub-strategies similar to those contained within the Housing Chapter of the General Plan for countywide housing issues elaborate on the principal strategy. These involve planning for housing, expediting the actual construction of needed housing, and augmenting affordability programs.

Sub-Strategy # 1A: Plan for a More Adequate and Balanced Housing Supply

Planning for a more adequate and balanced housing supply involves both supplying more housing types that meet various Stanford population needs as well as providing housing that is more affordable to the target populations. Strategy 1A emphasizes the importance of designating lands for housing development, as a necessary precursor to actual development. The diversity of the Stanford community and the groups in need of housing requires a multifaceted approach to housing development that enhances Stanford's already varied housing stock.

Specifically, the Community Plan provides for increased housing supply to students and faculty, the two groups which have traditionally been the priority populations for campus housing. The Plan also provides more balance in priorities for various populations, such as increased housing for medical residents and postdoctoral fellows, who have traditionally not been served by campus housing.

This Community Plan further recognizes the differing characteristics between student housing areas and faculty/staff housing areas. Student housing consists of dormitories and apartments that surround the academic portions of the campus. Its occupants are more transitional, with students moving on a frequent basis and heavily involved in activities throughout the campus. The nature of this housing is reflected in its inclusion in the Academic Campus land use designation, which allows for flexibility in the location and use of new student housing by not separating it from the academic uses.

Within the Academic Campus land use designation, this plan identifies several locations for new student housing, particularly in Escondido Village and an area near existing student housing known as the "Searsville Block" that is currently occupied by

13 faculty homes. Other potential sites are also identified near existing student housing areas. The Community Plan also defines locations along Quarry Road for medical resident and postdoctoral fellow housing.

In contrast to the student housing areas, the faculty/staff residential areas more closely reflects a traditional residential neighborhood. The density of most single family portions of the area is generally 3-5 units per acre, although some lots exceed one acre in size. There are two multi-family condominium complexes of approximately 15 units per acre and one complex of attached townhomes. Faculty and staff housing on the campus is almost entirely owner-occupied.

In recognition of the residents' interest in maintaining the character of the faculty/staff residential area, the Community Plan contains separate land use designations for these portions of the campus to distinguish them from the academic core area. These two land use designations for low- and medium-density housing allow up to 8 and 15 units per acre, respectively (see Land Use Chapter). Higher density faculty/staff housing is a permitted use in the Academic Campus land use designation.

With these designations, the Community Plan emphasizes higher densities than that characteristic of existing single family areas in an effort to use land more efficiently and promote production of more affordable housing. The plan also identifies two major sites for new faculty/staff residential neighborhoods at the medium density designation. The first is located on a field northeast of the Red Barn and is known as the "Stable Site." The second is located on the existing driving range near Lake Lagunita.

Developing substantial amounts of additional housing will require development of significant undeveloped sites and/or intensification of use in existing housing areas through redevelopment. Opportunity sites for housing development are identified under this strategy in the table below and should be the focus of future housing development on the campus. The housing sites as shown in this plan in Table 3.2 below do not preclude the identification of other locations for housing inside the AGB in the future, particularly within the Academic Campus land use designation. The Community Plan may also be amended to identify other areas appropriate for housing development over time to facilitate appropriate housing development.

Table 3.2: Proposed Housing Development Potential

Code	Location	Acres	# Units
A	Manzanita	1.6	100
B	Mayfield/Row by Florence Moore area	1.3	125
C	Escondido Village: Infill	116.5	1,495
D	Escondido Village: El Camino Real Frontage	4.3	250
E	Escondido Village: Stanford Avenue	9.4	9-75
F	Driving Range	17.5	102-195
G	Searsville Block W/removal of units	12.8	380 (-13)389
H	Quarry and Arboretum	8.0	200
I	Quarry & El Camino Real	6.2	150
J	The Lower Knoll	---	---
K	Lower Frenchman's	2.2	2-18
L	Gerona/Junipero Serra Blvd.	1.5	1-12
M	Dolores	---	---
N	Mayfield	1.3	1-9
O	Stable Site	---	---
	Totals (14 sites)	**182.6**	**2,824 to 3,018**

Table Notes: Previously identified sites including the Lower Knoll and Dolores sites have been eliminated from consideration. The 200 units of potential housing in the Lower Knoll site have been transferred to within the Escondido Village: Infill site (site C).

The Driving Range (site F) has been converted from graduate student housing as originally identified to faculty/staff housing to compensate for a reduction in the size of the Stable Site. The 350 units identified for the Driving Range site have been transferred to Searsville Block (site G) and Escondido Village: Infill (site C). In 2013, the 372 units identified for the Stable Site were removed from the faculty/staff housing category and added to the student housing category. In 2015, the housing type classifications were removed to provide greater flexibility in meeting campus housing needs; however, the General Use Permit retained the requirement that no more than 668 of the housing units can be constructed for faculty and staff and no more that 350 of the housing units can be constructed for postdoctoral residents and medical residents.

Figure 3.1 – Potential Housing Sites

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Potential housing sites by resident category are described in Table 3.3:

Table 3.3: Planned Housing and Sites

Planned Housing	Sites
New housing for single students, including: • apartments or group housing for graduate students or postgraduate fellows, and • dormitory spaces for single undergraduate students.	Escondido Village Mayfield/Row Searsville Block area Manzanita Quadrangle (undergrads)
Apartments for hospital residents and postdoctoral fellows	Arboretum and Quarry Rd. corner Quarry Rd. and El Camino Real
New units for faculty and staff, depending on the mix and densities	Driving Range Escondido Village: Stanford Ave. area Sites in existing campus residential neighborhoods (Mayfield, Lower Frenchman's, Gerona/Junipero Serra Blvd.

Policies

SCP-H 1
Promote a variety of housing types and supply adequate to meet the needs of faculty, staff, students, postgraduate fellows, and hospital residents.

SCP-H 2
Designate sufficient campus land at appropriate densities for student, faculty, and staff housing, as identified in Table 3.2 and Figure 3.1, Proposed Housing Development Potential and Sites.

SCP-H 3
Maintain student and postgraduate housing as an integral part of the academic areas of the campus.

SCP-H 4
Develop housing at densities that make more efficient use of land and enhance the affordability of housing.

Implementation Recommendation

SCP-H (i) 1
Ensure that student, postgraduate, and hospital resident housing are included as a permitted use within the Academic Campus areas.

SCP-H (i) 2
Subsequent to the adoption of the Community Plan, enact zoning districts and regulations that provide for low-density development of faculty housing (1-8 units/acre), with appropriate development standards, as a permitted use within the Campus Residential-Low Density areas of Stanford.

SCP-H (i) 3
Subsequent to the adoption of the Community Plan, enact zoning districts and zoning regulations that provide for medium-density faculty housing development (8-15 units/acre), with appropriate development standards, as a permitted use within the Campus Residential-Medium Density areas of Stanford.

Sub-Strategy # 1B: Facilitate and Expedite Needed Residential Development

Once residential development sites are planned, the timing and enabling of housing construction are important considerations. Designating land available for potential housing development alone provides only the basis for housing development. Additional mechanisms at both the plan and implementation levels are needed to ensure that designated sites are developed in a timely manner. A variety of tools are available to facilitate and expedite needed residential development.

Linkage Policy

The principal means for assuring that additional housing supply is constructed in a timely manner is referred to as a “linkage policy” in the Community Plan. This policy requires that Stanford construct significant proportions of the potential housing units identified within the Housing Chapter of the Community Plan prior to or concurrently with approved increases in academic space.

To implement the linkage policy, the General Use Permit, which serves to implement the Community Plan, would contain specific provisions to the effect that approval of proposed increases in academic space may be granted only on condition that a specified amount and type of housing supply has been or will be constructed concurrently. Such mechanisms ensure that approvals for new academic space do not exacerbate already significant housing supply and affordability deficiencies in the

regional housing market. A linkage policy also ensures that Stanford can achieve stringent transportation-related Community Plan goals and standards.

The County acknowledges that there are a number of contingencies which can affect the feasibility of completing housing development within a specific time period. Funding, competing academic priorities, and other factors obviously play a role. It is also important for the County to acknowledge its responsibility for housing development in approval of housing proposals. However, in light of overall housing trends and County General Plan policy, it is essential that the County assure that housing development proposed in the Community Plan be constructed in manner concurrent with academic development approved through the life of the General Use Permit. Approval of significant new non-residential development without such assurances could exacerbate housing shortages by adding population without augmenting housing supply. Furthermore, existing General Plan policies on the subject call upon all jurisdictions to address the continuing imbalances between employment-related land uses and housing. Providing housing commensurate with new academic development is therefore consistent with the policies of the Countywide Growth and Development Chapter and Housing Chapter of the General Plan.

Streamlining Permit Applications and Approval Processes

Other means of facilitating housing development include streamlining of environmental review and permitting processes. The concept of a Community Plan and General Use Permit afford the opportunity to minimize subsequent environmental review of individual projects by means of a program-level EIR to provide initial CEQA review for anticipated projects. Time savings may also be achieved in the permitting of individual projects by coordinating to ensure that applications for Architecture and Site Approval or for building permits are as complete and adequate as possible upon submittal. Other streamlining mechanisms are aimed at facilitating the planning and approval of new housing; these would include measures allowing consideration of General Plan amendments for additional areas within the AGB to be designated Campus Residential without first gaining Board of Supervisors approval of consideration of the amendment, as is required for other types of General Plan amendments. The Board would retain authority for final approval of the General Plan amendment.

Housing in Other Jurisdictions

Although Santa Clara County does not control the use of Stanford-owned land that is within incorporated cities or San Mateo County, the County recognizes both the need for housing created by uses on these lands and the opportunities for housing that appropriate development and redevelopment of these lands presents. Any housing on Stanford lands in any jurisdiction augments the regional housing supply and therefore contributes to the balance of the area's housing supply. The Community Plan policies are meant to encourage housing development on all appropriate Stanford lands, regardless of the jurisdiction.

Policies

SCP-H 5
Recognize the connection between expansion of academic facilities and the resultant increase in housing demand, as well as the immediate need for additional on-campus housing to meet address current demand.

SCP- H 6
Through the General Use Permit, permit development of additional on-campus housing, including housing for designated very low-, low- and moderate-income persons and faculty, staff, students, postgraduate fellows, and hospital residents.

SCP - H 7
Require that new housing development occur commensurate with population growth and academic development approvals on campus. Through the General Use Permit, establish conditions to require construction of needed housing prior to or concurrently with approval for increases in academic space.

SCP - H 8
Streamline the review and approval of housing projects to the extent possible consistent with County standards, land use policy, and State law.

SCP - H 9
Support Stanford's efforts to develop housing on land in other jurisdictions, particularly housing specifically targeted to Stanford faculty, staff, students, and other affiliated persons. Consider Stanford-developed housing in other jurisdictions eligible to meet quantified housing development requirements on a case-by-case basis.

Implementation Recommendations

SCP-H (i) 4
Determine through the General Use Permit appropriate housing/academic linkage requirements based on the amount of approved academic construction.

SCP-H (i) 5
Maintain current practices, such as pre-design consultations, and develop new mechanisms which would help streamline and facilitate County review and permitting processes. Examples include electronic plan submittal pilot programs, together with better means of assuring that changes in building plans are consistently incorporated in all mechanical, electrical and plumbing plans.

SCP-H (i) 6
Allow County Planning Office consideration of applications for General Plan amendments to create additional Campus Residential areas inside the AGB without requiring that the Board approve the consideration in the annual General Plan amendment review process. The Board will retain authority for final approval of the General Plan amendment, after considering the Planning Commission's recommendation.

SCP-H (i) 7
Allow County Planning Office consideration of applications for General Plan amendments to remove areas from the Campus Residential designation without requiring that the Board approve the consideration in the annual General Plan amendment review process, if Stanford is able to demonstrate that it will meet all quantified housing provision requirements. The Board will retain authority for final approval of the General Plan amendment, after considering the Planning Commission's recommendation.

Sub-Strategy 1C: Augment Affordability Programs and Funding

For housing to meet the needs of its target population, its price must be consistent with the income of the intended residents. Affordability needs vary greatly with the population served; housing can be considered "affordable" by accepted regulatory agencies but can still be too expensive for specific populations. Graduate students and postdoctoral fellows at Stanford are two groups whose incomes are substantially below the County median used to calculate affordability for purposes of government-sponsored housing assistance programs.

All of Stanford's graduate student housing is affordable to the target population according to the standards related to area median income supplied by the federal government. The income range of this population requires that housing be priced accordingly or it could not be occupied by graduate students. As a result, construction of new housing for this population is subsidized by the University. Planning for this housing must consider the affordability implications for both the graduate students and the University.

The postgraduate fellow/hospital resident housing program, largely new to the University through the Community Plan, also serves a population earning substantially less than the area median income. When the proposed undergraduate, graduate student housing, and postdoctorate housing are considered together, these 2,350 units—78% of all proposed housing under the Community Plan—should be affordable to its population.

Promotion of housing affordability is somewhat more complex for faculty and staff housing as it has been developed by the University. One mechanism for promoting housing affordability is to reduce the cost of each unit through higher density, which is

planned for most of the new housing under this plan. However, housing prices themselves are difficult to control, particularly for ownership housing. While Stanford can set the price for the initial housing offering, resale prices will reflect market forces without price controls. One approach to meeting this challenge would involve increasing the supply of on-campus rental housing for faculty and staff. Stanford could therefore control future rental prices and could retain a portion of such rental housing for designated populations.

Stanford's residential assistance programs are an important mechanism to make housing more affordable for eligible participants purchasing homes. The eligibility requirements for these programs reflect the University's educational objectives in their availability to faculty and senior staff. Other staff members, many of whom are in need of more affordable housing, are not currently eligible for the programs or for on-campus housing. In a related matter, provision of rental housing subsidy is another unmet housing need.

As indicated above, the University's primary means of promoting housing affordability to faculty and staff is in the form of subsidies and direct financial assistance. Increasing assistance levels to those for whom assistance has traditionally been provided, such as faculty, or extending financial assistance to those who have not previously been eligible for such programs will require a substantial increase in funding to those programs. The County supports increasing the funding of such programs by Stanford to the maximum extent feasible.

Policies

SCP-H 9
Provide financial assistance for housing to faculty and staff, and consider expanding programs to include rental assistance.

SCP-H 10
Promote the affordability of housing by:

a. Requiring Stanford to provide a sufficient level of affordable housing on campus to meet the affordable housing needs generated by new academic development on its unincorporated lands or make an appropriate payment in lieu of providing the housing; and,

b. Encouraging Stanford to extend housing assistance and on-campus residence eligibility to populations which have previously not been served.

Implementation Recommendation

SCP-H (i) 8
Stanford shall provide a number of affordable housing units equal to 15% of the units needed to house the non-student population increase associated with the development. One-third of these units shall be made available to persons of very-low income; one-third of these units shall be made available to persons of low income; and one-third of these units shall be made available to persons of moderate income. For rental units, the units shall be made available to persons in each group at a rate not to exceed 30% of the income for the respective group. For for-sale units, the units shall be made available to persons in each group at a rate not to exceed 40% of the income for the respective group. The dwelling units shall be located on Stanford lands and shall be made available to persons who are not undergraduate students, graduate students, post-graduate fellows or medical residents associated with Stanford or its affiliates. Compliance with this affordable housing requirement shall be ensured for at least 50 years.

SCP-H (i) 8
For each new academic development project built by Stanford, identify an appropriate payment that Stanford may elect to pay in lieu of compliance with SCP-H (i) 6. This payment shall be equal to the affordable housing payment (also known as the below market rate program payment) charged by the City of Palo Alto when the development project is built. If the City of Palo Alto does not have such a payment at that time or Stanford challenges the payment as unreasonable, the County will determine the appropriate payment based upon a study funded by Stanford and undertaken by or under the direction of the County.

Strategy # 2: Balance Housing Needs with Neighborhood Conservation

The residential character of both the faculty/staff neighborhoods and the student housing areas contributes to the quality and experience of the campus and the lives of its residents. Residential neighborhoods are characterized not only by the houses or apartments they contain, but by their range of uses and the visual character and feel provided by the density, infrastructure, and landscaping. Easy access to complementary services and transportation facilities can help reduce the need for automobile trips and enhance the residential quality of life.

Some important discussion topics regarding the residential character of the campus have been raised by various groups of campus residents.

- Existing residential neighborhoods present opportunities to expand the range of uses in easy walking distance of residents. Places to shop for food, eat, gather, and engage in recreational activities could have the dual benefits of

reducing the need to travel off campus and enhancing the quality of life for residents. For example, graduate students have expressed a desire for retail and recreational opportunities convenient to their residential areas. Child care is also a valued amenity that can directly serve neighborhood residents. Due to the potential of such amenities to reduce automobile trips, policies promoting an appropriate mix of such uses are also included in the Circulation Chapter.

- Parks and open spaces in the faculty/staff areas are a valued recreational amenity for many residents. These spaces are considered neighborhood institutions but have had no formal protection from development in the past. For more detailed discussion of parks, refer to the Open Space Chapter.

- Faculty and staff campus residents are concerned about the potential for development at higher densities than existing areas within their neighborhood. The concerns about neighborhood compatibility need to be balanced with global concerns about housing supply and affordability. The creation of more specific land use designations for faculty/staff housing areas can help achieve certainty regarding future development potential in these neighborhoods, which can be further reinforced with corresponding zoning.

These considerations are also applicable to new residential areas, which provide enhanced opportunities for the creation of a balanced range of uses in neighborhoods.

The importance of balancing housing needs with neighborhood conservation also extends to the off-campus environs of Palo Alto and Menlo Park located immediately adjacent to many of the potential sites for new or more intensely developed housing on the periphery of the campus. With respect to potential new or additional housing along the Palo Alto and Menlo Park interfaces, community members have raised concerns about maintaining compatibility with existing neighborhoods and preservation of campus open space that serves as a buffer between the University and the surrounding community. As with the concerns expressed by campus residents, the concerns of off-campus residents, too, need to be balanced with the larger concerns about housing supply and affordability.

Policies

SCP-H 11
Promote location of housing near compatible and neighborhood-serving support uses and facilities, such as child care, shopping, and recreation, and promote inclusion of such neighborhood-serving facilities in housing areas, as appropriate.

SCP-H 12

Plan housing areas and facilities to take maximum advantage of existing and planned transportation services and facilities.

SCP-H 13
Recognize and enhance the character of existing residential areas for faculty/staff and students.

SCP-H 14
Balance concerns about the compatibility of new housing development in existing neighborhoods with the need for increased housing supply and improved affordability.

SCP - H 15
Provide and maintain parks and related facilities in Campus Residential areas (see Open Space Chapter).

SCP - H 16
Balance concerns about the compatibility of new housing development on the campus periphery with existing off-campus neighborhoods with the need for increased housing supply and improved affordability.

SCP - H 17
Balance concerns about the maintenance of buffers between the University and Menlo Park and Palo Alto with the need for increased housing supply and improved affordability (see Open Space Chapter).

Implementation Recommendation

SCP-H (i)9
Adopt zoning that allows appropriate non-residential uses in both faculty and student housing areas.

SCP-H (i) 10
Adopt zoning consistent with the General Plan designations for Campus Residential-Low Density and Campus Residential-Moderate Density (see Land Use). This zoning may incorporate height limits, floor area ratios, and setbacks for appropriate compatibility with adjacent off-campus neighborhoods in Palo Alto and Menlo Park.

SCP-H (i) 11
Identify opportunities for creation of childcare facilities, commercial services, recreational facilities, or other types of support services in residential development and redevelopment.

SCP-H (i) 12
Encourage and, as appropriate, require support facilities to serve residential areas through both the General Use Permit and through subsequent review of individual projects.

SCP-H (i) 13

Review development applications for projects on the campus periphery for provision of adequate landscaping elements to separate and buffer adjacent uses and to retain the quasi-rural feel of the campus where it abuts the surrounding community.

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Circulation

Stanford Community Plan Issues and Policies

Chapter Summary

One of the greatest challenges that jurisdictions throughout the Bay Area have faced as they try to alleviate local congestion is the degree to which the existing patterns of land use and development undermine efforts to reduce dependence on the single-occupant automobile. The objective of circulation systems is to allow for access and mobility; congestion impedes achievement of this objective.

The Stanford University campus is a unique setting in which many of the limitations found elsewhere of land use, density, transit accessibility, and mechanisms for coordinated problem-solving are reduced, creating opportunities for walking, bicycling, and transit use unknown throughout much of Santa Clara County.

This chapter of the Community Plan attempts to capitalize on the transportation potential of Stanford and its surrounding communities, primarily through a standard of "no net new commute trips" for the unincorporated Santa Clara County portion of Stanford University. The plan defines this standard as no additional trips above a measured base level during the peak commute time in the campus commute direction.

The "no net new commute trips" standard is a challenging one that is much more stringent than any standard applied elsewhere in the county. Meeting this standard will require a combination of approaches that together form a comprehensive system allowing people to function without cars on a daily basis:

- **Land use.** On-campus housing will reduce the need for new commute trips to the campus. The availability of convenient support services on the campus is also crucial for reducing automobile trips.
- **Transportation Demand Management.** The innovation and effectiveness of Stanford's current transportation demand management (TDM) programs are widely recognized, but new opportunities may need to be identified in order to continue meeting the "no net new commute trips" standard. While most TDM programs are directly commute-related, non-commute alternatives also need to be provided in order to allow workers to commute without cars and still be able to meet their daily needs.

This Community Plan chapter also recognizes that, while commute trip reduction is a priority, in some cases other mechanisms may be needed to address non-commute congestion or inadequacies in the street system. System expansion may also be needed if Stanford is unable or unwilling to meet the "no net new commute trips" standard. Such mechanisms may include intersection or street widening.

The Community Plan strategies for Circulation are:

Strategy # 1: Achieve "no net new commute trips" through land use and transportation demand management.

Strategy # 2: Alleviate local congestion in the context of commute trip reduction.

Strategy # 3: Alleviate local congestion during special events.

Background

As congestion grows throughout the Bay Area, employers, government agencies, and the general public are increasingly concerned with the inability of existing roadways to meet current and future needs. While expansion of roads and intersections can help temporarily ease congestion, better use of the existing system through less use of single-occupant automobiles is a corresponding effort that can avoid many of the social and economic costs of added roads.

The closely integrated nature of the uses within the Stanford area and the wide range of activities that take place on and around the campus have made traffic congestion a fact of everyday life in the region. Increasing intensity in the use of land has led to substantial concerns about traffic levels in the area immediately surrounding the University. On a more regional level, long-distance commutes from distant counties have become more common as rising housing prices and increasing demand for a fixed amount of housing force local employees to live farther from their workplaces. Commuters in ever-increasing numbers spend more time on freeways each day.

The increasing intensity of development on and around the Stanford campus can potentially be offset by the high level of transportation accessibility in the area. Many locations, including the campus, have a number of amenities that make it possible to move to and around the area without using cars, thereby decreasing the potential for local congestion. These amenities include:

- A well-integrated mix of land uses, with employment and service opportunities in close proximity to housing;
- An environment that is pleasant and accessible to pedestrians and bicyclists; and,
- A variety of convenient transit services accessing major activity centers (see sidebar).

The Community Plan strategies, policies and implementation measures for circulation focus on enhancing those amenities to allow for new development to occur without corresponding increases in commute traffic to the campus.

Stanford's Land Use and Circulation System

Stanford's circulation system operates within the context of a larger regional system (See Figure 4.1 - Regional Circulation Context). Local campus roadways provide links between academic facilities and between on-campus residences and academic facilities. Collector roadways on the campus operate as a traditional street network, providing connections from local on-campus roadways to the collectors and arterials surrounding the campus.

Traffic Congestion and Stanford University

Traffic congestion is of major concern throughout Santa Clara County. In addition to the inconvenience of traffic congestion, extensive use of single-occupant automobiles poses serious threats to the environment, requires extensive amounts of land to accommodate automobiles, and is expensive for both individuals and the public.

Some of the streets around Stanford carry significant amounts of traffic each day, with daily traffic volumes reaching or exceeding 20,000 cars on several important campus access roads such as Embarcadero Road/Galvez Street, University Avenue/Palm Drive, Sand Hill Road, and Alpine Road. The most heavily traveled roadway in the campus vicinity is El Camino Real (SR 82), which is used by over 40,000 cars each day on the portions of the road adjacent to the campus and over 50,000 cars each day to the north and south of the campus. The traffic throughout the area

Circulation Systems Supporting Stanford

Standford students, employees and visitors regularly use road networks and systems administered by a variety of agencies in the travels to and from campus.

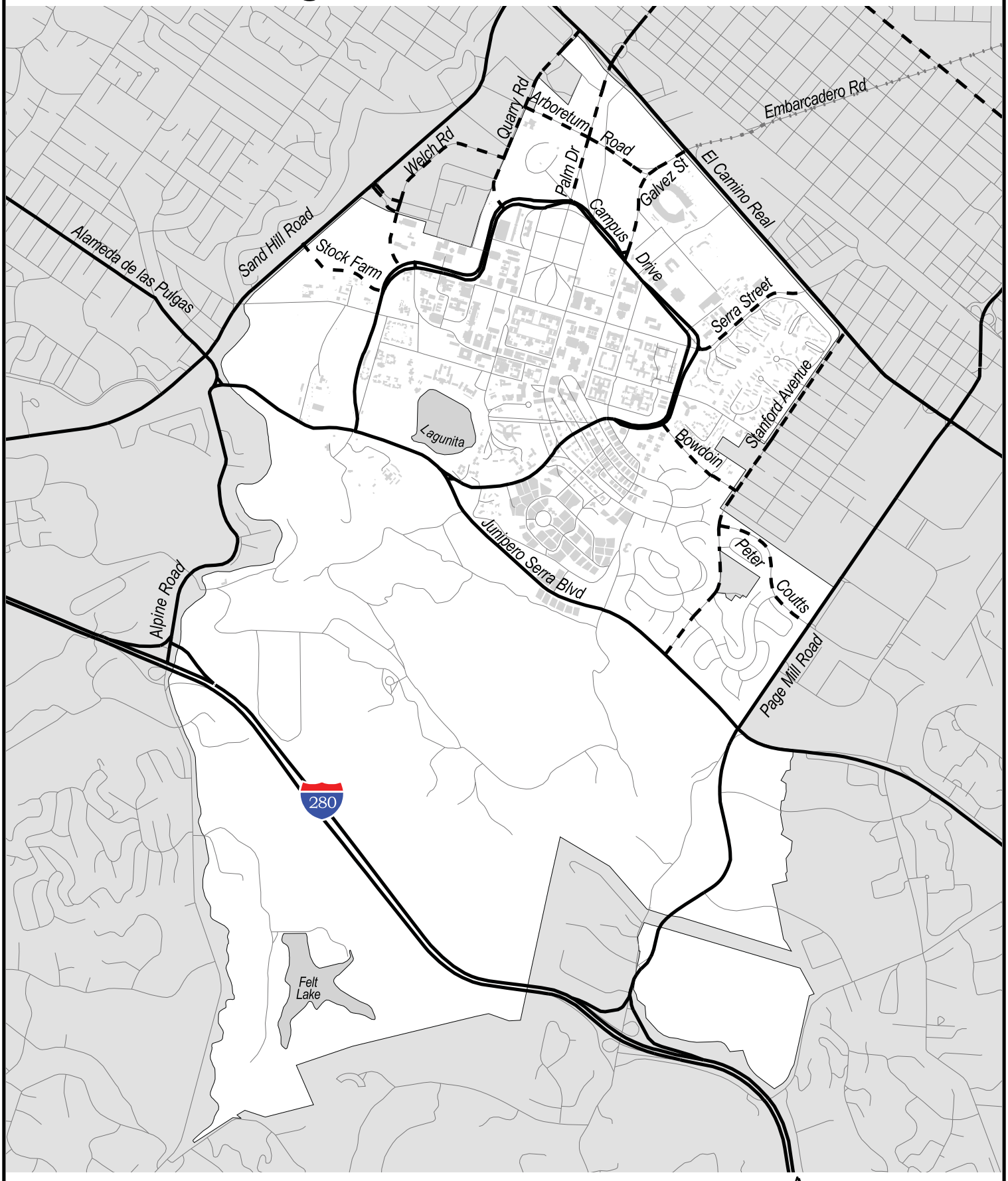
Transit

- CalTrain serving north-south Peninsula travel and the cities of San Francisco and San Jose operated by the CalTrain Joint Powers Board with Palo Alto stations at University Avenue and California Avenue. Both stations are highly accessible to residential and employment areas and are heavily used, the University Aveue Station is ranked second and the California Avenue Station is ranked eighth of the system's 32 stations in terms of ridership
- Regional bus routes operated by Santa Clara Valley Transportation Authority, with four routes in the area and San Mateo County Transit (SamTrans), with eight routes in the area.
- Marguerite free shuttle system operated by Stanford University serving both intra-campus routes and off-campus destinations such as the University Avenue and California Avenue Caltrain stations and downtown Palo Alto

Roadways

- Local and arterial street, bicycle, and pedestrian network maintained by surrounding cities
- Interstate 280, US 101, and State Route 82 (El Camino Real) maintained by the California Department of Transportation (Caltrans)

Regional Circulation Context



Freeways
Arterials
Residential Arterial
Collector Streets
Local Streets

Scale
1:30,000

N

0 0.5 1 Miles

Figure 4.1

has been and will continue to be attributable to both Stanford and other traffic generators in Palo Alto, Menlo Park, and other surrounding jurisdictions.

Stanford University has the potential to be a major contributor to traffic in the area. The current average daytime population of the campus, which includes students, faculty and staff on unincorporated lands, is approximately 21,000 persons. The resident population of the campus is approximately 12,400, of which eighty-four percent are estimated to also work or attend classes on the campus. This reduces the potential of campus residents to contribute to commute traffic (Community Plan/ General Use Permit Draft Environmental Impact Report). In addition, there are an estimated 24,000 people employed on other portions of Stanford lands, including the Stanford Research Park, the Stanford Shopping Center, and the Stanford University Medical Center.

In the past, Stanford has been subject to special conditions on its General Use Permit that were meant to limit the impact of growth in the unincorporated portion of Stanford on traffic congestion. The 1989 General Use Permit contains a "no net new commute trips" goal as a condition of approval, which required increases in population to be offset by increased TDM participation and additional on-campus housing.

Over the last decade, this goal has helped encourage Stanford to both add housing for over 1,200 new campus residents and to enhance a TDM system that today includes a free shuttle bus system, pay parking, car- and vanpool incentives and programs, and cash incentives. Stanford initiated many of these efforts without the additional incentive of the General Use Permit. In 1990, when the General Use Permit trip reduction requirement had been in place for less than one year, only 55% of Stanford students, faculty, and staff commuted alone to work compared to 78% of all the workers in Santa Clara County.

A variety of mechanisms can be used to alleviate local congestion:

- **Land use approaches,** particularly location of places of work, residence, and services in close proximity to one another, reduce the need for automobile use to meet basic daily needs. With sufficient intensity and combination of uses, non-auto trips are convenient and have a greater possibility of occurring than in a low-density, single use development pattern. A close integration of different uses can reduce the overall number of vehicle miles traveled on a regional level and the amount of time that individuals must spend commuting.
- **Transportation Demand Management** refers to the combination of incentives and programs used to make it possible and desirable for people to use alternatives to single-occupant vehicles during commute hours
- **Roadway system improvements,** which include efforts such as intersection and street widening, are necessary for a functioning street system and can reduce congestion and associated social and environmental impacts in specific locations. This approach does not reduce automobile trips or vehicle miles traveled.

In addition to the University's contribution to routine commute hour congestion, the hosting of special events during non-peak hours contributes to both on- and off-site congestion. The University frequently uses its public safety personnel and others to direct traffic entering and leaving the campus during special events. This approach helps mitigate, but does not avoid the congestion resulting from the large number of visitors who arrive and depart from the campus within a relatively short timeframe.

Strategies, Policies and Implementation

Strategy #1: Achieve no net new commuter trips" through land use and transportation demand management

Commute trip reduction concepts expressed in the 1989 General Use Permit have been adopted as a standard in this Community Plan, with direct measurement of commute trips rather than use of a formula to measure compliance. The standard of "no net new commute trips", as articulated in this plan, establishes a goal that there be no additional automobile trips over the calculated baseline in the peak commute direction during peak commute hours. This standard is at the core of the transportation approach expressed in this plan, and is the basis of its policies and implementation recommendations.

Stanford proposes to add 2,200 students, faculty and staff through 2010 and to construct several thousand housing units for Stanford students, faculty and staff. This added population creates the potential to create additional traffic throughout the local area. The concept behind "no net new commute trips" is that the added population should create no additional transportation impact in the commute direction during commute times.

Achievement of this standard will require a comprehensive system that makes it possible for individuals to meet their transportation needs without using a car. Such a system involves both land use solutions to bring a variety of uses together and thereby reduce the number of activities that require car use, as well as a range of alternative means of transportation that can meet a variety of needs. Although the strategy is focused on commute trip reduction, options for those without cars will need to be provided at non-commute times as well to make it possible for individuals to function throughout the day without their cars.

In the past the County has not required any single solution for commute trip reduction, but instead allowed Stanford the flexibility to achieve commute trip reduction within the overall goal. The monitoring system allowed for both land use and transportation demand management approaches. While the Community Plan calls for a more direct monitoring system than was used under the 1989 General Use Permit, it maintains the County's role of establishing the overall standard and allowing Stanford to use a variety of mechanisms as appropriate to meet the standard.

Land Use and Trip Reduction

An important land use pattern that supports non-auto transportation is the location of housing close to jobs and services. Stanford is a residential university, allowing students and faculty to live in close proximity to one another and to the academic facilities on the campus. Integration of academic, residential and supporting land use, and the concentration of uses in the central campus are strategies for supporting travel alternatives to the single occupant vehicle. One reason behind the Community Plan's emphasis on on-campus housing is the potential to reduce commute trips by locating more housing close to the University's jobs, classrooms and laboratories.

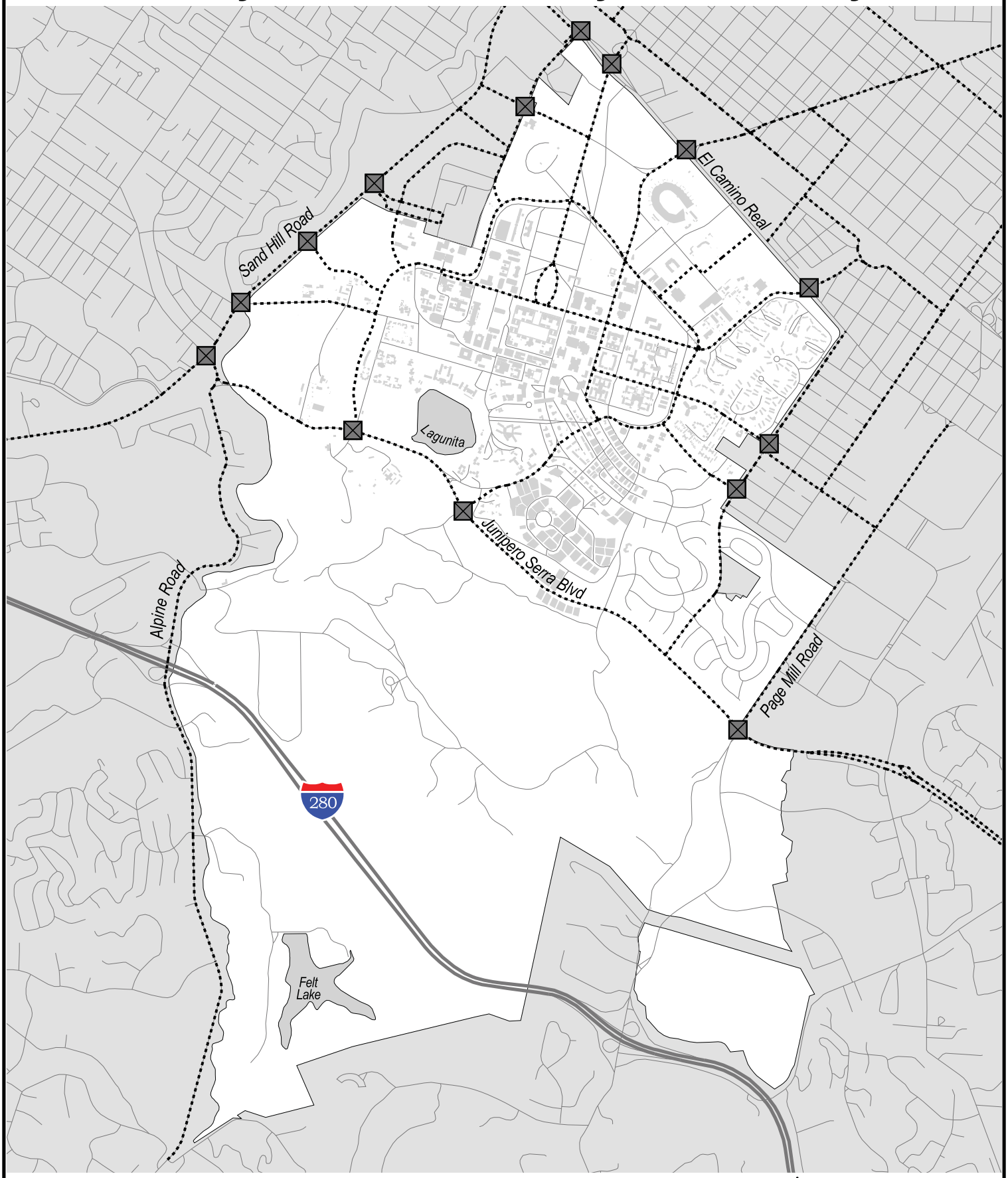
The existing concentration of uses in the central campus allows for a circulation system that is well integrated with the campus land use pattern, enhancing the ability of those on campus to use travel alternatives. Comprehensive pedestrian and bicycle circulation systems and transit services to, from, and throughout the campus contribute to the ease with which people are able to move about without an automobile (see Figure 4.2 - Primary Pedestrian Pathways and Bikeways and Figure --4.3, Local Transit Services).

While uses within the campus are well-concentrated, the campus as a whole is relatively isolated from many service destinations within the surrounding communities. This separation between the campus and the adjacent cities is partially by design-the Arboretum, which separates Stanford from downtown Palo Alto, was an important component of Leland Stanford's original campus layout. In other cases, the isolation results from the nature of the uses that border the campus, such as the Stanford Research Park and Stanford Shopping Center. These uses are important destinations, but they are relatively inaccessible to pedestrians and are not commonly used on a daily basis by campus residents. The Community Plan has identified housing sites in areas which currently separate the developed portions of the campus from Palo Alto; from a transportation standpoint, development of these sites which are convenient to on- and off-campus activities and to transit services could be valuable.

Transportation Demand Management

The range of transportation alternatives that can be provided by the private and public sectors to reduce congestion through peak hour trip reduction is collectively known as Transportation Demand Management (TDM). The Santa Clara County General Plan TDM goal calls for use of transportation modes other than the single-occupant automobile by 2010, or an average vehicle ridership of 1.33. According to the 1990 Census, 78% of all commute trips in the county were made in single-occupant automobiles. Because of the unique nature of the population, activities, and opportunities for mixed land uses on the campus, Stanford can and does achieve a much higher rate of alternative transportation mode use. Stanford's TDM program is the most extensive in the county, and it includes services ranging from informational pamphlets to a free shuttle system running throughout the campus and to major off-campus destinations (see sidebar). TDM at Stanford goes well beyond basic programs that make other transportation modes more available or easier to use; for example, Stanford is the only major employer in the northern portion of the County that charges employees for parking, and has recently instituted a policy prohibiting a portion of campus residents (freshman students) from

Primary Pedestrian Pathways and Bikeways



Primary Community Connections
Pathways and Bikeways

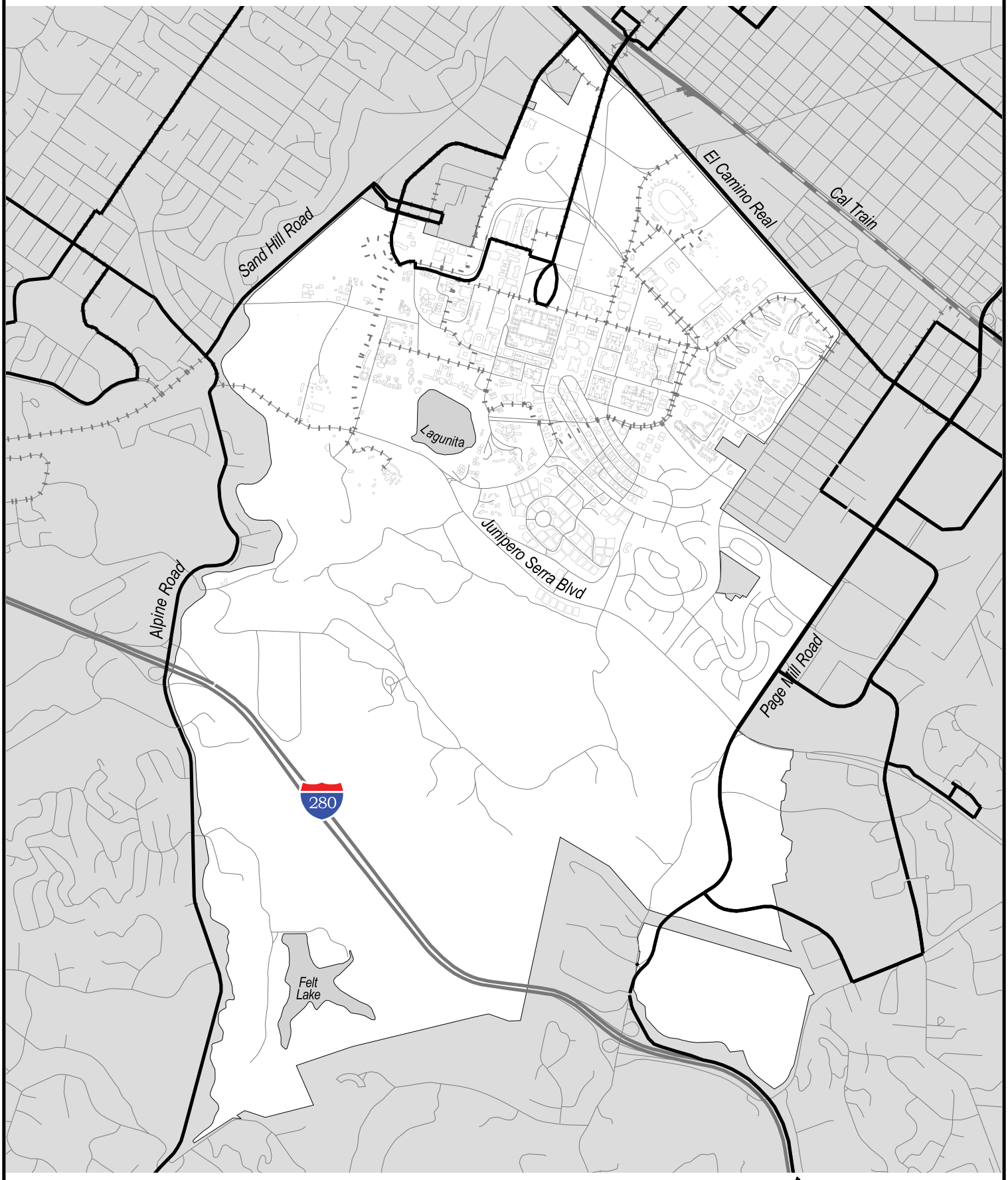
Scale 1:30,000

N

0 0.5 1 Miles

Figure 4.2

Local Transit Services



Marguerite
Local Transit Services
Local Streets
CalTrain

Scale 1:30,000

N

0 0.5 1 Miles

Figure 4.3

Stanford University Community Plan Adopted December 2000

Current Stanford Transportation Demand Management (TDM) Programs

Marguerite Shuttle System
- Free local shuttle bus system
- Service to two train stations, El Camino bus stops, Palo Alto and Menlo Park shopping districts, as well as on-camput travel
- Weeknight and weekend service

Carpool/Vanpools
- Full-time Stanford Employee Transportaion Coordinator
- Preferetial and reduced-rate parking for capools
- Over 500 separate carpools
- Vanpools to San Francisco, San Ramon, Berkeley, Oakland, Santa Cruz, and Modesto

Bicycle Support
- $650,000 in bicycle capital improvements for new bike racks, commuter bike enclosures, bike paths, and clothes lockers over the past five years

On-Campus "Transportation Store"
- Sales outlet for CalTrain, VTA, and Sam-Trans tickets and passes
- 1,700 transit passes sold annually
- Transit schedules for all major public transit systems
- Promotion of TDM programs

Parking Demand Management
- Parking fees
- Participants in the "Clean Air Cash" program receive cash for not purchasing a parking permit
- Parking restrictions

Guaranteed Ride Home Program
- "Safety net" for emergencies
- Provides free taxi rides or car rentals

Looking Ahead - Options Under Consideration
- Increased Marguerite frequencies and expanded services off campus
- Universal Transit Pass
- Satellite/remote parking with shuttle connections to campus
- Car-sharing program

keeping cars on campus. The current system under the General Use Permit of maintaining a "performance standard" (i.e., no net new commute trips) without mandating specific TDM programs has allowed Stanford to modify its programs as the University's needs change over time and as Stanford learns more about the effectiveness of individual measures.

Currently, state law restricts the County's ability to impose TDM requirements. It is the County's intent that the no net new commute trips standard be enforced to the fullest extent allowed by law.

Parking

Anecdotal evidence indicates that some transportation demand management programs, particularly parking fees and shortages, can affect neighborhoods adjacent to the campus through parking "spillover." However, oversupply of parking on the campus could undermine efforts to encourage alternative transportation mode use. Any negative external impacts of individual transportation demand management strategies will need to be considered and balanced by the University and the County.

Parking is currently available on the Stanford campus at a ratio of 1.03 spaces per student, faculty and staff (including Medical School students and faculty), with a non-residential ratio of 0.52 spaces per student, faculty and staff. On-street and residential parking serving faculty housing is not included in this total. Provision of on-campus housing can help reduce the need for additional commuter-oriented parking, as on-campus residents

should not regularly need parking places in commuter lots. The Community Plan does not encourage expansion of the current parking supply to a degree that would substantially change current parking ratios on the campus, particularly as the potential impacts of a limited parking supply can be addressed through other means (such as residential parking permit programs in neighborhoods near the campus).

Off-Campus Trip Reduction Efforts

Recognizing the extreme challenge for Stanford to meet the "no net new commute trips" standard in the future, the Community Plan provides an additional mechanism for trip reduction efforts by the University through policies and implementation programs that recognize Stanford's future participation in trip reduction efforts that occur in other jurisdictions. Examples of such efforts might include a park and ride facility at the western end of the Dumbarton Bridge developed in cooperation with the Cities of Palo Alto and East Palo Alto that could help reduce traffic along the University Avenue corridor, or a comprehensive trip reduction program for the Stanford Research Park operated in conjunction with the City of Palo Alto and the Research Park leaseholders and employers.

The Community Plan provides the opportunity for the County Planning Office to recognize Stanford's participation in such effort as an appropriate credit toward the "no net new commute trips" standard. The Plan provides for such recognition because:

- Stanford's current rate of alternative transportation mode use is high, and additional efforts may prove to have reached the point of "diminishing returns" with regard to their effectiveness. In contrast, other workers in the region may prove to be more receptive to TDM programs because there are fewer programs now available to them.
- Both Stanford's resources and the resources of neighboring cities may be more effectively leveraged in combination with one another than if they are devoted to independent and potentially competing programs.
- Cooperative measures that address traffic on streets around the campus may be of as much or more benefit to surrounding communities than measures directed only at Stanford residents and employees.

The County Planning Office will need to carefully monitor Stanford's participation and the effectiveness of such programs, and may choose to grant Stanford commute trip credit towards achievement of the "no net new commute trips" standard for such efforts.

Policies

SCP-C 1
Apply a "no net new commute trips" standard for campus-related trips in the commute direction during peak hours to the fullest extent allowed by law.

SCP-C 2
Within the overall pattern of land uses on the campus, promote a development pattern that supports reduction in automobile dependency through the following approaches: ·

- New academic and residential development shall occur within the Academic Growth Boundary.
- Support services for campus residents and employees should be accommodated in close proximity to residential and academic facilities.
- New development should be located near existing transit services, particularly if extension of transit service to the new facilities would otherwise be infeasible or impractical.

SCP-C 3
Encourage addition of housing in locations convenient to jobs on Stanford land in other jurisdictions, such as near the Stanford Medical Center.

SCP-C 4
Enhance pedestrian and bicycle access to and through the campus.

SCP-C 5
Permit and encourage regular modification of Stanford's Transportation Demand Management (TDM) program to allow for changes in user needs and in available services over time.

SCP-C 6
Continue to regulate parking supply as a mechanism for transportation demand management, while avoiding "spillover" of parking into neighborhoods adjacent to the campus. Over time, require Stanford to maintain a consistent level of parking in proportion to students, faculty and staff, as compared to the current ratio of 1.03 spaces per student, faculty and staff member.

SCP-C 7
In addition to meeting the no net new commute trips standard, encourage Stanford to reduce automobile travel at non-commute hours and in non-commute directions, such as traffic associated with lunchtime activities by employees or travel by families of on-campus residents.

SCP-C 8
Credit participation in off-campus trip reduction efforts that benefit the streets surrounding the campus towards Stanford's achievement of the "no net new commute trips" standard.

Implementation Recommendation

SCP-C (i) 1
Adopt and maintain zoning regulations that allow for a mix of land uses in academic and residential areas in order to reduce the need for automobile use on and off the campus.

SCP-C (i) 2
Locate supporting services such as day care and convenience retail in new and existing graduate student and faculty I staff residential neighborhoods. Particularly review for provision of support services in applications for substantial new residential development.

SCP-C (i) 3
Review development project applications for access to and integration with the overall system of pedestrian bikeways and pathways on the Stanford campus. Particularly consider this issue for development along the Quarry Road corridor with regard to enhancement of pedestrian access to the Palo Alto lntermodal Transit Center

SCP-C (i) 4
Establish a system for direct, independent, and verifiable monitoring of Stanford's level of achievement with the "no net new commute trips" standard through the annual monitoring procedure.

SCP-C (i) 5
Review the Transportation Demand Management system on an annual basis and consult with Stanford, and adjacent communities as appropriate, to ensure that new needs or opportunities are considered. Incorporate the following considerations into the review process:

a. TDM strategies should serve to reduce the number of cars entering the campus during the morning peak hour and leaving during the evening peak hour.

b. Programs serving intra-campus or off-peak travel should be primarily aimed at making it possible for employees and residents to conduct their daily activities without a car.

SCP-C (i) 6
Encourage Stanford to identify opportunities and develop proposals for participation in off-campus trip reduction efforts. Assess the expected effectiveness of the proposed programs, and apply trip reduction credits to the annual calculation of Stanford's compliance with the "no net new commute trips" standard.

Strategy #2: Alleviate local congestion in the context of commute trip reduction.

The Community Plan emphasizes on-campus housing and commute trip reduction as mechanisms to alleviate the potential effects of development at Stanford on the local street system. These approaches are meant to reduce congestion at a regional level, by making it possible for more Stanford students and employees to live within walking or biking distance of their place of work, and to reduce Stanford's contribution to peak traffic levels.

However, growth which occurs under the Community Plan will still affect the local street system. The addition of residents and employees to the campus community will increase the number of people in the area, creating more potential for congestion due to non-commute related trips. Spouses of Stanford-affiliated campus residents commute away from the campus to reach their workplaces. Special events at the campus during evenings and weekends have created and will likely continue to create traffic congestion on streets that access the campus.

While the increased traffic resulting from these activities does not outweigh the benefits of on-campus housing and commute trip reduction, the potential for this added traffic to inconvenience local residents needs to be considered and addressed accordingly. Current General Plan policies indicate that where local level of service impacts are unavoidable, particularly at locations that already have a poor level of service, making system-wide improvements (such as transit enhancements) that provide regional benefits is an appropriate response. However, in some situations street system alterations such as widening roads or adding dedicated turning lanes at intersections may also be needed. In many locations surrounding the campus, such alterations may either be infeasible or undesirable. This Community Plan recognizes that the County cannot by law require Stanford to implement TDM programs. Therefore, intersection improvements may be needed if Stanford is unable or unwilling to achieve the goal.

Congestion Management

The balance between land use and congestion is coordinated through the Congestion Management Program of the Santa Clara Valley Transportation Authority (VTA). The Congestion Management Program (CMP) works to maintain service levels on a designated network of roadways in the county. The CMP recognizes the potential for development in congested areas to create traffic that exceeds service level standards, particularly in locations that are highly accessible to transit and therefore desirable for higher density development, and sets direction for land use planning in these areas to focus on expanded capabilities for alternative transportation modes.

Following the direction set by the VTA, the County General Plan emphasizes the concept of transportation demand management and the tradeoffs between local and regional congestion (see Circulation chapter of the Santa Clara County General Plan). As a goal, the General Plan calls for 35% of all trips to occur in ways other than the single-occupant automobile. Stanford has far exceeded this goal for many years. The "no

net new commute trips" standard is a much more stringent approach that reflects the unique opportunities for trip reduction on the campus.

System Capacity Expansion

Local congestion can be reduced in two primary ways: reducing the number of cars or expanding a street or intersection to allow more cars to pass through it more easily. Although the County's preferred approach at Stanford is to pursue trip reduction, there are some situations where system expansion may be needed in order to alleviate "bottlenecks" that would indicate system problems and contribute unduly to the social and environmental costs of traffic congestion. In the Stanford area, traffic can be attributed partially to University activities and partially to other traffic generators, both on and off Stanford-owned land. When system expansions are needed, Stanford's responsibility for contributing to the cost of the projects needs to be considered.

When considering the need for changes to individual intersections as a strategy for reducing congestion, the standards of the appropriate local jurisdiction with regard to acceptable levels of congestion and the point at which the contribution of Stanford's traffic will be significant are applicable.

At Stanford, the "no net new commute trips" standard should be adequate to reduce the effects of growth at Stanford from impacting the transportation network. Expansion of system capacity that involves modification of intersections is in most cases considered a mechanism to mitigate traffic impacts if Stanford is unable or unwilling to achieve the "no net new commute trips" standard.

The following policies and implementation recommendations emphasize a set of priorities for consideration when considering roadway modifications:

- Maintain the street hierarchy. Efforts to increase through traffic capacity should be focused on appropriate streets that serve as important intra-campus or off-campus linkages.
- Use the internal campus street system. As much as possible, the internal campus street system rather than roads bordering on areas outside the central campus should be used. The campus road system should be maintained and upgraded as needed to accommodate appropriate trips.
- Recognize surrounding land uses. Streets should be designed and operated in a manner consistent with the types of development they serve. This issue has been of particular concern to campus residents directly on Junipero Serra Boulevard.
- Consider jurisdictional priorities. Different jurisdictions affected by Stanford traffic have different priorities for street expansion. Coordination between the County, Stanford, and the appropriate jurisdiction is needed to determine the most appropriate strategy for addressing the congestion.
- Maintain a proportional approach. Stanford should be responsible for its fair share of necessary expansion of off-campus roads and intersections.

- Think beyond cars. Modifications and system improvements for transit, walking and bicycles can complement Stanford's on-campus transportation demand management efforts in reducing trips and congestion.

Policies

SCP-C 9
Maintain consistency with the procedures and adopted policies of the appropriate jurisdiction when evaluating local intersection service levels and defining mechanisms for addressing impacts.

SCP-C 10
Modify street and intersection capacity and configuration in a manner consistent with the street hierarchy and surrounding land uses.

SCP-C 11
Prioritize use and improvement of the internal campus circulation system over roadways on the campus edges.

SCP-C 12
Consult with jurisdictions surrounding the campus regarding the potential non-commute traffic impacts of new development and activities at Stanford, and work with the jurisdictions to reduce potential effects on neighborhoods surrounding the campus.

SCP-C 13
Identify opportunities to improve access and circulation for pedestrians, transit and bicycles instead of or in addition to system expansions that accommodate automobiles.

Implementation Recommendation

SCP-C (i) 8
Require street system expansions on the campus that will ease traffic flow and internal circulation, particularly in situations where such capacity expansion would make on-campus routes preferable to off-campus roadways.

SCP-C (i) 9
If Stanford does not meet the "no net new commute trips" goal for new development on campus, require Stanford's contribution toward intersection improvements at impacted locations or equivalent funding toward other transportation impact mitigation efforts, to a degree proportional to the effect of the new development on future traffic levels. If Stanford does not either meet the no net new commute trips goal or contribute proportional funding toward intersection improvements or equivalent funding for transportation mitigation efforts, do not grant additional development permits until Stanford meets the established requirements.

SCP-C (i) 10
Negotiate renewal of agreements with the City of Palo Alto for the management of traffic associated with special events.

SCP-C (i) 11
Cooperate with the Congestion Management Agency in implementing deficiency plans, where needed, for Congestion Management Program system roadways and intersections in proximity to the Stanford campus.

SCP-C (i) 12
Consider redesign of Junipero Serra Boulevard in order to reduce speeding, enhance bicycle, pedestrian and motorist safety, recognize the needs of residents taking access from the street, improve migration opportunities for the California tiger salamander, and maintain the scenic character of the roadway, without substantially affecting traffic volumes. Pursue redesign through cooperative efforts among the County, Stanford University, and local residents, as well as other agencies as appropriate.

SCP-C (i) 13
Work cooperatively with surrounding jurisdictions to develop solutions to regional transportation problems.

Strategy #3: Alleviate local congestion from special events

Stanford hosts a variety of special events. While generally not held during peak commute hours, these events draw large numbers of visitors to campus. Because these visitors tend to arrive in a compressed timeframe, they often overwhelm the local transportation infrastructure. The Community Plan addresses these impacts with the following policies and implementation recommendations.

Policies

SCP-C 14
Identify opportunities to promote the use of public transit for special events at Stanford.

SCP-C 15
Work with neighboring jurisdictions to manage special event traffic.

SCP-C 16
Provide advance notification of events expected to draw large crowds to on-campus residents and the surrounding community.

SCP-C 17
Consult with jurisdictions surrounding the campus regarding the potential non-commute traffic impacts of new development and activities at Stanford, and work with the jurisdictions to reduce potential effects on neighborhoods surrounding the campus.

Implementation Recommendation

SCP-C (i) 14
Require Stanford to institute a special events hotline and website that on-campus residents and the general public can contact for information regarding upcoming special events.

SCP-C (i) 15
Require Stanford to provide the public with notice of special events in two newspapers of local circulation in the Palo Alto and Menlo Park area.

SCP-C (i) 16
Negotiate renewal of agreements with the City of Palo Alto for the management of traffic associated with special events.

Open Space

Stanford Community Plan Issues and Policies

Chapter Summary

Open land is a defining feature of Santa Clara County, and a resource that is becoming increasingly valued with the expansion and intensification of urban areas. At Stanford, formal open lands and natural open spaces define the visual character of the campus and frame the academic core. Open spaces, particularly the foothills south of Junipero Serra Boulevard, are visible almost everywhere on the campus and from many locations in surrounding communities.

Preservation of open space and the natural character of undeveloped lands is a prominent goal of the Santa Clara County General Plan policies. The Academic Growth Boundary will serve to define lands which are to be retained as open areas from those areas which should be targeted for future development. The strategies, policies and implementation recommendations in this chapter create a framework for open space protection based on a differentiation of open lands according to their location within or outside the AGB:

- Outside the AGB, land is to remain undeveloped except for uses associated with research activities that require a remote or foothill setting for their functioning. Recreational use of the areas outside the AGB is promoted through dedication of trails consistent with the Countywide Trails Master Plan.
- Future development should be targeted to areas inside the AGB. While some areas inside the AGB that are currently undeveloped are suitable for future development, others are to be preserved as important elements in the campus layout, as biological resource areas, or as recreational resources. On the whole, a balance between development, open space, and recreational facilities will need to be achieved.

This Community Plan seeks ways to maintain these open lands in a manner consistent with both County goals and policies and Stanford's interests as a private property owner. To that end, this chapter incorporates land use strategies that preserve the character of these lands and conservation of all of their resources into the future, while retaining them under university ownership.

Strategies for open space preservation include:

Strategy # 1: Locate additional development inside the Academic Growth Boundary

Strategy # 2: Balance recreational use and environmental objectives

Strategy # 3: Plan for parks and open space land within the Academic Growth Boundary

Background

Open space at Stanford performs a multitude of functions beneficial to both the University and the community at large, including:

- preservation of natural habitats,
- protection of sensitive species of animals and plants,
- protection of watersheds and flood control,
- preventing development in hazard areas,
- preservation of scenic vistas,
- provision of respite areas and recreational opportunities, and
- buffers to define urban form.

At Stanford, open space serves the additional purposes of supporting teaching and research and preserving the beauty and character of the campus.

Types of Open Space

The concept of "open space" applies to several types of land that serve a variety of purposes. At Stanford, open lands are located in both relatively flat areas within and bordering the central campus and in the foothills south of Junipero Serra Boulevard. Lands outside the Academic Growth Boundary (AGB) are to remain undeveloped except for field research purposes. Within the AGB, some undeveloped lands are intended and targeted for future development while others are meant to remain as open space that helps define the built university and is a key element in the campus design (see Figure 5.1- Types of Open Spaces).

Open Space Types

- - Academic Growth Boundary (AGB)
Open Space outside AGB
Open Space within AGB
Undeveloped Lands

Scale 1:30,000

N

0 0.5 1 Miles

Figure 5.1

Stanford University Community Plan Adopted December 2000

Open Space Outside the Academic Growth Boundary

Current Use and Setting

Stanford's lands outside the Academic Growth Boundary consist of undeveloped lands known as "the foothills," comprising approximately half of the Community Plan area and two-thirds of the University's total 8,180 acres. The future of these lands has been an issue of ongoing concern for both Stanford and the community.

These lands, which extend southwest of Junipero Serra Boulevard across I-280 and into San Mateo County, are comprised of grasslands, oak woodlands, and riparian areas. The area is largely undeveloped and used for low-intensity research agricultural leases, and recreation. It is also home to utility installations and the eighteen-hole Stanford Golf Course. The Stanford Linear Accelerator Center, and the 1,200-acre Jasper Ridge Biological Preserve are in San Mateo County.

Past land use policies for the foothills have included a General Plan designation of Academic Reserve and Open Space (which limits allowable uses to low-intensity activities in keeping with the character of the land). In addition, all land south of Junipero Serra Boulevard was included in Special Condition Area C under the 1989 General Use Permit, which required individual use permits for development in this area.

Other jurisdictions with Stanford lands have established land use policies for undeveloped Stanford foothill lands. Most of the undeveloped land in San Mateo County is designated Institutional/General Open Space/Future Study in the San Mateo County General Plan. The City of Palo Alto maintains three scenic easements on a portion of Coyote Hill in the Stanford Research Park south of Foothill Avenue. One easement will expire in 2002, while the others have expiration dates of 2010 and 2041 and are automatically extended by a year each January 1 unless the University gives the City notice of non-renewal.

By providing undeveloped settings for research and teaching, foothill open space at Stanford directly supports specific academic programs. Astrophysics, conservation biology, civil and environmental engineering and art are examples of academic programs directly supported by opportunities provided by open space in the foothills.

Competing Concerns and Priorities: Open Space Protection and Recreational Use

The Stanford foothills are recognized throughout the Midpeninsula as a valuable open space resource. However, the potential for future development of these lands has been a contentious issue for several decades. Stanford's internal policies call for the maintenance of land for future academic use.

On the regional level, the Stanford foothills are a functional component of the open space system that forms a visual and environmental backdrop for northern Santa Clara County. A combination of county and city parks, publicly-owned watersheds, and preserves owned by the Midpeninsula Regional Open Space District north and south of Stanford lands create a chain of open space along the ridges of the Santa Cruz Mountains. Conversely, Stanford's immediate surroundings in the foothills include land which is primarily in residential use in Los Altos, Los Altos Hills, Palo Alto, Portola Valley, and Menlo Park, making the Stanford foothills a rare example of open space adjacent to the urbanized area. The extensive development that has occurred in these jurisdictions has caused many of these neighbors to place a high value on guarantees for long-term or permanent protection of the Stanford foothills.

Recreational use of Stanford land is enjoyed by residents of the Stanford campus and neighboring communities. The close proximity of the Stanford foothills to the developed areas of the Midpeninsula make it a popular destination. Use of these lands is allowed by permission of the University. Recreational use of the foothills raises several associated issues:

- While the foothills are a popular recreation destination and used in the manner of a park by many visitors, they are not publicly owned or operated. Stanford does not provide the amenities that are normally associated with public trails and does not patrol the area to prevent visitors from leaving designated trails or manage the land as a recreation area. As a result, recreational use may contribute to trail and environmental degradation.
- Trail user parking is a particular concern to residents of the neighboring faculty I staff subdivision. As a result, Stanford instituted a residential parking permit program in this neighborhood and trail users have been parking along Stanford Avenue, which is a County-maintained road. As a result of continued resident concerns, the speed limit has been reduced and the County has modified the road to manage parking and reduce erosion, but has continued to allow public parking along portions of the street.
- Visitor access to environmentally sensitive areas, particularly riparian areas which are home to special status species, has the potential to result in degradation of habitat and direct impacts on animals, as well as adverse effects on research, education, and restoration efforts.

Maintaining natural resources in the foothills will require achievement of a balance between environmental protection and access to open space.

Open Space within the Academic Growth Boundary

Current Use and Setting

Inside the AGB, open spaces and undeveloped areas serve a variety of purposes:

- **Campus-defining open space.** Open spaces help define the form of the main campus. Major on-campus open spaces include the Oval, Palm Drive, the Arboretum, and Lake Lagunita. Several of these spaces serve additional purposes, such as storm water detention in the Arboretum and California tiger salamander habitat in Lake Lagunita.
- **Undeveloped central campus land.** Undeveloped tracts of varying size remain north of Junipero Serra Boulevard, primarily on the west side of the campus and in the faculty subdivision. Some of these areas are planned for future residential development while others could provide opportunities for new academic buildings.
- **Athletic fields.** Stanford maintains extensive athletic facilities, including playing fields located primarily in two areas (near El Camino Real and in the western portion of the campus near Sand Hill Road). These playing fields are programmed for use through the Department of Athletics, Physical Education and Recreation.
- **Recreational facilities.** Formal and informal recreation facilities such as Wilbur field and playgrounds in Escondido Village and the faculty subdivision are provided to serve campus residents. The golf driving range and the Stanford Golf Course (located outside the AGB) provide recreational opportunities to both Stanford students and others.
- **Buffer.** Undeveloped tracts along the Palo Alto and Menlo Park borders on Sand Hill Road, Stanford Avenue, and El Camino Real currently provide a buffer between the urban core of the University and the surrounding communities. Some of these areas are planned for future residential development while others will continue to provide a buffer.

Open Space Protection Policies

In the past, open space protection at Stanford has occurred through General Plan land use designations and through conditions of the 1989 General Use Permit. The General Plan designation of Academic Reserve and Open Space limited allowable uses to low-intensity uses compatible with the character of the land and its resources. North of Junipero Serra Boulevard, this General Plan designation was applied to the golf course, the portion of the Arboretum north of Campus Drive, and all of the land bordering El Camino Real.

Three Special Condition Areas identified in the 1989 General Use Permit area were also located in the central campus area. The Arboretum, the El Camino Real setback, and the lands on the west side of campus bordering Sand Hill Road were placed in these Special Condition Areas, which required a separate use permit for development rather than

allowing development under the General Use Permit. No restriction was placed on the types of uses that may be applied for in these special condition areas, other than those restrictions imposed by the Academic Reserve and Open Space land use designation.

Many of the open spaces and undeveloped areas in the central campus are within the area subject to the 1989 General Use Permit. Potential development in the GUP area requires Architecture and Site Approval (ASA) and is only limited by the cumulative population and square footage thresholds of the GUP.

Separate from the 1989 General Use Permit, the City of Palo Alto and Stanford entered into a development agreement in 1997 for projects along Sand Hill Road inside the City limits which also affects the land along Sand Hill Road that is located in the unincorporated portion of the County. Among many other stipulations, this agreement specifies that no use other than athletic fields may be developed along Sand Hill Road from Junipero Serra Boulevard to Pasteur Drive and east to Campus Drive West. The exception to this arrangement is that housing may be developed east of Fremont Road in the area known as the Stable Site. This agreement is in effect until 2020. The development agreement resulted from a negotiation between Stanford and the City of Palo Alto and involves an agreement by Stanford not to pursue certain activities rather than a condition or limitation imposed by the County. This development agreement may be modified at the mutual consent of Stanford and the City of Palo Alto.

Competing Concerns and Priorities

The open spaces within the AGB are subject to a variety of development pressures. While some of the areas are viewed as undeveloped lands which could be appropriate for future development, others provide important resources as open lands within the urban setting. Competing concerns and priorities for some of the open lands within the AGB include:

- The Arboretum is seen by many as the initial defining landscape at the main entrance of the university and as an open space buffer from the urban environs of Palo Alto. Given its altered natural state (replacement of much of the original oak woodlands with eucalyptus forest), it is seen by others as a potential location for future university expansion preferable to the foothills and other areas of critical habitat.
- Lake Lagunita is the most critical and highest value habitat of the California tiger salamander at Stanford. Undeveloped lands surrounding the lake have been identified as potential future sites for housing and expansion of the academic campus.
- Residential development in the faculty I staff subdivision is proposed in areas which currently serve as informal recreation areas for residents.
- While existing athletic facilities and recreational areas for students are not generally proposed for development at this time, the Academic Campus designation applied to much of this area does allow for the future development of these open areas through the definition of allowable uses.

- Development of faculty I staff housing could require relocation of the Driving Range to a site adjacent to the golf course.
- Faculty I staff and student housing proposed on the Stanford Avenue and El Camino Real frontages which currently serve to buffer development on Stanford's campus from the surrounding community.

Strategies, Policies and Implementation

Strategy #1: Locate additional development inside the Academic Growth Boundary

From the County's viewpoint, maintenance of the open space in the Stanford foothills is a central strategy for meeting the General Plan objectives of resource conservation and compact urban development. Concentration of academic development inside the AGB allows for retention of the open space character of the land outside of the AGB, while continuing to meet the University's land use objectives.

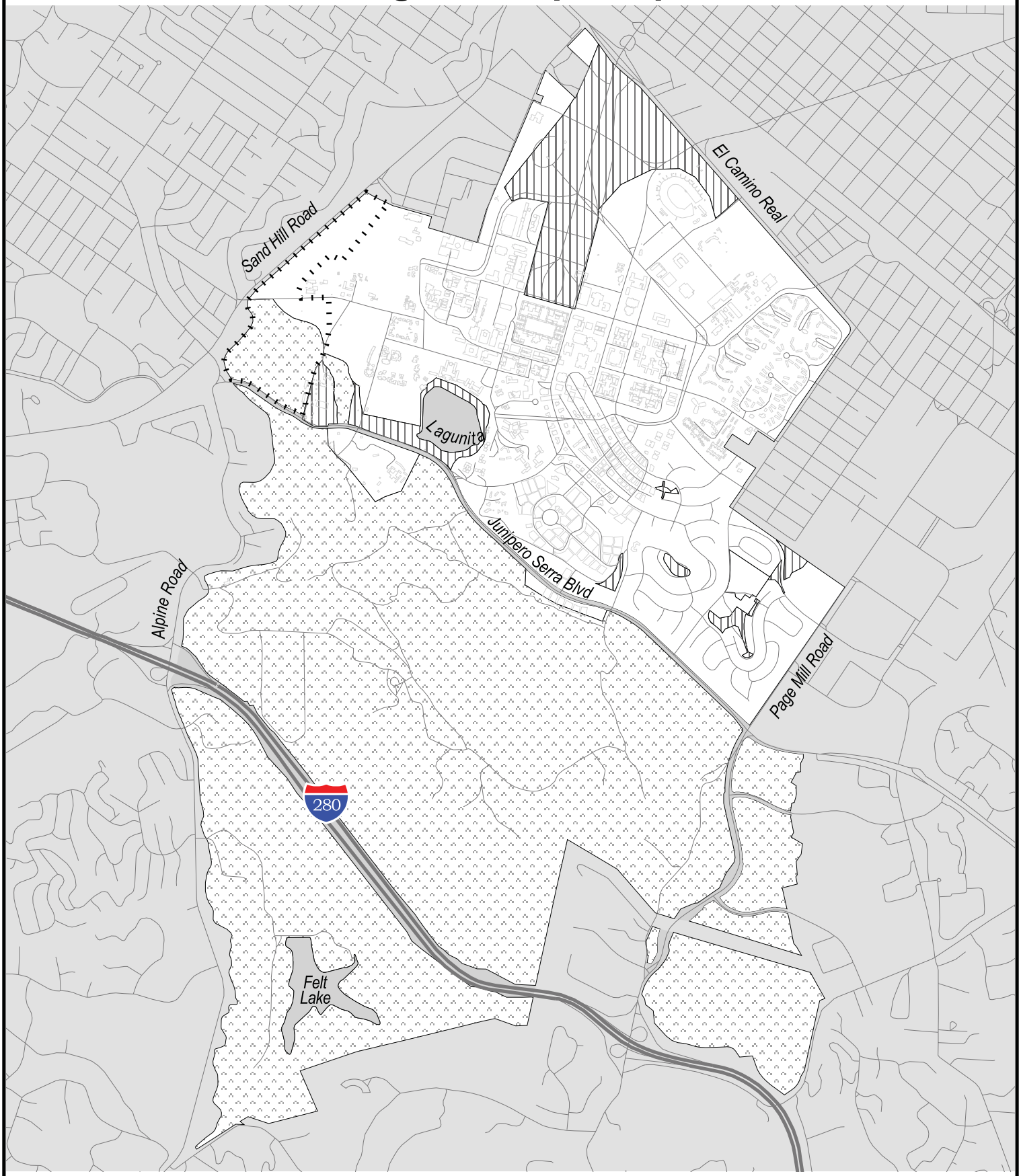
This strategy incorporates open space into the overall campus development approach, recognizing the area outside the AGB as an integral part of the campus environment that balances and moderates the intensity of the academic core. Efforts to preserve the foothills will require additional concentration and intensification of the central campus core. Conversely, maintaining the central campus as the focus of all new development will allow the foothills to remain in their natural state. The implementation measures discuss mechanisms for achieving long-term open space protection in the foothills that build on the overall land use strategy. Such measures include conservation easements in critical habitat areas and identification of opportunities to secure Stanford's commitment to open space protection.

This plan recognizes the need to protect open space in the Stanford foothills through the "Open Space and Field Research" land use designation, which allows for activities that support research and teaching requiring a remote or foothill setting for their functioning. Locations which are categorically not suited for development, such as habitats for rare species and geologic hazard areas, are designated Special Conservation and are completely restricted in terms of use and development.

This strategy and the associated policies and implementation recommendations reflect those policies articulated elsewhere in the Community Plan, particularly in the Growth and Development, Land Use, and Resource Conservation chapters. The policies are reiterated here to emphasize their value from the perspective of open space preservation.

Figure 5.2 - Designated Open Space, indicates those open space lands formally protected through Community Plan land use designations or other existing arrangements.

Designated Open Space



Open Space and Field Research/Special Conservation Areas

Campus Open Space

Sandhill Road Development Agreement (Open Space Area)

Scale 1:30,000

N

0 0.5 1 Miles

Figure 5.2

Policies

SCP-OS 1
Locate development inside the Academic Growth Boundary, allowing lands outside the boundary to continue as open space.

SCP-OS 2
Allow only field research and other uses that require a remote or foothill setting for their functioning in areas outside the Academic Growth Boundary. Do not permit any new development that is not associated with such uses (see Land Use Chapter).

SCP-OS 3
Identify and delineate Special Conservation areas where no development would be permitted (see Land Use Chapter).

Implementation Recommendation

SCP-OS (i) 1
Prioritize and use infill sites and areas with potential for redevelopment within the AGB as locations for new development.

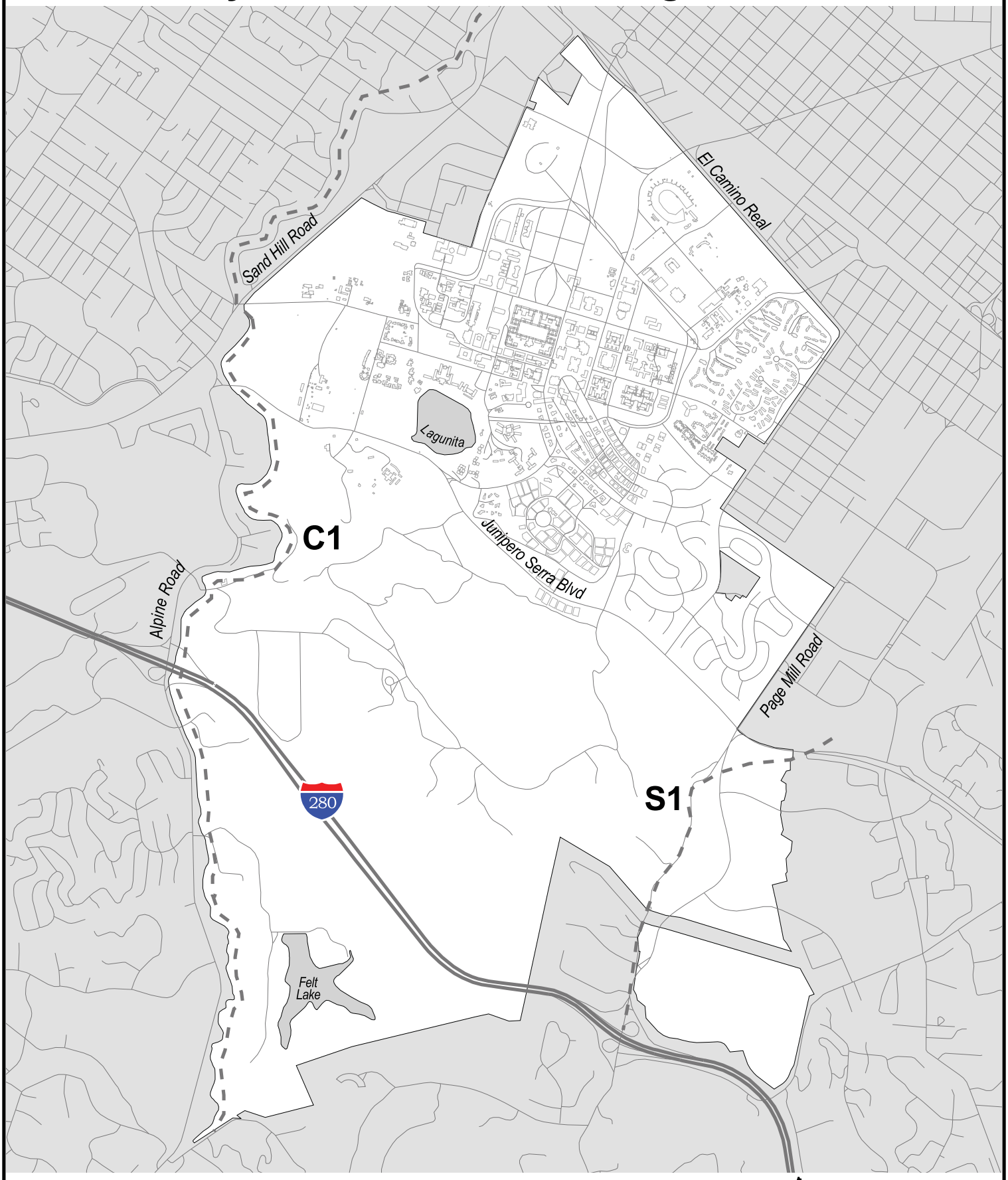
SCP-OS (i) 2
Require easements as appropriate in Special Conservation areas. Locate easements in areas which serve critical habitat needs.

SCP-OS (i) 3
Identify and pursue opportunities to remove existing obstacles to development within the Academic Growth Boundary in exchange for easement protection of lands outside the AGB.

Strategy #2: Balance recreational use and environmental objectives

Through its Countywide Trails Master Plan, the County has created the mechanisms to provide a comprehensive trail system throughout Santa Clara County. The plan articulates County policies for the location, management, dedication and use of trails. Because Stanford lands border on a number of designated preserves and parklands, the Trails Master Plan identifies trail linkages in the regional trail system which cross Stanford lands. These trails are intended to provide links between developed urban areas and open space in the foothills and baylands. The Community Plan incorporates trails in accordance with the Countywide Trails Master Plan. The Trails Master Plan identifies the following linkages on Stanford lands; actual alignments of these links must be designed to protect sensitive habitat areas, and on-going academic, agricultural, and residential uses. (See Figure 5.3 - County Trails Master Plan Designated Trails):

County Trails Master Plan Designated Trails



Sub-Regional Trail Routes from County Master Plan

Scale 1:30,000

N

0 0.5 1 Miles

Figure 5.3

Stanford University Community Plan Adopted December 2000

- Route S1 is shown as a "sub-regional route on other public lands" in the Matadero Creek/Page Mill Road corridor and is partially on a public road. The alignment follows Matadero Creek and Old Page Mill Road in the Stanford Community Plan area.
- The connector route C1, in the San Francisquito/Los Trancos Creek corridors, is designated as a "trail route within private property." The alignment generally follows the creeks and Alpine Road.

Some of these trails, in whole or in part, currently exist on Stanford land. The Los Trancos Creek and Arastradero Recreational trails have been in place for a number of years, and a portion of the San Francisquito Creek trail has been designated within the City of Palo Alto.

Development associated with the General Use Permit creates a need and an opportunity for trail dedication on Stanford land.

The actual alignment, design, and development of trails on Stanford land will need to comply with all relevant County policies. Creation of trails on Stanford land should be coordinated among the six jurisdictions in which Stanford lands are located, as well as the Midpeninsula Regional Open Space District.

Policies

SCP-OS 4
Require dedication of trails on Stanford land as specified in the Countywide Trails Master Plan, consistent with environmental objectives, academic uses and with the priorities of the County Parks and Recreation Department.

SCP-OS 5
Protect sensitive habitat areas, areas used for academic purposes, and areas under active agricultural use in the alignment and design of trails.

SCP-OS 6
Plan for, design, and develop trails on Stanford lands in a manner consistent with the policies articulated in the Countywide Trails Master Plan.

SCP-OS 7
Minimize impacts of recreational activities on academic and environmental resources.

SCP-OS 8
Encourage Stanford to work with the community to allow public access to trails not included in the County Trails Master Plan in a way that minimizes impacts on academic and environmental resources.

Implementation Recommendation

SCP-OS (i) 4
Coordinate efforts among Stanford and local agencies to define more precise trail alignments for the trails crossing Stanford lands as described in the Countywide Trails Master Plan, and to determine terms for trail development, maintenance, and liability.

SCP-OS (i) 5
Restrict access to sensitive habitat or hazardous areas, locations under ecological restoration, and research sites.

SCP-OS (i) 6
Develop programs to protect and restore overused or misused recreational areas.

Strategy #3: Plan for parks and open space land within the Academic Growth Boundary

The interplay between buildings and open space is an important distinguishing visual feature of the Stanford campus. The Stanford campus continually presents contrasts between intensive development and open space, and between formal and defined open space settings and informal, natural areas that evoke Stanford's natural setting.

The Community Plan identifies the areas within the AGB as the location for future development, maintaining the foothills as open space. As development of the academic core intensifies, treatment of open space areas becomes increasingly important for maintenance of the essential character of Stanford. In addition, implicit in the stated objective of maintaining Stanford as a residential campus is the provision of all of the physical elements of a complete residential community.

Planning for expansion of the basic academic facilities should include open space necessary for a balanced environment. The competing concerns for open space on the campus, and the need to protect significant open spaces, is the basis behind the Campus Open Space land use designation. Undeveloped lands or open spaces which are not specifically protected through the Campus Open Space designation are addressed through Community Plan policies that will help ensure the availability of adequate amounts of open land for recreational use and to balance built areas. Figure 5.2 - Protected Open Space, indicates those open space lands formally protected through Community Plan land use designations.

Recognizing the different types and roles of central campus open space, the Community Plan stipulates a variety of measures for protecting and enhancing these spaces:

- **Form-giving open space features:** Historic or form-giving open space features which are essential to the character of the campus are designated Campus Open Space in the Community Plan (see Land Use Chapter). This designation also applies to areas within the Academic Growth Boundary which are essential to the habitat value of critical natural areas located within the AGB.

- **Parks in residential areas:** Areas which have long been used as parks and playgrounds in the faculty I staff subdivision are a valued amenity for the resident community and are also designated Campus Open Space in the Community Plan. These designated Campus Open Space areas within and adjacent to the faculty I staff subdivision total 18.4 acres. This space can be considered adequate for a population of 3,680 according to the 5 acres per 1,000 residents standard recognized by the State of California as the maximum amount of park area that can be required in a new subdivision. The current estimated population of the faculty I staff subdivision is 2,262, projected to be 2,387 in 2010. Parks in new faculty I staff subdivisions will also be provided at the 5 acres/1,000 residents standard.
- **Athletic fields:** Athletic and recreational facilities also function as open space. The designated athletic facilities, intramural playfields, and informal fields near residences directly support academic and residential programs and are included in the Academic Campus designation. Community Plan policies call for provision of adequate outdoor athletic facilities to support the student population.
- **Buffers:** Undeveloped land on the periphery of campus both defines the gateway to the campus and provides a buffer to the surrounding community from the University's development. These buffer areas carry a variety of land use designations. Many of the important frontages are designated Campus Open Space. Others with some potential for development are designated Residential or Academic Campus. Community Plan policies call for the need to balance new development with the importance of maintaining adequate open space buffers along the interfaces with neighboring off-campus communities.

Policies

SCP-OS 9
Identify and preserve significant open space through use of the Campus Open Space designation in order to maintain the quality and character of the central campus.

SCP-OS 10
Require Stanford to maintain recreational open space to meet existing and future recreational needs of the Stanford community.

SCP-OS 11
Balance concerns about the maintenance of buffers between the University and Cities of Palo Alto and Menlo Park with the need for increased housing supply and improved affordability (see Housing Chapter).

Implementation Recommendation

SCP-OS (i) 7
Identify, protect, and restore historic campus open space features essential to the organizing principles of the campus plan.

SCP-OS (i) 8
Require Stanford to provide sufficient campus parks and open space in the areas designated Campus Residential, at the rate of 5 acres for 1,000 population.

SCP-OS (i) 9
Review development applications for continued provision of recreational and athletic facilities convenient to student residences and in adequate amounts to serve student needs.

SCP-OS (i) 10
Incorporate open space in redevelopment of the core campus.

SCP-OS (i) 11
Review development applications in the Academic Campus land use designation for continued provision of buffer between development on the campus and surrounding off-campus communities.

SCP-OS (i) 12
Develop appropriate setback requirements as part of the new zoning for the Campus Residential - Low Density and Campus Residential - Moderate Density land use designations.

Resource Conservation

Stanford Community Plan Issues and Policies

Chapter Summary

Stanford contains a great wealth of natural resources which the Community Plan aims to preserve and protect in a manner that balances conservation and development of the campus. Resources include plant and wildlife species, creeks and other special habitat areas, water resources, historic and prehistoric resources, and visual resources. All types of resources contribute to the natural and built environment of the campus.

Many types of resources are protected through various state and federal laws. The policies and implementation recommendations in this chapter reinforce, enhance, and supplement these mandated resource conservation approaches for the particular natural and built environment of Stanford lands.

This chapter of the Stanford Community Plan addresses a range of resource conservation subjects, and each has a subsection of the chapter devoted to it. These subsections include:

- Habitat and Biodiversity,
- Water Quality and Watershed Management,
- Heritage Resources, and
- Scenic Resources.

Other Resource Conservation topic areas are discussed in the County of Santa Clara's General Plan, including Water Supply, Agricultural Resources, Mineral Resources, Solid Waste Management, and Energy Resources, in sufficient detail to guide activities at Stanford.

Community Plan strategies for resource conservation are:

Habitat and Biodiversity

Strategy # 1: Improve Current Knowledge and Awareness of Habitats and Natural Areas

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Water Quality and Watershed Management

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Heritage Resources

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Scenic Resources

Strategy # 9: Employ Growth and Development Policies That Conserve Scenic Resources

Strategy # 10: Maintain and Enhance the Scenic Values of Urbanized Area Settings

Background

While the concept of resource conservation encompasses a diverse set of topics that involve both the built and the natural environment, there are common themes that bring these issues together. These themes are expressed in the General Plan but are discussed in this Community Plan to provide a sense of their application to Stanford and the importance of resource conservation in the overall approach to development on University lands:

- **Value:** Stanford's resources discussed in this chapter all provide a variety of types of values to both the Stanford community and the wider area. For example, species and habitats have value from both the ecological viewpoint and for scientific research purposes. Historic buildings house Stanford's academic programs and also enhance the physical identity of the University and the wider community.
- **Stewardship:** The concept of stewardship involves recognition of the value of natural and heritage resources, leading to active efforts to preserve and enhance the quality of the environment and its resources. Stanford's preservation of the vast majority of its foothills is an example of stewardship, particularly in times when the University actively chose not to develop this land. As pressure to grow increases, stewardship becomes both more difficult and more important.
- **Challenges:** Challenges to effective resource conservation stem from the increasing demands on natural resources presented by growth at the University and elsewhere, from the limited capacity of the environment to absorb impacts from human activity, and from the need for cooperative, regional action to implement effective measures.

The General Plan advocates a set of overall strategies for resource conservation efforts, which include:

1. Improving and updating current knowledge of resources;
2. Emphasizing pro-active, preventive measures to avoid impacts
3. Minimizing or compensating for impacts which do happen;
4. Restoring resources where possible; and,
5. Evaluating the effectiveness of mitigation measures employed.

Strategies and policies for various subjects as they relate to Stanford's lands are based upon these overall strategies, but may be tailored or limited to the specific resources and circumstances involved with Stanford lands.

One advantage for resource conservation at Stanford is the tremendous amount of knowledge that has been gathered and activities that have been initiated over the years. These measures are discussed more fully for each topic area.

One of the most important tools available to local government in the area of resource conservation is the California Environmental Quality Act (CEQA), which requires that the significant environmental impacts of development projects be recognized and mitigated as appropriate. At Stanford, the County has taken the approach to require comprehensive environmental review of potential impacts associated with the issuance of the General Use Permit. This analysis is then supplemented by additional environmental review of the impacts of each new project.

Habitat and Biodiversity

Background

Stanford's natural setting is an asset to both the University and the region. The diversity of local flora and fauna, and close proximity of the main campus to relatively unspoiled areas, allow for laboratory activities, teaching, and research to be closely linked to field-based studies, providing Stanford with academic opportunities unique among its peer institutions. The large acreage in open space supports relatively uninterrupted habitat and wildlife corridors connecting to publicly-owned open spaces in the region. On lands which are not owned by Stanford and are not under public ownership, extensive development has occurred, leading to habitat fragmentation and increasing local interest in maintaining Stanford as open lands.

Protection of species depends on protection of the habitats in which they live. Stanford's lands support a rich array of native biological communities including riparian oak woodland, other oak woodlands, and annual grasslands. A number of species and biotic communities found on Stanford lands are protected by one or more local, state, or federal statutes such as the federal Endangered Species Act (ESA), the California Endangered Species Act, and the federal Migratory Bird Treaty Act. These species are collectively referred to as "special status species" and include:

- Two species which use creeks on Stanford lands as habitat, the California red-legged frog and the steelhead trout, are listed as "threatened" under the ESA. These species can be protected through use of buffers along creeks and protection of water quality. Another important consideration for creek species is the effect of water use from creeks for irrigation and other purposes.
- Several other species found at Stanford are candidates for protection under the ESA, most notably the California tiger salamander (CTS). Because there is the most immediate conflict between this species and both ongoing activities and proposed new development, the salamander is the subject of extensive effort; issues related to the CTS are described in more detail below.
- Trees in the riparian forest, oak woodland savanna, and central campus provide breeding and foraging habitat for a wide variety of birds, including several species of special concern such as the Cooper's hawk, sharp-shinned hawk, golden eagle, and loggerhead shrike. The Land Use designations and Open Space chapter policies are in part intended to conserve the resources of these areas for the habitat value they provide.

Stanford has engaged in a number of efforts over time to preserve habitats and biodiversity. These endeavors include:

- Planting of over 1,700 new oaks and other native trees as part of a reforestation program in both the foothills and the central campus.
- Steelhead trout restoration projects in San Francisquito Creek, in conjunction with the State Department of Fish and Game, CalTrout, and Santa Clara and San Mateo counties.
- Establishment of the 1,200-acre Jasper Ridge Biological Preserve in San Mateo County in 1973. The preserve is used for fieldwork in biological studies by Stanford students and faculty and researchers from other institutions.
- Creation of experimental breeding ponds for use by CTS in the foothills in order to reduce the number of salamanders exposed to traffic hazards as a result of crossing Junipero Serra Boulevard to reach Lake Lagunita.
- Maintenance and preservation of the oaks and other trees in the central campus through sensitive building design, incorporation of natural areas in the central campus setting, and relocation of mature trees displaced by building projects.

An important aspect of these conservation activities is the opportunity to learn from these efforts. As an academic institution and long-term landowner, Stanford is able to monitor and test different methods of habitat conservation and restoration in search of the most effective strategies. In addition to the Jasper Ridge Biological Preserve, Stanford faculty, students, and researchers have long-term research and teaching interests in San Francisquito Creek, Los Trancos Creek, Matadero Creek, and the oak woodlands and annual grasslands.

The oak reforestation program is perhaps the best-known habitat restoration program on the campus, involving Stanford, nonprofit organizations, and numerous volunteers from the campus and neighboring communities. This program was initiated by Stanford in the early 1980s, following the preparation of a Vegetation Management Plan in 1983 which found a lack of young oak trees and a decline in mature trees in the natural areas on the campus. After several years of operation in the foothills, the reforestation program has been extended to the Arboretum, and it has also involved reintroduction of native understory shrubs, grasses and forbs (broadleaf herbs) in addition to oaks. This continuing program has yielded many lessons and insights that have been used to modify techniques for planting and maintenance. The oak reforestation program is an excellent example of comprehensive land stewardship and management that restores habitat and contributes to the knowledge of the natural environment.

California Tiger Salamander

The CTS is a state species of special concern and a federal candidate for listing as threatened or endangered. Lake Lagunita and the surrounding undeveloped lands provide both aquatic breeding and terrestrial habitat for CTS. Stanford's population is the only remaining known population of this species on the San Francisco Peninsula. The rarity of this population and the fact that the salamander habitat is located in potential development areas create a particularly high level of interest in the potential effects of development under the Community Plan on this species.

The CTS has very particular life cycle needs which require extensive habitat preservation and management, in both developed and undeveloped areas. CTS breed in Lake Lagunita, where seasonal filling makes water available for a period of time that coincides with the amphibian's breeding cycle. After hatching and developing to their terrestrial form in water, juvenile salamanders migrate to upland habitats up to one kilometer or more from the breeding site, where they live in holes created by ground rodents. These estivation sites are located both north and south of Junipero Serra Boulevard. Adult salamanders return to their breeding ponds with the first heavy rains of winter. Aquatic breeding sites and usable upland habitat, particularly within 500 meters of the lake, comprise the salamander's crucial habitat needs.

Primary threats to the CTS at Stanford are:

- Traffic mortality due to crossing of Junipero Serra Boulevard during migration;
- Impacts from activities associated with development, such as trapping in utility boxes and harm to individuals from landscape maintenance; and
- Loss of habitat from new development.

In 1998, a Management Agreement for the California Tiger Salamander was signed by the U.S. Fish and Wildlife Service, the California Department of Fish and Game, the County, and Stanford. The CTS Management Agreement identified mechanisms to reduce the impact of these threats on the CTS, particularly addressing a defined zone around Lake Lagunita known as the CTS Management Zone. The agreement was required as a condition of approval for construction of the Lyman graduate student residences near Lake Lagunita, as a mitigation for the impacts on the salamander associated with that project and other identified projects within the Management Zone. The Management Agreement allows for additional mitigation of projects in the Management Zone which are not covered by the agreement, which would include all development associated with the new General Use Permit.

Some of the primary strategies have included efforts to make developed areas inaccessible to salamanders, modification of management practices, and the creation of several experimental breeding ponds in the foothills to reduce the population's reliance on Lake Lagunita. While Stanford hopes to increase use of the foothill breeding ponds over the long term, the success of these ponds has not been established. The University also intends to construct a tunnel crossing under Junipero Serra Boulevard to reduce traffic mortality. Protection of Lake Lagunita and habitat around the lake will remain as an important aspect of salamander management in the future.

Strategies, Policies and Implementation

The Community Plan incorporates the major habitat preservation concepts or strategies included in the General Plan, namely, acknowledging habitat and biological resources, preserving habitat, mitigating impacts, and restoring habitat. The plan implements these concepts through restrictions on development in the foothills to only those activities which support academic activity based on the foothill setting and through emphasizing development in the central campus that is sensitive to the natural resources affected by the development.

Strategy #1: Improve Current Knowledge and Awareness of Habitats and Natural Areas

This strategy acknowledges the need for accurate and up-to-date information on local biodiversity in order to conduct successful conservation and land use planning. Stanford maintains an evolving database on many levels of local biotic diversity. In particular, data on the distribution and condition of protected species and plant-defined biological communities, such as serpentine grasslands, are incorporated into the database on an annual basis and should be transmitted to the County as well. Stanford is also conducting ongoing studies investigating the impacts of non-native species on local ecosystems. The policies associated with this strategy call for continued data collection and information transmission to the County.

Policies

SCP-RC 1
Maintain and update inventories and maps of important biological resources on Stanford lands, including protected species, species considered at risk of local extinction, and habitat types (biotic communities), for use in conservation efforts, land use decision making, and monitoring of resource status.

SCP-RC 2
Allow field research and other academic activities related to improving knowledge and understanding of habitat resources to occur in areas south of Junipero Serra Boulevard.

Implementation Recommendation

SCP-RC (i) 1
Require Stanford to prepare California Natural Diversity Database records for species of concern.

SCP-RC (i) 2
Transmit natural resource map updates to the County using the County's current electronic map format standards.

Strategy #2: Protect the Biological Integrity of Habitat Areas and Adequately Mitigate Impacts

Protection of existing natural resource areas is an essential component of successful conservation planning. At Stanford such protection involves the management and long-term commitment to the preservation of environmentally significant areas, particularly in the foothills.

The question of what habitat areas are "sensitive" and most in need of protection is not a simple one. Habitats for some special-status species under state or federal law are clear candidates for protection. Such habitats at Stanford include Lake Lagunita, other breeding ponds, and the upland habitat (undeveloped land within 500 meters of breeding sites) for the California tiger salamander. It also includes the creeks and their riparian surroundings which support steelhead and red-legged frogs. While much of this habitat area is located in the foothills which will remain largely undeveloped, some areas around Lake Lagunita on the north side of Junipero Serra Boulevard are within the Academic Growth Boundary (AGB). This area is viable salamander habitat and should be considered a sensitive area for management purposes.

While location of development and activities outside of the most sensitive habitat areas is important, appropriate management within already developed areas and in locations used for agriculture and recreation is also critical to the protection of species and habitats. For example, there is concern about the effects of recreational activity in the foothills in terms of erosion and effects on habitat and wildlife. Unlimited access to the creeks in these areas could pose a threat to the special status species in such aquatic environments. Resource management of some of these areas can be particularly challenging in areas that are not directly controlled by the University, such as on agricultural leaseholds on undeveloped lands.

California Tiger Salamander

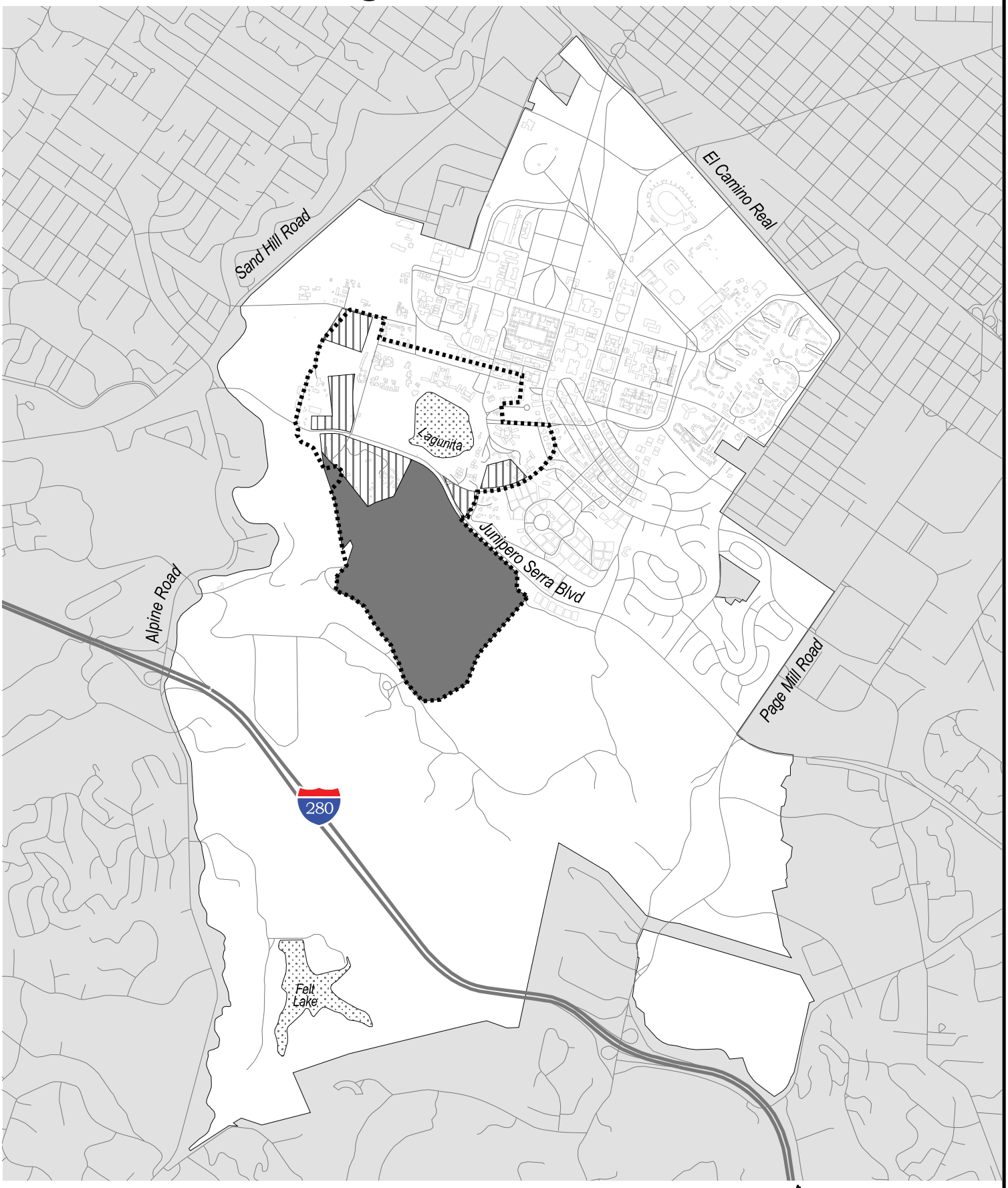
Measures to protect habitat for the CTS under the Community Plan will minimize development in the most crucial habitat areas over the long term. These areas are undeveloped lands within 500 meters of CTS breeding sites, without intervening development that fully blocks salamander access. Specifically, existing prime habitat includes Lake Lagunita and its undeveloped environs and the Lower Knoll, with undeveloped lands south of JSB also serving as important habitat (See Figure 6.1 - California Tiger Salamander Habitat). While the Driving Range is adjacent to the lake, recreational activities have prevented it from acting as prime salamander habitat.

The primary tools to protect prime habitat are long-term conservation easements and creation of new salamander habitat through addition of viable breeding ponds. The AGB itself is an important tool for CTS habitat protection in that it will prevent development in some portions of the CTS habitat area.

If the CTS is listed as a threatened or endangered species by the U.S. Fish and Wildlife Service in the future, Stanford will be required to obtain incidental take authorization and prepare a Habitat Conservation Plan if any development or activities that affect the salamander are proposed.

The policies associated with this strategy emphasize both avoidance of disturbance to sensitive habitat areas and mitigation of any impacts that do occur.

California Tiger Salmander Habitat Areas



Special Conservation Zone

Occupied California Tiger Salamander Habitat within AGB

California Tiger Salamander Management Zone

Scale 1:30,000

N

0 0.5 1 Miles

Figure 6.1

Stanford University Community Plan Adopted December 2000

Policies

SCP-RC 3
Assure the protection of habitats for special status species in approving the location and design of new development. Avoid habitat areas for these species in the location of development whenever feasible.

SCP-RC 4
Protect and maintain habitats, natural areas, and wildlife corridors in development and redevelopment.

SCP-RC 5
Protect habitat areas through use of the Open Space and Field Research, Special Conservation, and Campus Open Space land use designations, and through use of the Academic Growth Boundary. If land use designation changes or AGB relocation is proposed, conduct detailed studies for presence of special status species and their habitat prior to decision making.

SCP-RC 6
Require Stanford to mitigate any impacts on special status species or other biological resources that result from land use and development through:

a. Mitigation measures that have proven to be effective which shall be implemented prior to commencement of site preparation and construction activities as appropriate.

b. Mitigation measures such as provision of new habitat areas which shall be monitored and, if necessary, revised over time to ensure the viability of these measures as mitigation.

SCP-RC 7
Maintain and restore riparian buffer zones along creeks as described in Santa Clara County General Plan policy R-RC-37.

SCP-RC 8
Monitor and evaluate the recreational use of sensitive habitat areas and limit if necessary the recreational use of areas supporting significant, but less sensitive, natural resources.

Implementation Recommendation

SCP-RC (i) 3
Establish guidelines for review and approval of research and teaching activities in habitat areas, particularly in those areas which support special-status species.

SCP-RC (i) 4
Develop and implement a program for monitoring and managing recreational activities in the foothills with regard to the habitat impacts of these activities.

SCP-RC (i) 5
Participate in the preparation and implementation of a Habitat Conservation Plan for Stanford lands, if such an effort is initiated by Stanford or the U.S. Fish and Wildlife Service.

SCP-RC (i) 6
Require long-term habitat protection measures in appropriate locations as mitigation for development in habitat areas that support special-status species or that are protected through local, state, or federal regulations.

SCP-RC (i) 7
Require replacement of trees greater than 12 inches in diameter which are removed at a 1:1 ratio of replacement to removed trees. For oaks which meet this criteria, require relocation of trees or replacement at a 3:1 ratio.

SCP-RC (i) 8
Develop guidelines for the location, siting and review of proposed construction projects that minimize impacts to natural resources.

SCP-RC (i) 9
Identify opportunities to conserve water used for irrigation and other purposes in order to limit use of water from creeks.

Strategy #3: Encourage and Promote Habitat Restoration

Just as protection of existing natural resources is a critical element to successful resource conservation planning, so too is habitat restoration. After well over 200 years of occupation by European settlers and their descendents, and more than 8,000 years of occupation by Native Americans, Santa Clara County, including the Stanford area, has been modified significantly by humans. Habitat loss, habitat fragmentation, and habitat modification have all occurred on a large scale in the region, with most changes occurring in the last 150 years. For example, the Stanford foothills, which are considered an important natural resource, are primarily comprised of non-native grasses and have been substantially altered through cattle grazing. Both foothill areas and flatlands in areas surrounding Stanford lands have been extensively developed.

Habitat restoration is also a potential mitigation measure for development in sensitive habitat in other locations.

The policies associated with this strategy encourage continued habitat restoration as part of a comprehensive approach to habitat preservation and management.

Policies

SCP-RC 9
Establish priorities for the restoration or rehabilitation of sensitive habitat areas and include habitat restoration as a key component of conservation management and planning.

SCP-RC 10
Stanford shall continue and support efforts to enhance habitats and populations of protected native species, including, but not limited to:

a. reduction of non-native invasive species;

b. wetland creation efforts, particularly to increase breeding sites for the California tiger salamander; and

c. the oak reforestation program in the foothills, the Arboretum, and in other natural areas.

Implementation Recommendation

SCP-RC (i) 10
Coordinate wetland preservation for flood control purposes with habitat restoration efforts.

SCP-RC (i) 11
Encourage location of facilities and trails out of sensitive habitat areas and areas undergoing habitat restoration.

Water Quality and Watershed Management

Background

Healthy watersheds with good water quality are a critical component of resource conservation because watercourses are home to many of the campus' sensitive species, and because the quality of the watershed affects the larger San Francisco Bay ecosystem. Activities on Stanford lands have the potential to affect the quality of creeks and their associated riparian habitats, creating lasting impacts on both terrestrial habitat and water quality and species.

Stanford lands are included in two watersheds: the San Francisquito and the Matadero (see Figure 6.2- Watershed Boundaries). The San Francisquito Creek system, including San Francisquito, Los Trancos, Corte Madera, Sausal, and Bear creeks, and the Searsville Reservoir, is the larger of the two and is located in the west and north portions of the University. Stretches of this system form the boundary between Santa Clara and San Mateo Counties. Stanford has three water diversions in this watershed: the Searsville Dam, a recently redesigned pumping facility located at the Stanford Golf Course near Junipero Serra Boulevard, and the Felt Lake diversion on Los Trancos Creek (at Arastradero Road).

The Matadero system encompasses the eastern areas of the University and consists of Matadero and Deer creeks. This watershed is located entirely in Santa Clara County. The Stanford portion of this watershed in unincorporated Santa Clara County is in natural streambeds with substantial existing riparian vegetation. Downstream portions of the system are maintained in artificial channels. Stanford has no water diversions in this system.

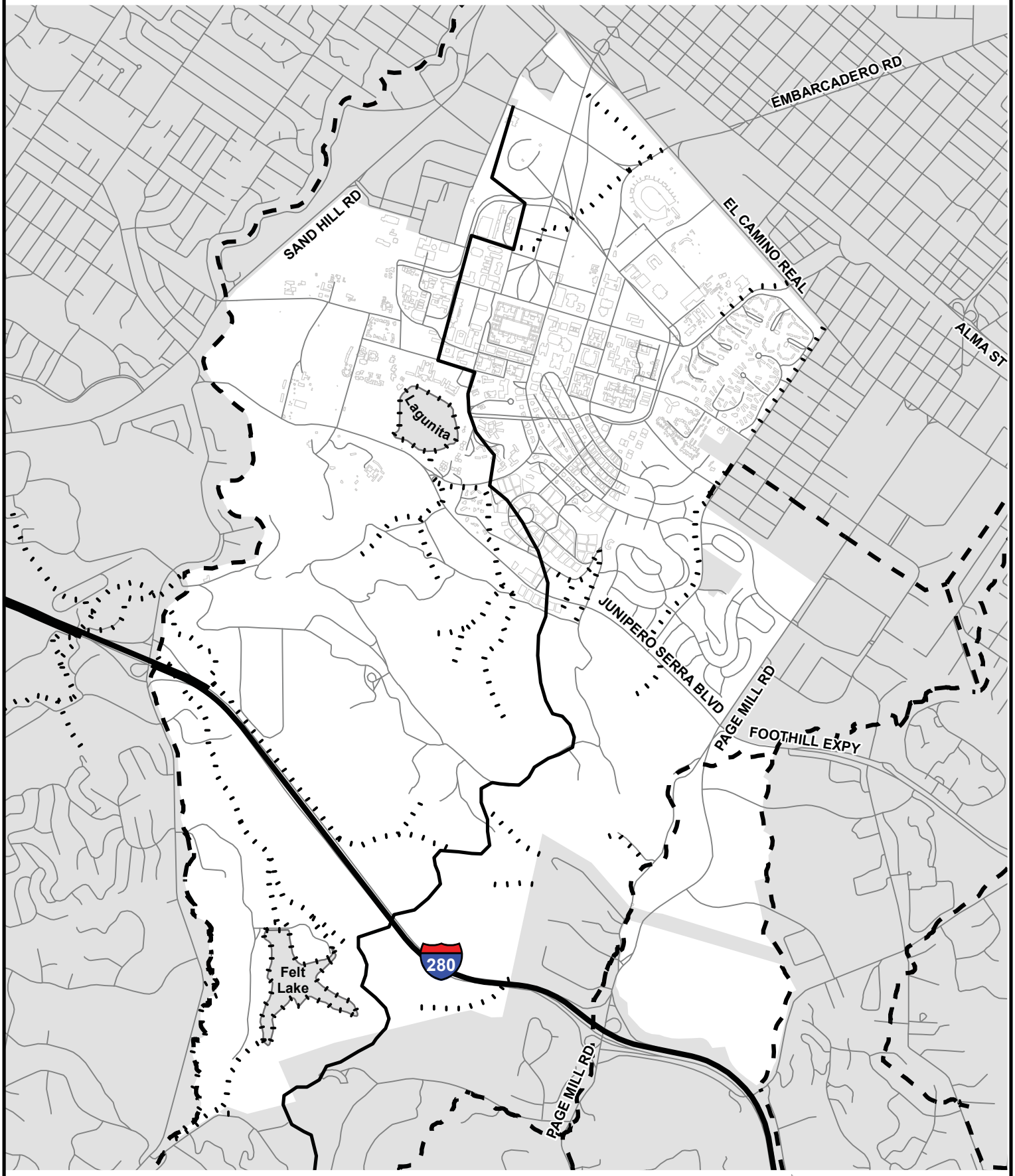
Portions of Stanford lands also contain a groundwater recharge area, which crosses the central campus (see Figure 6.3 - Groundwater Recharge Area). This area is referred to as an "unconfined" zone where groundwater recharge is not generally precluded by soils and geologic features. As additional development occurs in this portion of the campus, there is less opportunity for infiltration and recharge of the aquifer through ground percolation and more runoff into creeks and storm drain systems. Drainage design and detention pond systems can offset increases in impervious surfaces, ensuring opportunities for recharge.

Stanford participates in a regional Joint Powers Agency (JPA) for the San Francisquito Creek Watershed, along with the Cities of Palo Alto, Menlo Park, and East Palo Alto, the County of San Mateo, and the Santa Clara Valley Water District. This JPA focuses on both habitat protection and flood control in the watershed. It grew from the Coordinated Resource Management and Planning (CRMP) process for San Francisquito Creek. Watershed management and planning in Santa Clara County is conducted under the auspices of the Santa Clara Valley Water District (SCVWD).

Strategies, Policies and Implementation

The strategies, policies and implementation recommendations related to water quality and watershed management reflect the General Plan's comprehensive approach to this issue. These focus on reducing pollution sources and maintaining streamside environments rather than on treatment of polluted water. Comprehensive watershed management requires coordination among a multitude of landowners and jurisdictions. As a major landowner with a variety of uses on its lands, Stanford is an important contributor to the overall health of watersheds in which it lies.

Watershed Boundaries



Watershed Boundary
Creeks
Seasonal Drainage

Scale
1:30,000

N

0 0.5 1 Miles

Figure 6.2

Stanford University Community Plan Adopted December 2000

Groundwater Recharge Area

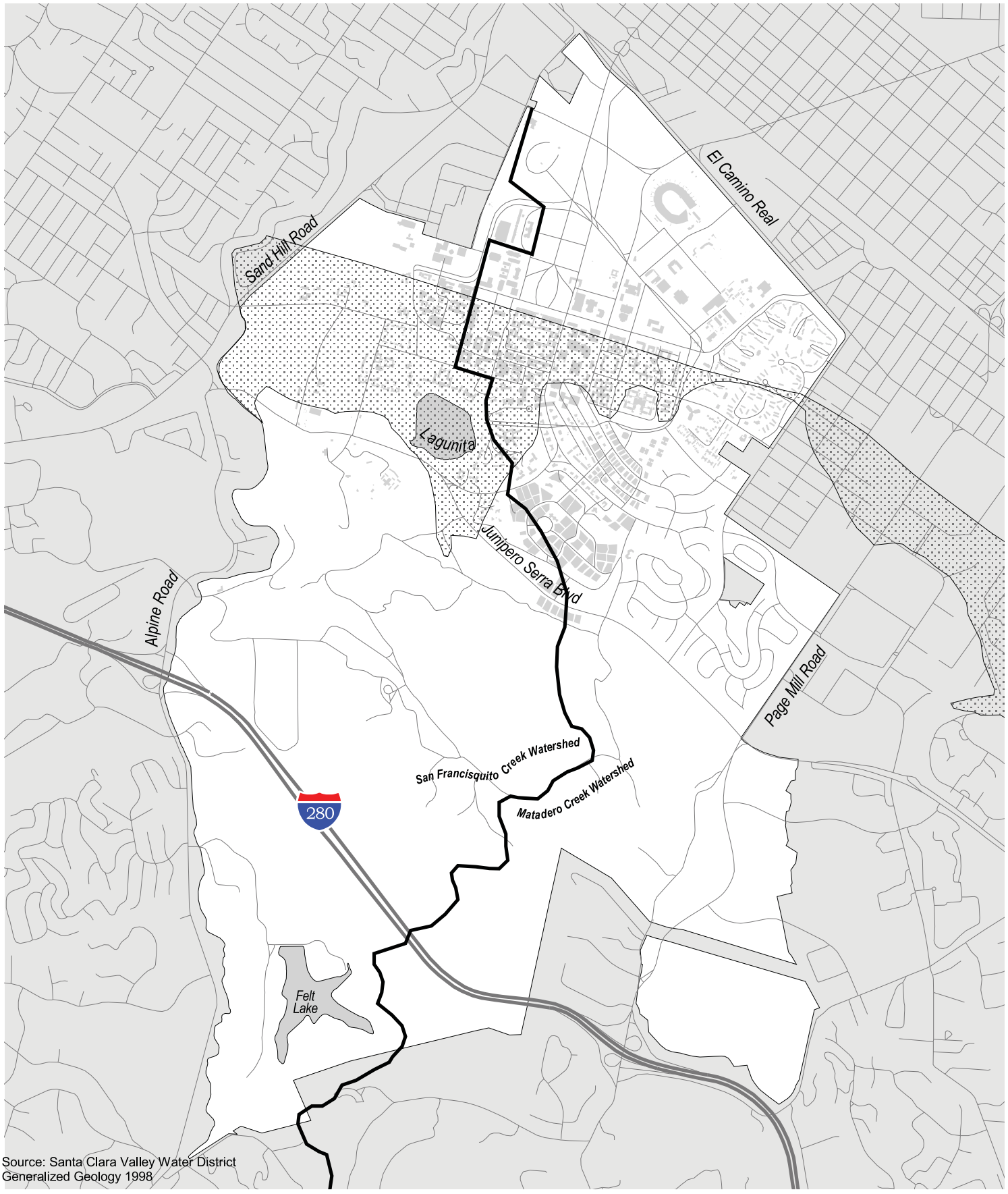


Figure 6.3

Stanford University General Use Permit Approved December 2000

Strategy #4: Reduce Non-Point Source Pollution

Non-point source pollution has been identified as a major regional problem, accounting for approximately half of the contaminants discharged into San Francisco Bay. This type of pollution sterns from a variety of sources on the campus, such as streets, parking lots, agricultural waste and runoff, erosion, and chemical or other waste from research activities. Stanford and the County's efforts to reduce non-point source pollution are diverse, ranging from public education to development and implementation of best management practices.

Agricultural activities on leased lands owned by the University have been a . particular source of water pollution. These activities are under the influence of Stanford as a landowner, but not the direct control of Stanford as an operator. As landowner, Stanford has the ability to require water pollution prevention practices as terms and conditions of its leases.

Policies

SCP-RC 12
Continue the use of appropriate best management practices to reduce non-point source pollution in agricultural, recreational, and academic areas and for construction activities, and include these practices as terms and conditions of leases of Stanford lands.

SCP-RC 13
In planning for new development and redevelopment, utilize site, building and landscape design features which serve to reduce non-point source pollution.

SCP-RC 14
Promote and participate in interjurisdictional efforts to identify and reduce non-point source pollution and to develop economically viable best management practices for improving water quality.

SCP-RC 15
Emphasize groundwater recharge through natural percolation and filtration over increased runoff to storm drains and creeks.

Implementation Recommendation

SCP-RC (i) 12
Develop education programs for relevant University personnel and for campus leaseholders on water quality issues.

SCP-RC (i) 13
Conduct regular maintenance on existing storm water systems.

SCP-RC (i) 14
Incorporate conditions within approvals for new development to minimize sources of non-point source pollution and employ best management practices as mitigations.

Strategy #5: Enhance and Restore Wetlands, Riparian Areas, and other Habitats that Improve Watershed Quality

A critical feature of efforts to improve regional water quality is the existence of functioning wetlands and surrounding vegetated areas. Wetlands and associated vegetated areas act to reduce erosion, absorb runoff, and reduce the intensity of flood events. Natural areas contribute to water quality of both surface water features and underground aquifers. This function adds to the County and Stanford's interest in the protection of riparian areas through streamside buffers and in the protection of central-campus wetlands, particularly in the Arboretum and around Lake Lagunita.

Policies

SCP-RC 16
Assist Stanford in identifying and implementing agricultural and other land management practices that promote native species and that contribute to erosion control.

SCP-RC 17
Avoid development in riparian areas and wetlands.

SCP-RC 18
Maintain native plant communities south of Junipero Serra Boulevard and in Campus Open Space areas such as oak woodland, chaparral, and riparian trees and shrubs that serve to prevent soil erosion and creek bank collapse.

SCP-RC 19
Enhance seasonal wetlands in the Arboretum.

SCP-RC 20
Continue to seasonally fill Lake Lagunita and create seasonal wetlands habitat, creek flow permitting.

Implementation Recommendation

SCP-RC (i) 15
Where appropriate during development and redevelopment, Stanford shall be required to relocate structures, roads, and trails away from creeks and in a manner that minimizes the addition of impermeable surfaces.

SCP-RC (i) 16
Incorporate flood control features such as detention basins into new development. Design and engage in flood control activities for entire drainage areas rather than on project-by-project basis for each new campus facility.

Strategy #6: Prepare and Implement Comprehensive Watershed Management Plans

The primary goal of watershed management planning is greater assurance of water quality, with the important additional benefits of habitat and natural resource protection. Because watershed management issues are complex and involve multiple parties, efforts have increased in the last several years to approach water quality issues from a comprehensive watershed management approach. One such ongoing endeavor is the Watershed Management Initiative for Santa Clara County, in which numerous jurisdictions and stakeholders have worked together over time to address watershed management and water quality collectively from a comprehensive perspective.

Stanford's participation in the preparation and implementation of watershed management plans is important due to the amount of land owned by the University and the variety of activities and resources on University lands. In order to manage watersheds on Stanford lands and to contribute to regional planning, Stanford contributes scientific information and participates in regional planning efforts such as that of Joint Powers Authority for San Francisquito Creek Watershed.

Policies

SCP-RC 21
Support and encourage Stanford's participation in regional watershed management planning and implementation for watersheds including Stanford lands.

Implementation Recommendation

SCP-RC (i) 17
Stanford should continue to participate in region-wide watershed conservation and management activities (e.g. Coordinated Resource Management Program and the Joint Powers Authority for San Francisquito Creek).

Heritage Resources

Background

Heritage resources at Stanford include those features which reflect and embody the campus history. Many of these features are central to the visual and functional form and character of the campus. While many equate heritage resources with historic buildings only, these resources encompass a range of features that contribute to the campus heritage, including archaeological sites from prehistoric and historic times as well as major landscape features.

Archaeological Sites

Archaeological sites are an important link to the past and source of understanding of the area's history. Archaeological sites at Stanford reach as far back as remains indicating a human presence 7,600 years ago. Resources on the Stanford campus include sites from the local Muwekma Ohlone culture and their ancestors, as well as nineteenth- and earlier twentieth-century archaeological deposits associated with Spanish, Mexican, early American, and Stanford history.

Stanford faculty and students have conducted archaeological digs on campus since the 1920s. In 1986, the Campus Archaeology program made the first effort to systematically investigate the entire 8,180-acre land holding. More than 50 prehistoric archaeological sites relating to the ancestors of the local Muwekma Ohlone culture, primarily along the creeks at the campus edges, were identified during that process. Historic records have also been investigated to ensure documentation of deposits associated with European settlers and their descendants. It is customary not to include maps of archaeological sites in plans in order to help protect the integrity of the sites. Stanford makes efforts to protect these ancient sites and has designed development to avoid or to permit and mitigate potential impacts to prehistoric resources.

The University created an 11-acre archaeological preserve along San Francisquito Creek in 1986 that encompasses one of the oldest prehistoric sites on the campus. A conservation easement was dedicated over this preserve in conjunction with the City of Palo Alto's development agreement for the Sand Hill Road projects in 1997.

Prehistoric sites are generally protected from development disturbance by the Community Plan land use designations and Academic Growth Boundary. In the event that future development does occur that affects prehistoric sites, such as in the golf course, protective measures would be required. Ecological restoration and flood control in creeks also pose a threat to archaeological resources, which should be considering in the planning and implementation of such efforts.

Historic Structures and Sites

The Stanford University campus contains a number of significant historic structures and sites associated with the Stanford family and the University, as well as with the previous occupants of the land. Stanford's academic facilities include more than 200 structures that meet the minimum age criteria for being potentially historic, i.e., constructed more than 50 years ago. (See Figure 6.4 -Age of Existing Structures). In addition to these resources related to Stanford's history over the past 120 years, the University lands contain a small number of older structures dating from the 1860s and 1870s, prior to the establishment of the Stanford Palo Alto Stock Farm and the University.

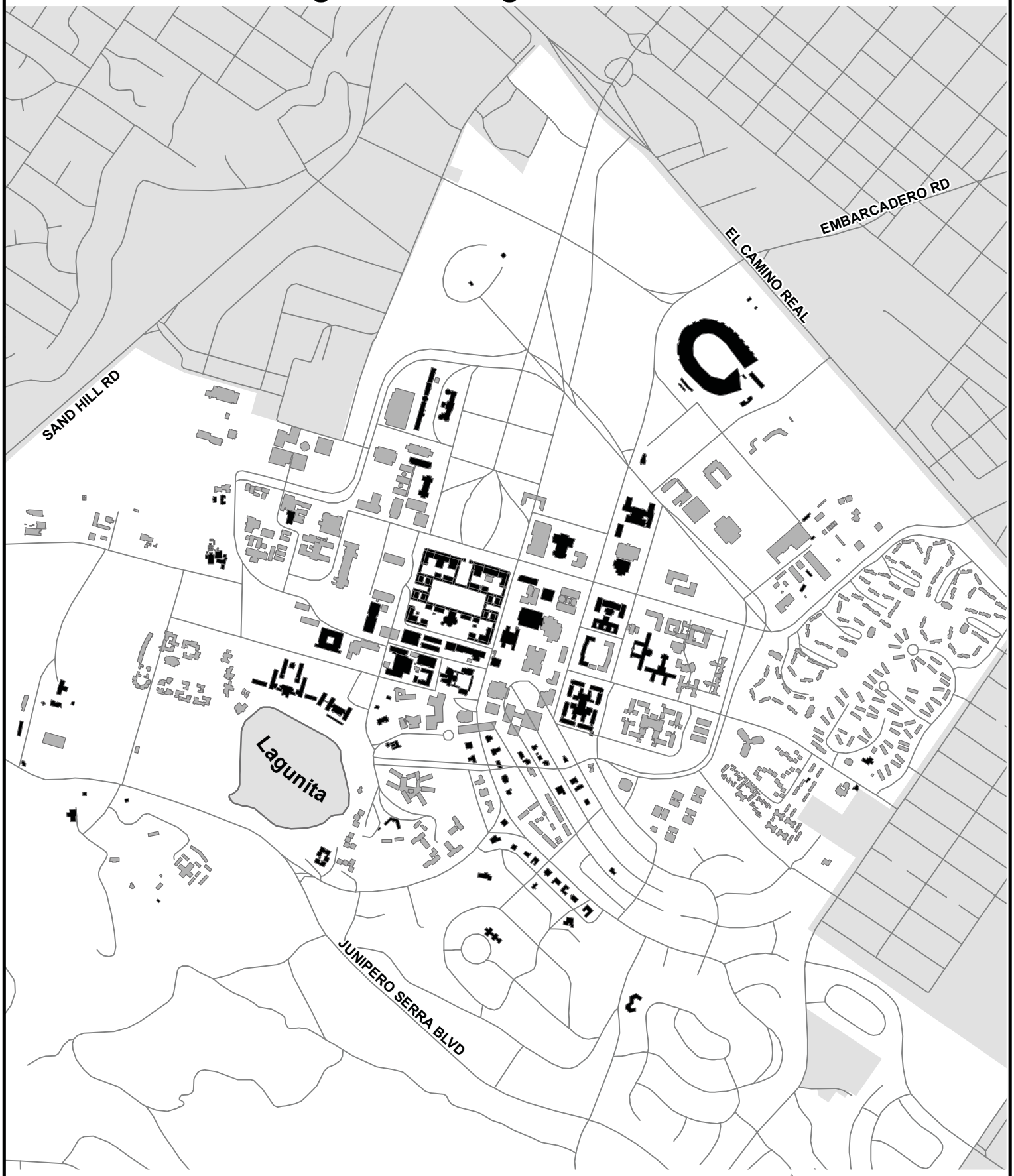
The University established a Historic Values Subcommittee, an advisory group to the University Committee on Land and Building Development, in 1987 to evaluate the significance of campus buildings and landscapes. The Historic Values Subcommittee maintains a Historic Values Index (HVI) to inform their recommendations on historic structures and features. The HVI has been in use since 1986 as a mechanism for evaluating the relative historic value of campus features in order to guide land use and building projects. To date, 94 buildings or other features (such as Palm Drive) have been evaluated for placement on the HVI Cumulative Evaluation Index. Inclusion on the index is based on five criteria: age, aesthetic quality, uniqueness at Stanford, importance in Stanford history, and importance to the external community. Structures more than 50 years old are evaluated for inclusion on the HVI.

The University has included reports on the activities of the Historic Values Subcommittee, as well as projects relating to historic structures, in the Annual Report required by the 1989 GUP. While the Historic Values Index provides important information about the local significance of campus structures, the Index is not an official listing or register of historically important resources. Some campus buildings do appear on federal, state, and county lists of historic resources, including the Santa Clara County Heritage Resources Inventory. (Figure 6.5 -Listed Historic Structures).

The County's Heritage Resources Inventory is a publication of the Santa Clara County Historical Heritage Commission. Stanford projects which involve properties included in the County's Heritage Resources Inventory are referred to the Historical Heritage Commission for review and comment, and potential impacts on any historic resources are also considered in the environmental review process associated with a development proposal. The County is currently reviewing its process for evaluation and protection of historic resources.

As with other resource conservation issues, the strategies for conservation of historic resources call for inventorying and evaluating the resources involved, preventing and minimizing impacts, and restoring and enhancing resources, as appropriate.

Age of Existing Structures



Buildings older than 50 years
Buildings less than 50 years

Scale
1:16,000

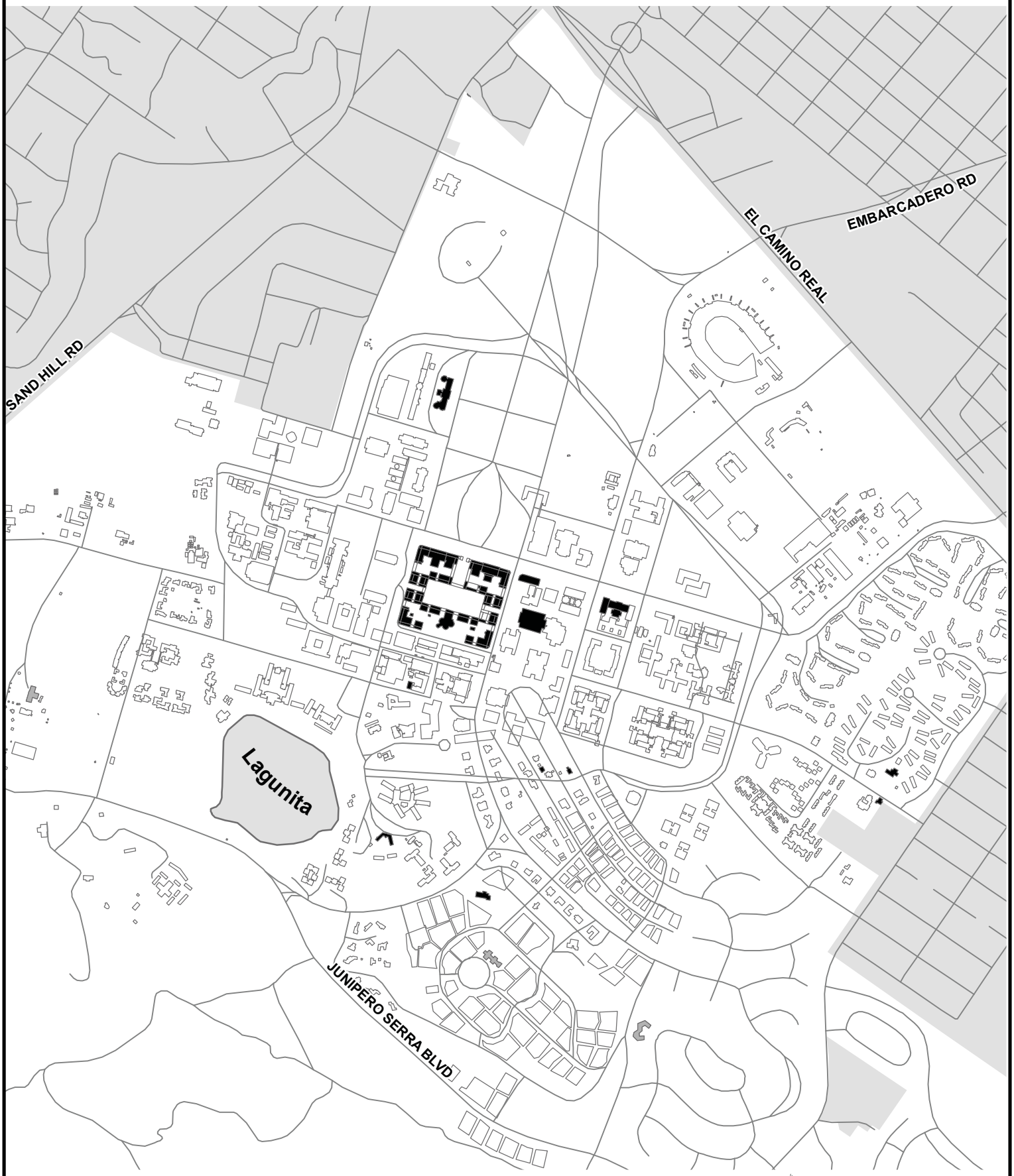
N

0 1,000 2,000 Feet

Figure 6.4

Stanford University Community Plan Adopted December 2000

Listed Historic Structures



National Register of Historic Places

County Heritage Resources Inventory

Scale
1:15,000

N

0 1,000 2,000 Feet

Figure 6.5

Stanford University Community Plan Adopted December 2000

Strategies, Policies and Implementation

Strategy #7: Inventory and Evaluate Heritage Resources

The key architectural and landscape elements that define the character of the campus should be identified and evaluated for the purpose of ensuring their protection in future planning.

The County's primary mechanism for identifying and evaluating heritage resources is the Historic Heritage Commission and the Heritage Resources Inventory. Campus features which are highly rated in Stanford's Historic Values Index are not necessarily included in the County's inventory. Each must be individually considered and included within the County's Heritage Resources Inventory by action of the Board of Supervisors. Evaluating Stanford's historic resources for inclusion in the Heritage Resources Inventory will be an important ongoing aspect of the conservation of these resources.

Policies

SCP-RC 22

Maintain informational databases and formal inventories of heritage resources as the basis for local decision-making regarding historic buildings, archaeological and paleontological sites, heritage trees, and landscape features.

Implementation Recommendation

SCP-RC (i) 18

Stanford shall inventory, map, and monitor the status of archaeological and paleontological resources on Stanford lands and prepare and update archaeological site records for transmittal to the California Historical Resources Information System.

SCP-RC (i) 19

Review existing and potential historic resources at Stanford for possible inclusion on the County's Heritage Resources Inventory, including heritage trees.

Strategy #8: Protect Heritage Resources Through Avoidance, Adaptive Reuse, and Sensitive Planning and Design

Heritage resources can be protected in a variety of ways. Of primary importance are land use planning and site design that incorporate historic features, heritage trees, and archaeological resources in ways that avoid the need for relocation or destruction of the resource. Another involves the careful review and consideration of alternatives to the potential loss of a resource when plans or individual development proposals conflict with heritage resource preservation.

One opportunity for heritage resource conservation is adaptive reuse of historic structures rather than demolition when a building becomes obsolete. Stanford has employed both adaptive reuse and avoidance in site design in numerous cases over time.

For example, Encina Hall, a designated historic structure, was one of the first dormitories on the campus. It was used for administrative offices, and is now being converted for academic use. The Stanford Museum (now the Iris and Gerald B. Cantor Center for the Visual Arts) was extensively restored in conjunction with construction of a new building to expand the facility. Stanford's record of historic preservation has been acknowledged through the Governor's Award for Excellence in Historic Preservation in 1999, an Honor Award from the National Trust for Historic Preservation in 2000, and many national awards for individual restoration projects.

While it is common to recognize, acknowledge and restore important historic buildings, the preferred approach for archaeological resources is to allow the sites to remain undisturbed and leave their locations undisclosed.

The General Plan recognizes the importance of preserving heritage resources as well as the difficulties and financial burdens of adapting older structures to modern use. The challenge for Stanford and the County in the future is to plan for preservation and provide incentives rather than disincentives for adaptive reuse.

Policies

SCP-RC 23
Protect heritage resources, including sites, structures, and trees in campus development through careful campus land use planning, individual project design, project review, use of appropriate guidelines, and other implementation measures.

SCP-RC 24
Protect the integrity of significant archaeological sites and other heritage resources. Ensure the confidentiality of archaeological site locations in conformance with state laws.

SCP-RC 25
Take into account the need to protect archaeological and paleontological resources in any environmental enhancement activities involving creek restoration and flood control.

SCP-RC 26
Give priority to the avoidance or adaptive reuse of historic structures over demolition whenever possible.

Implementation Recommendation

SCP-RC (i) 20
Require adequate background information and site plans to assist in evaluation of potential impacts to heritage resources resulting from project development.

SCP-RC (i) 21
Acknowledge and make use of the information contained within the University's Historic Values Index, as appropriate, when considering individual project applications.

SCP-RC (i) 22
Identify appropriate incentives and seek opportunities to encourage preservation of historic structures on the campus.

Scenic Resources

Background

The Stanford University campus and its associated undeveloped lands are a significant visual resource on the northern edge of the County. The largely undeveloped hillsides, natural streams, landmark architecture, and landscape setting of the central campus are important to the quality of life in this area of the county.

Central Campus

Stanford is making substantial efforts to improve the visual character of the central campus through a return to the concepts behind the original campus plan, which called for a series of interconnected quads in a formal setting. Recently, the University has focused on emphasizing the major axes crossing the campus and on enhancing the natural landscape and creating contrasts between formal landscaped areas and more natural settings. Additional efforts have been made to translate the campus architectural vernacular of sandstone, red tile roofs, and arcades to a contemporary use in new campus buildings.

Open spaces in the central campus also contribute significantly to Stanford's visual character; both major spaces like the Arboretum or Lake Lagunita and small open and landscaped settings are integral to the campus.

Foothills

While the central campus is a setting that is generally experienced only by those actually on the campus, the undeveloped foothills are an important component of the regional setting that help define the visual character of the surrounding communities. Strong limitations on foothill development espoused and established in this Community Plan will help protect the predominantly natural appearance of the foothills. If appropriate development does occur consistent with the Open Space and Field Research land use designation, screening or other strategies that minimize the impact of any new structures or developed areas can be incorporated in project design and mitigations.

The strategies for protection of visual resources differentiate between the open space and the central campus built environment, reflecting the differences in these two visual environments and in appropriate protection mechanisms.

Strategies, Policies and Implementation

Strategy #9: Employ Growth and Development Policies That Conserve Scenic Resources

The land use designations adopted in the Community Plan afford significant protection for lands both in the Campus Open Space areas and in the Open Space and Field Research areas beyond the limits of the Academic Growth Boundary. The natural streams which cross the campus are protected by riparian buffer zones, as discussed in the Habitat and Biodiversity and Water Quality and Watershed Management sections of this chapter. In addition, the Community Plan provides for parks and recreational open space in the Open Space chapter. These land use policies are reflected in the Land Use Designations, described in the Land Use chapter.

Policies

SCP-RC 27
Protect the scenic and aesthetic qualities of the natural setting of Stanford lands in the County by means of appropriate land use designations, growth management tools, and careful review of individual development projects.

SCP-RC 28
Emphasize development within the Academic Growth Boundary (see Land Use and Growth and Development chapters).

SCP-RC 29

Ensure adequate screening and reduction of visual impacts of any development in designated open space areas through the development review process.

Strategy #10: Maintain and Enhance the Scenic Values of Urbanized Area Settings

The Community Plan includes measures designed to protect open space and historic landscape elements on the central campus, as well as significant architectural landmarks contributing to the scenic quality of the area. In addition to the policies described above in the Heritage Resources section, the Campus Open Space land use designation has been adopted in part to protect the scenic character of major campus open spaces (see Open Space Chapter).

The County's role in enhancing the scenic character of the central campus is review through the Architecture and Site Approval. This review ensures adequate and integrated landscaping and screening, when appropriate. Through the University Architect/Planning Office the University takes the lead role in defining the character of the campus built environment.

Policies

SCP-RC 30
Preserve and enhance attractive, scenic urban settings on the Stanford campus and within Stanford's residential areas.

SCP-RC 31
Preserve significant historic landscape elements within the fabric of the campus' architecture and design.

SCP-RC 32
Maintain elements of the native landscape in Campus Open Space areas and throughout the developed portion of the campus.

SCP-RC 33
Maintain sign standards to ensure that signs are harmonious with the character of scenic area.

Health and Safety

Stanford Community Plan Issues and Policies

Chapter Summary

This chapter of the Stanford Community Plan addresses a range of public health and safety issues. It includes policies that are intended to minimize potential human or environmental injury and property damage.

This chapter refines the Strategies identified in the County's General Plan Health and Safety chapter for the following sections that require further refinement for Stanford lands:

- Air Quality,
- Geological Hazards,
- Flooding,
- Hazardous Materials,
- Emergency Preparedness and Response,
- Noise, and
- Law Enforcement.

Other Health and Safety topic areas discussed in the County's General Plan include Aviation Safety, Fire Hazards, Health and Safety Facilities Planning, and Waste Water Disposal. These subjects do not require refinement in the Stanford Community Plan because the strategies, policies, and implementation recommendations contained in the General Plan are in sufficient detail to guide Stanford land use.

The overall strategies or public policy approach to addressing Health and Safety issues involve prevention, mitigation, or minimizing risk, and preparedness. These overall strategies provide a framework for understanding the more detailed policies that have been developed with respect to natural hazards, for example. Where most applicable, these strategies also provide the basic framework for public policy with regard to the Stanford Plan.

It should be further noted that with regard to sanitary waste water disposal, the University maintains a sanitary sewer collection system that serves all areas of the main campus. The campus sewer system consists of approximately 46 miles of sewer lines. The Stanford sewer system connects to the Palo Alto sanitary sewer system and the sewage is treated at the Palo Alto Regional Water Quality Control Plant (RWQCP). The City of Palo Alto operates the RWQCP for the communities of Palo Alto, East Palo Alto, Los Altos Hills, Mountain View, and Stanford University.

The Community Plan contains the following strategies for health and safety:

Air Quality

Strategy # 1: Manage Campus Growth and Land Use for Cleaner Air

Strategy # 2: Emphasize Transportation Alternatives and Transportation Demand Management to Reduce Vehicle Emissions

Strategy # 3: Control Sources of Particulate Emissions

Geologic Hazards

Strategy # 4: Design, Locate, and Regulate Development to Avoid or Withstand Hazards

Flood Hazards

Strategy # 5: Design, Locate, and Regulate Development to Avoid or Withstand Hazard

Hazardous Materials

Strategy # 6: Manage Hazardous Materials Safely and Efficiently

Emergency Preparedness and Response Noise

Strategy # 7: Adequately Plan for Risk Reduction, Immediate Disaster Response and Post-Disaster Recovery

Noise

Strategy # 8: Prevent or Minimize Excessive Noise

Law Enforcement

Strategy # 9: Provide Law Enforcement Oversight

Air Quality

Background

Air quality is a regional concern that requires regional participation for improvement. Air quality is affected by emissions from automobiles, industrial facilities, construction, and other activities; the effects of these activities on air quality is further influenced by weather, wind and topography. Pollution created in one location has the potential to affect air quality many miles away. Air quality is measured and described through concentrations of pollutants, and is evaluated based on state and federal standards for a variety of pollutants.

Pollutants of the greatest concern in the San Francisco Bay Area, and which are most applicable to Stanford, are ground-level ozone (O_3) and respirable particulate matter (PM_{10}). The Bay Area is "non-attainment" for O_3 according to state and federal standards and is "non-attainment" for PM_{10} according to state standards.

Ozone is produced primarily from motor vehicle emissions and is the primary component of smog. The concentration of ozone can primarily be reduced through reductions in automobile use that stem from location of homes, jobs, and services in close proximity to one another and through use of alternative transportation or alternative fuels.

Respirable particulate matter is a combination of pollutants that includes dust, pollen, ash, smoke, and other similar pollutants. While some forms of PM_{10} result from natural processes, others can be reduced or avoided through "best management practices" that reduce dust from construction activities and through control on industrial emissions.

For more detailed information on air quality issues, refer to the Countywide Health and Safety Chapter, Book A, of the General Plan.

Stanford University's four primary sources of air pollution are:

- **Motor vehicle exhaust:** Stanford's Transportation Demand Management (TDM) program is meant to reduce use of automobiles, leading to corresponding reductions in the emission of pollutants. The same strategies that are applicable county- and region-wide for reducing motor vehicle use are applicable to Stanford as well: coordinated land use patterns that allow for reduction or elimination of automobile trips and measures to facilitate the use of alternative transportation modes. Programs to encourage these methods are in place and will be continued at Stanford. Electric, hybrid, and other alternative-fuel vehicles are other options for automobile emission reduction.

- **Cardinal Cogeneration Power Plant (Cardinal Cogen).** Cardinal Cogen is a combined-cycle power plant on the Stanford campus providing steam, chilled water, and electrical power for the core campus and the Medical Center. The plant burns natural gas, with its major emissions being nitrogen oxides (NOx) and carbon monoxide. The plant is permitted through the Bay Area Air Quality Management District; by granting this permit, the District indicates that the equipment should meet all air quality standards. The permits are held by Cardinal Cogen, which is a wholly-owned subsidiary of General Electric.
- **Facility maintenance and laboratory activities.** Stanford produces intermittent, low-volume emissions of odorous and/ or toxic substances resulting from various facility maintenance and research activities. Stanford currently reduces these emissions through various operational procedures.
- **Construction.** Construction projects on campus create particulate matter pollution during ground disturbance. Stanford utilizes procedures to control particulate matter during construction projects and from equipment exhaust which have been identified by the Bay Area Air Quality Management District (BAAQMD).

Strategies, Policies and Implementation

Strategy #1: Manage Campus Growth and Land Use for Cleaner Air

The strategies and policies for managing campus growth, together with the Land Use Designations of the Community Plan are consistent with the fundamental approach to improved air quality outlined in the General Plan. By focusing future campus development within the Academic Growth Boundary, emphasizing higher density of residential development, locating new residential development close to related academic facilities, and providing neighborhood commercial services and amenities close to residential development, land use patterns can contribute greatly to the success of related strategies to manage travel demand and reduce dependency on the automobile.

Policies

SCP-HS 1
Limit campus growth and development to lands within the Academic Growth Boundary in order to minimize cumulative impacts on air quality.

SCP-HS 2
Within the Academic Growth Boundary, emphasize concepts of appropriate integration of land uses, compact campus development patterns, and more efficient, higher density residential development to reduce automobile dependency and promote use of alternative transportation modes.

Strategy #2: Emphasize Transportation Alternatives and Transportation Demand Management to Reduce Automobile Dependency and Vehicle Emissions

Closely linked to growth management and land use patterns, provision of travel alternatives and transportation demand management (TDM) are also instrumental in reducing vehicle emissions and improving air quality. The subjects of transportation alternatives and TDM are most thoroughly addressed in the County's General Plan within the Transportation Chapter and Air Quality Section of the Health and Safety Chapter. Additional information on Stanford's use of these strategies is also provided in the Circulation Chapter of the Community Plan.

Policies

SCP-HS 3
Maintain and enhance the use of transportation alternatives and demand management to the extent allowed by law for the purpose of reducing automobile dependency, reducing trip generation, and reducing vehicle emissions.

SCP-HS 4
Promote the use of alternative fuel and propulsion systems for shuttle vehicles, other transit vehicles, construction and fleet vehicles.

Implementation Recommendation

SCP-HS (i) 1
Consider a program that would credit the use of electric, "hybrid" gas and electric, or other reduced-emission vehicles toward the "no net new commute trips" standard.

Strategy #3: Control Sources of Particulate Emissions

Particulate emission sources range from earthmoving and construction equipment to gasoline-powered leaf blowers, wood-burning fireplaces and charcoal grills. Each contributes to various types of pollutant emissions to varying degrees. Primary emphasis for Stanford involves the reduction of construction-related emissions.

Trucks, earthmoving equipment, and construction activities can introduce particulate matter and dust that have localized impacts as well as cumulative impacts in the region. There are a variety of best management practices intended to reduce the amount of particulates generated by these sources. Potential air quality impacts from significant construction projects are typically addressed within the environmental assessments and conditions applicable to each development project. The latter often involve best management practices as defined the Bay Area Air Quality Management District for such purposes.

Policies

SCP-HS 5
Reduce particulate matter pollution originating from road and building construction. Require all best management practices and feasible control measures through project conditions and mitigations, as appropriate.

Implementation Recommendation

SCP-HS (i) 2
Require Stanford to use appropriate best management practices and other feasible mitigation for the reduction of particulate matter pollution during construction.

Geological Hazards

Background

The Stanford campus is located on the boundary between the San Francisco Bay alluvial plain to the northeast and the foothills of the Santa Cruz mountains to the south and southwest. The western boundary of the Community Plan area lies approximately 2 miles east of the San Andreas fault.

Earthquake Faults

Earthquake faults are the contact areas between major plates of the earth's surface. The San Andreas fault is the contact surface between the North American plate on the east and the Pacific plate to the west. Over many millions of years, the relative movements of these two plates have deformed bedrock units which have, in turn, been eroded differentially, resulting in the northwest-trending ridges and valleys present in Santa Clara County and throughout the Coast Range. Continued movement of the Pacific plate northwards relative to the North American plate causes strain to accumulate in the bedrock, which is periodically released by fault rupture along the San Andreas and other related faults nearby, producing earthquakes of various magnitudes.

While the San Andreas fault is the most well-known fault in the vicinity of the University, other related faults which are also sources of seismic activity in the area. These include the Hayward, Calaveras, San Gregorio, and Monte Vista/Berrocal faults.

Stanford has been substantially affected by earthquake activity in the past, including the 1906 earthquake which originated on the San Andreas fault (Richter magnitude 8.25) and the 1989 Loma Prieta earthquake (magnitude 7.1), which occurred on a fault subordinate to the San Andreas. The 1906 earthquake completely destroyed several major unreinforced masonry buildings on the campus. While no buildings collapsed during the 1989 earthquake, moderate damage was widespread, and repairs to campus structures are still underway after 10 years, at a cost of many millions of dollars.

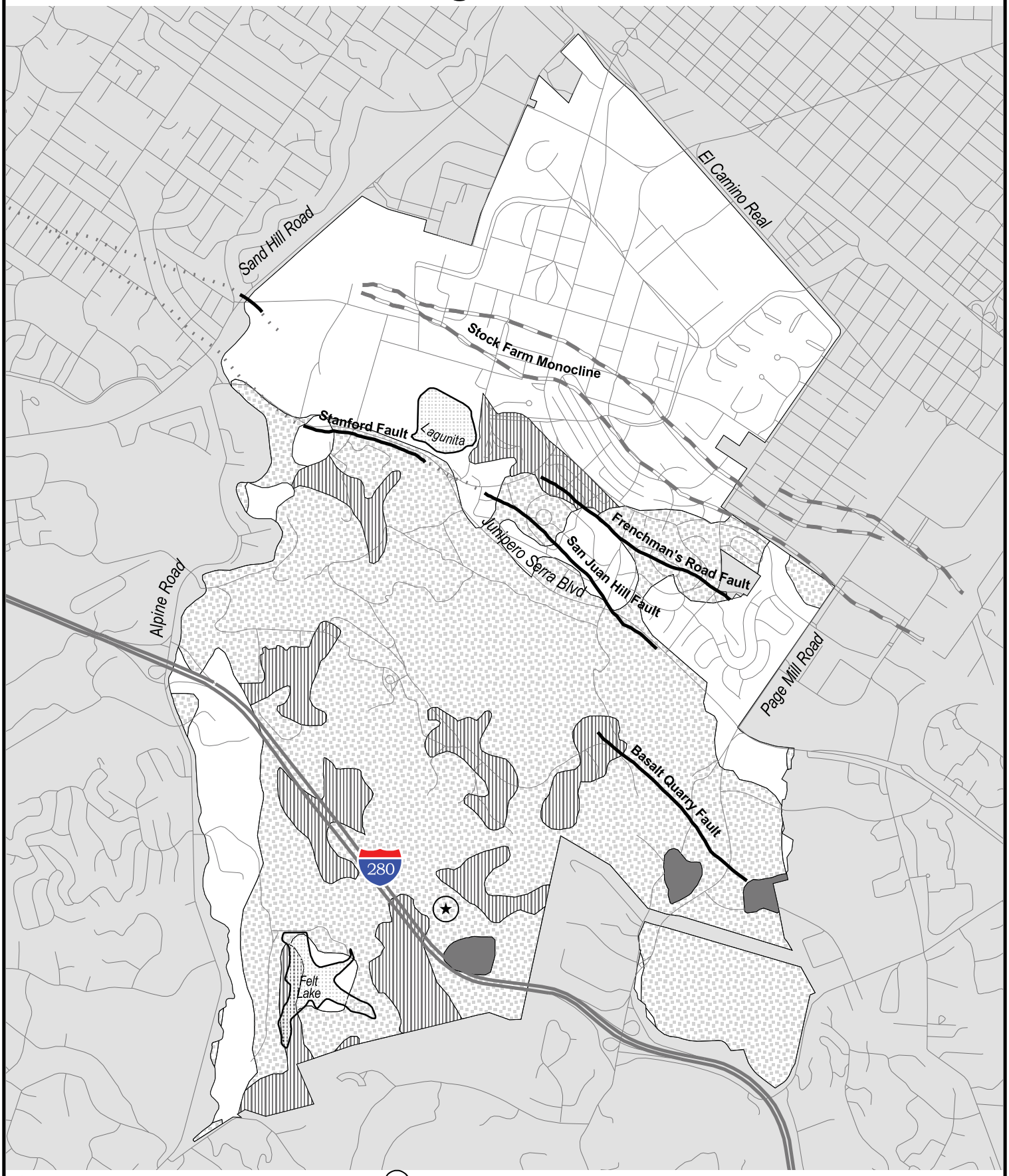
Several small faults have been mapped on Stanford lands, including the Frenchman's Road, Stanford, San Juan Hill, and Basalt Quarry faults (see Figure 7.1 - Geologic Features). These faults are all 2.5 miles or less in length. The degree of activity of these faults is not known with any certainty, and they are subject to investigations prior to development approvals within their fault zones.

Stock Farm Monocline

Another geologic feature of concern on the Stanford campus is the Stock Farm Monocline. The monocline is a northwest-trending feature indicated by a northeast-facing slope located between Page Mill Road and Campus Drive West. It has been studied extensively and judged to be an active fold in the geologic strata. An underlying "blind" thrust fault is believed to produce the folding, but it is not certain whether the thrust fault is capable of generating earthquakes.

Although no surface deformation has been detected on the monocline as a result of the 1906 or 1989 Loma Prieta earthquakes, it is considered capable of having minor ground deformation along its lower hinge in association with a strong earthquake originating on the San Andreas fault. Several inches of bending and compression are possible over a zone up to 100 feet wide, according to the 1995 Dames and Moore report. Consequently, a "zone of special consideration" has been established along the lower hinge of the monocline where it crosses the Stanford campus, and special requirements were established for all projects within the Monocline Zone, subject to review by the County Geologist.

Geologic Features



Slope Stability
- Stable (slope 0-5%)
- Generally Stable (slope 5-15%)
- Generally to Marginally Stable (slope >15%)
- Unstable

★ Small Landslide Deposits: Unstable

Faults
- Faults
- Faults- concealed
- Monocline

Scale 1:30,000

N

0 0.5 1 Miles

Figure 7.1

Stanford University Community Plan Adopted December 2000

Seismic Hazards and Slope Stability

Seismic hazards include ground shaking, surface rupture, ground deformation, liquefaction, and differential settlement. Shaking intensity is a measure of the effect of an earthquake at a specific location. The intensity of ground shaking depends on several factors including:

- the amount of energy released during the earthquake (magnitude)
- the distance between the source fault and the site (attenuation)
- the type of geologic material underlying the area (amplification).

Slope instability, which can also be related to seismic activity, is the other primary geologic hazard that potentially affects Stanford land. Landsliding can occur when soils rich in clay minerals are saturated with water, reducing the shear strength of the soil and underlying rock. Modifications of topography or drainage can also destabilize slopes and lead to landsliding. Earthquakes can also cause landsliding in areas prone to slope instability. Areas with high landslide potential in the foothills portion of Stanford lands are shown on the map of Geologic Features.

Measures for Hazard Reduction and Management

The areas of Stanford land in the County that might be subject to greatest slope instability are located outside the Academic Growth Boundary. Land uses within these areas have been restricted by the Land Use designations and policies included within the Community Plan, consistent with the General Plan. In particular, the "Open Space and Field Research" designation applied to most of the land area in question limits allowable land uses and minimizes the potential risk to people and property from seismic and geologic hazards. "Unstable" slope areas are designated "Special Conservation Areas" in the Community Plan Land Use Map (see Figure 2.2).

Following the Loma Prieta earthquake in 1989, the University prepared the Earthquake Risk Management Report of 1990. The report recognizes the risks from earthquakes on the Peninsula Segment of the San Andreas Fault, outlines ways to strengthen potentially hazardous buildings and improve organizational preparedness, and establishes institutional goals during and following an earthquake nearby.

The University's seismic strengthening and replacement program has resulted in the investment of approximately $250 million in nearly 100 seismic rehabilitation programs since 1989. The work includes the retrofit of approximately 45 hazardous unreinforced masonry (URM) buildings by the year 2000 to conform to the Santa Clara County URM Ordinance. Stanford's seismic strengthening program meets the requirements of the Uniform Building Code (UBC) and all current amendments.

Strategies, Policies and Implementation

The strategy of the Community Plan for geologic hazard mitigation involves the adequacy of the design, location, and review of individual development proposals within areas of the campus designated for academic and residential development.

Given the considerable amount of state and local regulation concerning seismic safety for building and development, policies of the Community Plan essentially reiterate existing General Plan policies, with particular geologic review requirements for Stanford lands in the Stockfarm Monocline "zone of special consideration."

Otherwise, the policies of the Growth and Development, Land Use, and Open Space chapters of the Community Plan serve to significantly limit the potential use and development of areas outside the Academic Growth Boundary such that the risk of exposure to natural hazards is low. The information provided within the Community Plan, General Plan, and the maps and inventories of the County Geologist, including the County's Geologic Hazard Zone Maps are utilized in land use and development permit decision-making processes. Lastly, educational programs or efforts related to natural hazards for Stanford campus residents and employees are described in the Emergency Preparedness and Response section of this chapter.

Strategy #4: Design, Locate, and Regulate Development to Avoid or Withstand Hazards

Campus areas designated for academic use and development north of Junipero Serra Boulevard are generally not subject to significant slope stability problems or greater ground-shaking intensities than other similar areas within the region. The primary means of assuring adequate building safety are the provisions of the County's Geologic Ordinance, state law, and adherence to applicable provisions of the Uniform Building Codes.

Policies

SCP-HS 6

Avoid significant geologic hazard areas, such as unstable slopes, in locating new development. For projects proposed within areas of concern, provide geologic reports of investigations which quantify the risks and recommend mitigation measures. Such reports must be reviewed and approved by the County Geologist.

SCP-HS 7

Through the development review process, ensure compliance with all applicable County ordinances and other laws, regulations, and codes for seismic evaluation and the design of new and existing buildings and campus infrastructure.

SCP-HS 8
Designate such lands with significant geologic hazards Special Conservation Areas in the Community Plan Land Use map.

Implementation Recommendation

SCP-HS (i) 3
Refine geologic hazard maps based on the results of reports submitted to and reviewed by the County Geologist.

Flood Hazards

Background

Watersheds

Stanford lands in Santa Clara County are primarily located in the San Francisquito and Matadero creek watersheds, and contain several creeks, reservoirs, and dams (see Figure 6.3- Watershed Boundaries).

The San Francisquito Creek watershed encompasses 40 square miles. Stanford lands in unincorporated Santa Clara County comprise approximately 1,800 acres or about 8 percent of the watershed, of which 510 acres are developed. The watershed extends from the ridge of the Santa Cruz Mountains to San Francisco Bay and is characterized by a wide variety of both developed and undeveloped areas across five municipalities and two counties. Both San Francisquito and Los Trancos Creeks on Stanford lands are within the watershed, as well as Felt Lake, Searsville Lake, and Lake Lagunita.

Stanford lands in other jurisdictions that are within the San Francisquito Creek watershed include all land in San Mateo County, which is largely undeveloped with the exception of the Stanford Linear Accelerator Center (SLAC) and the Stanford Hills residential neighborhood. These lands also contain several agricultural leaseholds and the 1,200-acre Jasper Ridge Biological Preserve. The northern portion of Stanford's land in the City of Palo Alto, which contain the Stanford Medical Center,the Stanford Shopping Center, and several residential complexes are also in this watershed. All told, Stanford lands comprise approximately 21 % of the total watershed land area.

Approximately 2,100 acres of the project area are located in the Matadero Creek Watershed. This watershed encompasses the eastern portion of Stanford lands and includes Matadero, Arastradero, and Deer Creeks. The watershed also contains the Stanford Research Park and residential and commercial areas in Palo Alto. The Barron Creek watershed, which is located to the southeast of the Matadero Creek watershed, drains portions of Los Altos Hills, the Stanford Research Park, and the Barron Park residential neighborhood; this creek ultimately drains to the Bay through Matadero Creek.

Approximately 100 acres of the Community Plan project area lies within the Arastradero Creek Watershed. Arastradero Creek flows in a southerly direction.

Storm Drainage System

The University campus storm drain system consists of a number of systems working together to manage storm water runoff. The system's main working components are more than 800 catch basins, approximately 40 miles of pipeline, and 6 miles of open soil drainage ditches. Stanford also has runoff detention areas in topographically low areas, such as the Arboretum and the Oval. Once storm water is collected in the drainage network, it flows by gravity from the campus to Matadero Creek or San Francisquito Creek. Storm water flows to Matadero or San Francisquito Creek, in many cases through the City of Palo Alto's storm drainage system, before joining San Francisco Bay.

Hazard Potential

Like many other issues addressed in the Community Plan, flood hazards and flooding are multijurisdictional in nature, in that the manner in which development and drainage are handled in one location can have substantial effects on other property owners or communities. Primary hazard potential involves creek overflow and storm drainage system overflow.

No portion of the Community Plan project area is located within the 100-year flood zones defined by the Federal Emergency Management Agency (1996 data). However, flooding may at times occur due to extraordinary events. For example, flooding has occurred on the campus and downstream of Stanford as recently as February 1998, when prolonged and steady rainfall caused San Francisquito Creek and local storm drainage systems to overflow. Overall, an estimated 11,000 acres of land in Palo Alto, Menlo Park, and East Palo Alto were flooded due to the creek overflow, resulting in an estimated $28.1 million in damage, according to the Santa Clara Valley Water District.

Regional and local flood hazards also include inundation due to dam failure. The University coordinates with the California Department of Water Resources, Division of Safety of Dams, to inspect the dams yearly for structural integrity and proper maintenance.

Effective flood control requires extensive cooperation of government agencies, landowners, and land users. Stanford, as the owner of extensive amounts of land within the watersheds, has the potential to affect downstream flooding and flow along San Francisquito and Matadero Creeks. Stanford is working with the Cities of Palo Alto, Menlo Park, and East Palo Alto on Coordinated Resource Management Planning (CRMP) for the San Francisquito Creek Watershed, resulting in a Watershed Master Plan. The Community Plan policies and implementation recommendations are based on this plan and those of the County General Plan.

Strategies, Policies and Implementation

Strategy #5: Design, Locate, and Regulate Development to Avoid or Withstand Hazards

Policies and implementation have been included to address two different flooding issues: (1) possible flooding and storm drainage issues on and near the campus that could result from campus activities, and (2) the effect of campus activities on the hydrology of the watersheds and creeks.

One effect of the Community Plan's growth and development-related policies, which encourage compact development and infill use of campus lands, will be the intensification of land use within the Academic Growth Boundary. More development and associated parking and streets will increase impervious surfaces over time, with the potential to marginally increase creek flooding and stormwater flooding on campus as well as downstream flow within the watersheds. The Community Plan therefore focuses on accommodating all increased peak drainage flows on site until storm water can be accommodated within local streams and creeks after the time of peak flows.

Policies and implementation specific to maintenance of riparian corridors are included in the Resource Conservation chapter.

Policies

SCP-HS 9
Require Stanford to design development and infrastructure improvements, including storm drainage detention facilities, to accommodate runoff from future development so as to achieve no increase in peak flows.

SCP-HS 10
Stanford shall maintain and enhance surface and subsurface drainage systems.

SCP-HS 11
Stanford shall control erosion from future development in order to limit sediment from reaching the storm drain system and creeks, to avoid hydrological impacts.

Implementation Recommendation

SCP-HS (i) 4
The State Division of Safety of Dams shall continue to annually inspect Stanford darns for structural integrity and encourage repairs as needed.

SCP-HS (i) 5
Review proposed Stanford projects and require best management practices (BMPs) for reducing erosion at construction sites:

SCP-HS (i) 6
Provide public education/information on erosion and drainage issues for university project managers and leaseholders.

SCP-HS (i) 7
Construct and maintain storm drainage detention facilities and other improvements as needed to ensure no net increase in downstream flows.

Hazardous Materials

Background

Transportation, use, storage and disposal of hazardous substances are governed through numerous state and federal legislative measures. While the regulations originate with federal and state government, the County plays a role in enforcing these regulations within its jurisdiction. The County Department of Environmental Health is a primary agency responsible for addressing hazardous materials, along with the Planning, Building, and Fire Marshal's Offices.

At Stanford, hazardous materials are used in the academic areas and the Medical Center in teaching, research, and patient care programs. Hazardous materials are addressed through a variety of programs and procedures by both the County and the University.

Stanford University's Department of Environmental Health and Safety (EH&S) oversees the collection, recycling, and disposal of chemical, biomedical, and low-level radioactive wastes generated by laboratories, shops, and studios at the University. These waste types are managed under the University's Hazardous Waste Program.

Hazardous Materials Management Plans for campus buildings are prepared, regularly updated, and submitted to Santa Clara County Environmental Health Department's Hazardous Materials Compliance Division. In addition, Stanford requires that employees involved in hazardous materials handling receive appropriate training.

Stanford's EH&S oversees the campus Environmental Safety Facility, which currently operates as a "generator" facility that can provide interim storage for hazardous waste for less than 90 days. This facility is regulated by Santa Clara County Department of Environmental Health. The Environmental Safety Facility also contains a waste incinerator, which is currently licensed and operated to incinerate a small volume of low-level radioactive wastes containing tritium and carbon-14 when necessary. Since 1994, the incinerator has been operated less than 1 or 2 days per year.

Over time, Stanford has focused increasingly on off-site rather than on-site waste disposal. Hazardous wastes that are shipped off-site are packaged, marked, labeled, manifested, and transported in accordance with applicable governmental regulations to a permitted disposal facility. In the area of waste reduction, waste generating processes have been evaluated in laboratories producing larger volumes of waste to determine options to reduce sources and to minimize wastes.

EH&S reviews proposed plans for new campus facilities and for remodels to address health, safety, and environmental risks associated with activities conducted in the buildings, in accordance with applicable environmental and health and safety laws, codes, and regulations. Building plans are also reviewed by the County's Building Inspection Office and Fire Marshal's Office for compliance with applicable codes.

The County reviews building design and occupancy standards based on a reported inventory of chemicals or other hazardous materials which are to be stored and used inside a building. Over time, the use of the building and the needs of its occupants changes, creating a risk of unsafe circumstances whereby more or different materials are being used in a building than the design and construction allow. The inventory of materials in a building is reviewed at the time that any building permits are reviewed and issued and through regular inspections by the County Fire Marshal's Office. It is important that the inventory of materials in a building remain consistent with the building construction. Obsolescence in building design is a major factor behind the continuing redevelopment of the campus.

Strategies, Policies and Implementation

Strategy #6: Manage Hazardous Materials Safely and Efficiently

The strategy for hazardous material management and its associated policies focuses on issue~ of oversight and emphasizes compliance with the significant existing array of regulations and laws governing hazardous materials. It also incorporates a broadly recognized need to find substitute materials and reduce volumes of hazardous materials as much as possible to reduce risk levels.

Policies

SCP-HS 12
Employ all feasible measures to safely and effectively manage hazardous materials and wastes and to site hazardous wastes treatment facilities.

SCP-HS 13
Ensure compliance with all federal, state, and local regulations concerning hazardous waste management and disposal.

SCP-HS 14
Evaluate, as required under the California Environmental Quality Act, the potential health risks and effects of buildings proposed by Stanford in which hazardous materials will be used.

SCP-HS 15
Encourage the substitution of less hazardous materials and/ or use of smaller volumes of hazardous materials, while maintaining amounts necessary to support University activities.

Implementation Recommendation

SCP-HS (i) 8
Collaborate with Stanford and other regulatory agencies to develop appropriate standards for review of possible health risks from air emissions of future Stanford laboratory facilities.

SCP-HS (i) 9
Require the implementation of good laboratory practices to prevent release of odorous and toxic air contaminants.

SCP-HS (i) 10
Stanford shall provide adequate training for staff and students to segregate incompatible chemicals, use earthquake protection for chemical storage areas, and employ secondary containment.

SCP-HS (i) 11
Support Stanford's provision of an integrated waste management program to manage collection of chemical, radioactive and biomedical waste, and ensure environmentally protective disposal.

SCP-HS (i) 12
Prepare Risk Management Plans for compliance with California Accidental Release Prevention Laws as needed, or reduce/substitute quantities of materials to levels below that which requires such plans.

Emergency Preparedness and Response

Background

In Santa Clara County, the first responsibility for emergency response lies with the individual jurisdictions. Under the provisions of the 1985 Land Use Policy Agreement, Stanford functions in this case as a jurisdiction, with its own plans and programs for emergency response, preparedness, and prevention. The County's role is to collaborate with Stanford in ensuring adequate emergency response and to consider emergency-related issues in review of development applications from Stanford.

Emergency Preparedness at Stanford

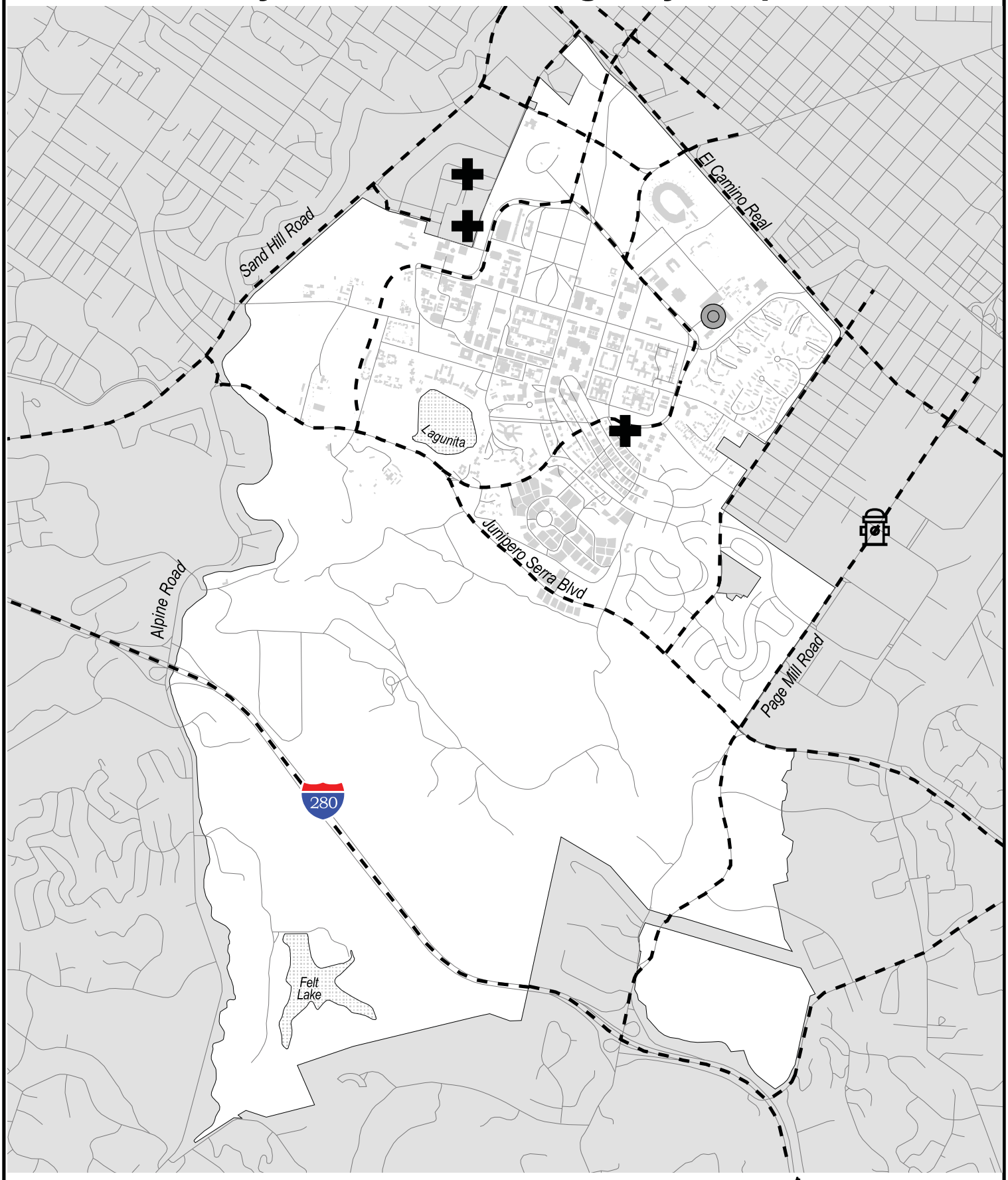
Emergency preparedness addresses the response to, and recovery from, natural and human-induced emergencies. Stanford University emergency plans include the Stanford Emergency Plan, Cabinet Emergency Planning Guidelines, and Department Emergency Planning Guidelines. These documents provide a management framework for responding to major emergencies that may threaten the health and safety of the University community or disrupt its programs and operations.

The plans address a variety of types of emergency situations, including earthquakes, fires or explosions, hazardous material releases, extended power outages, floods, and mass casualty events. In accordance with these emergency plans, the University maintains supplies to support post-disaster recovery. For example, the University currently stores emergency food supplies for on-campus residents, and maintains water reservoirs to increase the emergency water supply.

The Stanford Emergency Plan establishes an Emergency Management Team (EMT) that ascertains the scope of an incident and advises the University President. EMT emergency response actions are guided by the University's overriding emergency priorities: 1) protect life safety, 2) secure critical infrastructure and facilities, and 3) resume the teaching and research program.

Figure 7.2, Primary Access for Emergency Response, illustrates current major access routes within the campus, the location of existing fire and police facilities, and major evacuation routes.

Primary Access for Emergency Response



Hospital/Health Care

Primary Evacuation Routes

Fire Station

Police and Fire Station

Scale 1:30,000

N

0 0.5 1 Miles

Figure 7.2

Stanford University Community Plan Adopted December 2000

Strategies, Policies and Implementation

Stanford University engages in emergency prevention, preparedness, and response through its plans and programs. In addition, the Stanford Hospitals and Clinics are an important regional resource for the surrounding area in the case of an emergency that results in injuries and casualties. The County and Stanford should continue to work as partners in the emergency response arena, with each entity assuming the appropriate responsibilities. The County's role in the emergency process includes:

- Review of development projects in the Planning, Building Inspection, and Fire Marshal's Offices and in the Department of Environmental Health to ensure avoidance or reduction of risks associated with the location, access to, or design of new buildings or the use of hazardous materials.
- Ongoing inspection of facilities for code compliance.
- Application of appropriate land use designations or building requirements in areas more prone to hazard.
- Support for Stanford's emergency response efforts through implementation of the Santa Clara County Emergency Plan, prepared and implemented through the County Office of Emergency Services.

Strategy #7: Adequate Plan for Risk Reduction, Immediate Disaster Response and Post-Disaster Recovery

This strategy and the associated policies emphasize a multifaceted approach to reduction of risk, emergency response, and recovery. Like many aspects of the Community Plan, disaster preparedness and response is in many ways a multijurisdictional issue that requires efforts on the part of Stanford, the County, and other jurisdictions. Community Plan strategies and policies are largely implemented through existing programs, efforts, and procedures. However, in the event of certain types of emergencies, particularly earthquake and fire, most households and businesses are individually under-prepared for the aftermath of a significant disaster.

Policies emphasize the continuation of existing programmatic efforts by Stanford for emergency preparedness and response, while also promoting the potential for improving coordination and preparedness for faculty, staff, and student residents of the University. Improved neighborhood coordination, campus-wide preparedness, and communication capabilities will enable Stanford's many populations to cope with the effects of a major disaster, such as an earthquake, more effectively.

Policies

SCP-HS 16
Coordinate with Stanford and local jurisdictions in both reducing general risk levels and preparing for emergency response.

SCP-HS 17
Stanford shall prepare and maintain effective and feasible emergency plans for disaster response and recovery.

SCP-HS 18
Consider emergency prevention and ability for emergency response in review of development projects on the campus with regard to access, seismic risks, flooding, fire, and other emergency issues.

SCP-HS 19
Stanford shall promote coordination at the neighborhood level and within campus student housing areas to achieve improved earthquake or other disaster preparedness and response capabilities.

SCP-HS 20
Stanford shall provide training and general public education for faculty, staff, and students regarding improved emergency preparedness and response.

Implementation Recommendation

SCP-HS (i) 13
Periodically assess emergency preparation and recovery plans for adequacy.

SCP-HS (i) 14
Conduct emergency drills, training, and simulations on a periodic basis to enhance preparedness and make needed improvements to emergency response plans.

Noise

Background

The overall purpose of addressing noise in general plans is to limit the exposure of the community to excessive noise levels. Various kinds of noise generators, such as airports, roads, and train corridors, are identified, evaluated, and the noise levels generated are used to guide various kinds of land use planning and development decision-making

processes.

Noise on or near the Stanford campus can affect both the campus population and residents of surrounding areas. Stanford lands inside the Academic Growth Boundary, like the surrounding area, are urbanized and contain a variety of noise sources. The most notable sources include transportation-related uses such as arterial roadways, railroad tracks, and airplanes, as well as construction projects and miscellaneous sources.

Noise sources on the campus include traffic on major campus streets and adjacent arterial roadways, construction noise, and operational noise sources, such as mechanical equipment, delivery vehicles, and garbage pickup. Noise sources also include athletic events at the University's outdoor athletic facilities, including Stanford Stadium and Sunken Diamond; performances and other events at Frost Amphitheater; and Life Flight emergency helicopter landings and takeoffs at Stanford University Medical Center. Noise from these sources is intermittent and often seasonal. Its potential for impact on off-site residences is a direct function of the responsible operation of these facilities.

Growth at Stanford has the potential to increase noise on the campus and in the surrounding area through an increase in traffic and through additional construction related noise. It also increases the campus population which may be subject to sources of excessive noise.

As part of the Community Plan environmental review process, noise sampling sites were evaluated for noise levels and projected noise levels were evaluated for potential significance by year 2010. The sites selected represent potentially noise-sensitive uses. None of these sites, including on-campus and off-campus locations along major arterial roads, were considered to result in significant and excessive noise generation. Of all the possible sources of excessive noise, construction and operational sources are considered substantial enough to warrant special efforts to minimize noise and the impacts to humans and the natural environment.

Santa Clara County regulates noise under the standards identified in the County noise ordinance and noise element of the General Plan. The ordinance applies to all unincorporated lands, including those at Stanford University. Off-site noise impacts are evaluated at property lines, not within the campus lands.

Strategies, Policies and Implementation

Strategy #8: Prevent or Minimize Excessive Noise

The effects of noise can be reduced through either minimizing or eliminating the noise itself or through land use and development that reduces the effect of noise. Some of the means of minimizing noise conflicts include:

- Reducing activities which create noise. Trip reduction at Stanford helps reduce roadway noise both on and off the campus.
- Locating noise sources away from sensitive noise receptors (such as residences or, conversely, locating sensitive receptors away from noise sources in new development.
- Design and construction of buildings in a manner that reduces interior noise levels.

Policies

SCP-HS 21
Identify potential noise-producing uses and determine needs for mitigation using applicable County, local, and other government standards when evaluating proposals for new Stanford facilities.

SCP-HS 22
Locate new land uses and development projects to conform with County noise compatibility standards for land uses.

SCP-HS 23
Minimize noise from construction equipment and other operational sources, through engineering solutions, hours of operation, delivery schedules, and the location of specific noise sources as far away from sensitive receptors as possible.

Implementation Recommendation

SCP-HS (i) 15
Provide noise buffers as needed and control excessive noise sources from future facilities.

SCP-HS (i) 16
Ensure compliance with the County noise ordinance and other applicable standards.

SCP-HS (i) 17
Require that Stanford design and construct new buildings with soundproofing materials as necessary and appropriate.

SCP-HS (i) 18
Require that Stanford maintain a hotline that members of the public can contact to register noise complaints.

Law Enforcement

Background

The Stanford University Department of Public Safety historically has provided law enforcement services for the University under authority delegated by the County Sheriff. However, the County Sheriff is ultimately responsible for law enforcement on Stanford's unincorporated lands. The County and the Sheriff have the responsibility to ensure that the Stanford University Department of Public Safety is staffed with qualified personnel, provides necessary law enforcement information to the Sheriff, maintains an appropriate reporting relationship with the Sheriff's office, and complies with state laws and regulations regarding public access to law enforcement information.

Policies

SCP-HS 24
The Stanford University Department of Public Safety shall be permitted to undertake law enforcement activities on unincorporated Stanford lands if it enters into an agreement with the County Office of the Sheriff setting forth the terms and conditions under which the Stanford University Department of Public Safety will be authorized to undertake law enforcement activities.

Implementation Recommendation

SCP-HS (i) 19

The County Office of the Sheriff and Stanford will develop and maintain an agreement setting forth the conditions under which the Stanford University Department of Public Safety is authorized to undertake law enforcement activities on campus. The issues addressed in the agreement shall include, but not be limited to, adequate qualifications and training of Stanford University Department of Public Safety personnel, appropriate reporting relationships between the Stanford University Department of Public Safety and the Sheriff, complete and timely submission of law enforcement information to the Sheriff, and compliance with legal requirements regarding public access to law enforcement information.

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The Santa Clara County Planning Office gratefully acknowledges the many individuals and representatives of groups who have participated in the Stanford Community Plan process since its beginning. In addition, Planning Office staff recognizes the hard work and cooperation of the Stanford University administrative staff.

Attachment A-3

Stanford Report, September 23, 2014

Stanford's new P&TS director talks peak-hour traffic, "green" Marguerites, parking

Reducing peak-hour vehicle trips remains a top priority for Stanford, and for the university's new transportation director.

BY KATHLEEN J. SULLIVAN

L.A. Cicero

Brian Shaw, the new director of Parking & Transportation Services at Stanford, has a master's degree in city planning, transportation and traffic engineering, and a bachelor's degree in history.

But what he really wants to talk about these days is math – the math of the drive-alone commuter.

Nearly half of the people who commute to campus – 48 percent – drive alone.

While that's an impressive number, well below comparable employers nearby, the steady downward trend of Stanford's drive-alone rate could be at risk of stalling.

"We're doing well, but we're reaching a plateau," Shaw said.

"It took a lot of work to get us to this low drive-alone rate, including alternative transportation

programs, such as the free Caltrain pass and VTA Eco Pass, and expanding the free Marguerite Shuttle. But Stanford continues to grow. If we add more people, even at the current drive-alone rate, that's going to increase the number of trips coming to campus. That's just doing the math."

The calculation is important because Stanford agreed to keep the number of vehicles entering and exiting campus during peak commute hours – 8 a.m. to 9 a.m. and 5 p.m. to 6 p.m. – below the number recorded in 2001, under the General Use Permit (GUP) approved by Santa Clara County in 2000.

"In order to continue to accommodate campus growth, we need to figure out ways to motivate more people not to drive alone and to address the reasons they *need* to drive," said Shaw, who has more than two decades' experience in transportation planning and leadership, including 14 years at universities in Philadelphia, Chicago and Atlanta.

Brian Shaw is the new director of Parking & Transportation Services at Stanford.

The approach dovetails with Stanford's commitment to sustainability, since limiting the number of vehicle trips during peak commute hours helps reduce carbon dioxide emissions, helps improve air quality, reduces the need for parking and helps reduce traffic in surrounding communities.

Under GUP, every trip counts

Santa Clara County performs "cordon counts" on campus every year, recording the number of vehicles that enter and exit campus at 16 locations.

While Stanford has achieved its trip-count goal during the morning commute by a comfortable margin, the afternoon commute has always proved more challenging. During the last cordon counts, spring and fall 2013, the county tallied 3,744 vehicles leaving campus between 5 and 6 p.m. – which is 153 trips *over* the limit.

Stanford can apply "credits" earned primarily through Marguerite Shuttle ridership outside the cordon count area – taking hospital employees to the train station, for instance – to reduce its trip count. In 2013, those credits enabled the university to stay within the GUP limits, but Stanford tries to accomplish the goal without credits.

"We're running up against the trip count limit," Shaw said.

Shaw doesn't own a car. He rides Caltrain to the Palo Alto station from San Francisco, then takes a Marguerite Shuttle to his office in Bonair Siding. He said the personal benefits to people who bike, walk or share the ride – via bus, train, carpools or vanpools – are easy to enumerate.

Some Commute Club members say it improves fitness. It reduces stress, because they don't have to hunt for parking and can use their commute time to do something enjoyable or productive, such as reading or catching up on emails. It saves money, including the cost of a parking permit, gas or bridge tolls, and wear and tear on a car.

"I used our Commute Cost and Carbon Emission Calculator, and it showed that if I drove to work from San Francisco, it would cost me an average of $7,150 a year," Shaw said. "I use the Go Pass on Caltrain and take the Marguerite and it doesn't cost me a dime."

Transportation management plan 2.0

Currently, Shaw and his staff are conducting additional analytics on the results of the 2014 commute survey, as well as assessing the effectiveness of existing programs.

They also are considering how to modify future surveys to collect more detailed information about commuting attitudes and behavior, with questions such as, "What is it about other modes of transportation that precludes you from using them – schedule, proximity, family commitments, time – or other reasons entirely?"

He said employees with children may not be able to use alternative transportation, because they need to drive children to and from day care or school.

Some employees may be able to get to campus in far less time if they drive, rather than taking public transportation.

"There's not much we can do about that," Shaw said. "But then we have to think,

'Are there other ways to address that situation, for example, by letting them know about our carpooling and vanpooling programs?'"

Currently, there are four Stanford vanpools that bring employees to campus from Berkeley, San Francisco, Santa Cruz/Scotts Valley and Tracy. Each passenger van holds seven to 15 commuters,

and the Stanford vanpools can request free, reserved parking on campus.

While that is a premium incentive on campus these days, Shaw said P&TS hopes to make Stanford's vanpool program even more enticing by providing new options to employees – smaller, easier to handle minivans or crossover SUVs that would qualify for incentives with only four or five commuters.

Encouraging more people to carpool in their own cars is another option. Carpoolers have reserved access to any carpool space on campus until 10 a.m.

Changing face of campus parking

Stanford recently eliminated street parking on Santa Teresa Street – west of Lomita Drive to Campus Drive West – to help improve pedestrian and bicycle circulation in the area and to provide an extra measure of safety as construction ramps up in that neighborhood.

Stanford also recently closed the Roble and Lagunita Court parking lots on Santa Teresa Street to make way for new dorms.

The university is building a new underground parking structure on Santa Teresa Street below Roble Field. Parking Structure 10 is expected to open in 2016 and will provide approximately 1,100 parking spaces.

Over the past year, the university added two new parking options that are open for commuters: a new parking lot on Searsville Road at Campus Drive West and a new parking garage, Parking Structure 9, on Quarry Road near Hoover Pavilion.

The new Searsville parking lot, which is paved and lighted, has 600 spaces.

The new Hoover Pavilion Garage, which is officially known as Parking Structure 9, has more than 1,000 spaces, including 403 patient/visitor spaces and 675 permit spaces for commuters. The entrance for commuters is located on the south side of the building on Sweet Olive Way.

"These new parking facilities have spaces readily available throughout the day, and Marguerite service to bridge the distance to campus destinations," Shaw said.

"Another option is to consider leaving cars at home and taking alternative transportation instead. The Marguerite buses have stops that are often much closer to campus destinations than driving and parking."

Shaw and his staff are considering other ways to reduce demand for parking in congested areas of campus and to shift demand to less crowded areas, a feat he achieved at the University of Pennsylvania, where he oversaw parking and transportation services from 2010 to 2014.

"When I was at Penn, I was able to curb the high demand we were experiencing in some areas of campus and shift it to other areas," he said.

Shaw said Stanford will need to look at the issue in a comprehensive way, considering all options, and may need to move to a system of managing parking on a district level.

Marguerite buses go electric

This summer, Stanford increased its fleet of zero-emission, battery-electric Marguerite transit buses to 13, up from three. As Stanford retires up to 15 buses that are less fuel-efficient and more costly to maintain, the university is "greening" its fleet with electric vehicles.

In the coming year, 10 more electric buses are on their way. Once they join the fleet, battery-electric buses will account for more than half of the 1.1 million miles Stanford's free shuttle service travels annually.

The 10 new electric vehicles will be smaller – 30 feet long – than earlier models, which are 40 feet long. Stanford will reduce its kilowatt-hours per mile by operating the smaller electric vehicles on routes with lower ridership.

"We're not just running buses, we're leveraging cutting-edge technologies and running clean, quiet electric buses," Shaw said.

Stanford, which is considered a leader in transportation management, frequently receives calls from other universities about its successful programs.

"We have to keep trying to do better to maintain that vanguard position," Shaw said. "People are always asking: What is Stanford doing now?"

Attachment A-7

HEXAGON TRANSPORTATION CONSULTANTS, INC.

Technical Memorandum (Revised)

Date: December 11, 2013

To: Jaime Rodriguez, Chief Transportation Official

From: Jill Hough

Subject: Palo Alto Model Validation - Documentation

Introduction

The purpose of this memo is to present the 2013 model validation and 2035 forecast result of the Palo Alto Transportation Model (PATM). The PATM was developed as a transportation planning tool to assist City staff in evaluating traffic impacts of land use proposals and transportation improvement projects; as well as a tool for testing and evaluating a Comprehensive Plan Update. Hexagon was charged with developing the PATM using the Valley Transportation Authority (VTA) countywide model and focusing on the Palo Alto area.

Refinements to the VTA model were made to the network and land uses within Palo Alto, and the model was validated against 2013 traffic counts. The scope of work that was developed for this assignment consisted of the following tasks:

(1) **2013 Model Validation.** Although the original PATM had been validated to year 2005 traffic counts, the previous validation was not easily aligned to the VTA travel demand model and often resulted in diverging model results that were not easy to explain.

(2) **Documentation:** Technical documentation of the Palo Alto Model was prepared consisting of VTA's documentation of the Countywide models and this Technical Memorandum that documents the land use assumptions and the model validation. A future memorandum will be prepared, presenting future forecasting results, and the year 2035 intersection level of service results.

2013 and 2035 Land Use Consolidation

The 2013 and 2035 estimates of households and numbers of jobs for the zones within the City of Palo Alto were developed by city staff. The land use data were then transferred to a set of variables that are used as input into the PATM.

2013 Residential Data

City staff developed the estimates of year 2010 single-family and multi-family units for each traffic zone within the city. The zonal household data were extrapolated to estimate household population, total population, employed residents, and households by four income categories using shares and factors derived from the ABAG data. The total base year 2013 citywide residential data are summarized and compared to the VTA 2010 data in Table 1 below. Although different years are being compared, there were not a significant number of approved projects between 2010 and 2013.

111 W. St. John Street, Suite 850 • San Jose, California 95113
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Table 1
Year 2010 Residential Data

Land Use Variable	VTA/ABAG	City of Palo Alto	Delta
Single-Family Households	17,909	17,950	41
Multi-Family Households	12,367	13,975	1,608
Total Households	30,276	31,925	1,649
Household Population	69,249	73,392	4,143
Total Population	76,331	82,407	6,076
Households in Income Quartile 1	9,210	9,358	148
Households in Income Quartile 2	4,802	5,226	424
Households in Income Quartile 3	5,596	6,014	418
Households in Income Quartile 4	10,675	11,327	652
Employed Residents	32,486	37,942	5,456

Note: "VTA/ABAG refers to the ABAG Socio-economic projections for City of Palo Alto and relates to year 2010. "City of Palo Alto" refers to City of Palo Alto's local planning database as of 2013.

2013 Employment-Based Data

The City of Palo Alto maintains a zone-based land use data set for the traffic analysis zones (taz's) within the City and sphere of influence that includes employment-based land uses. The LEHD was the primary source for the employment data. The total base year 2010 VTA and Citywide employment data are summarized in Table 2.

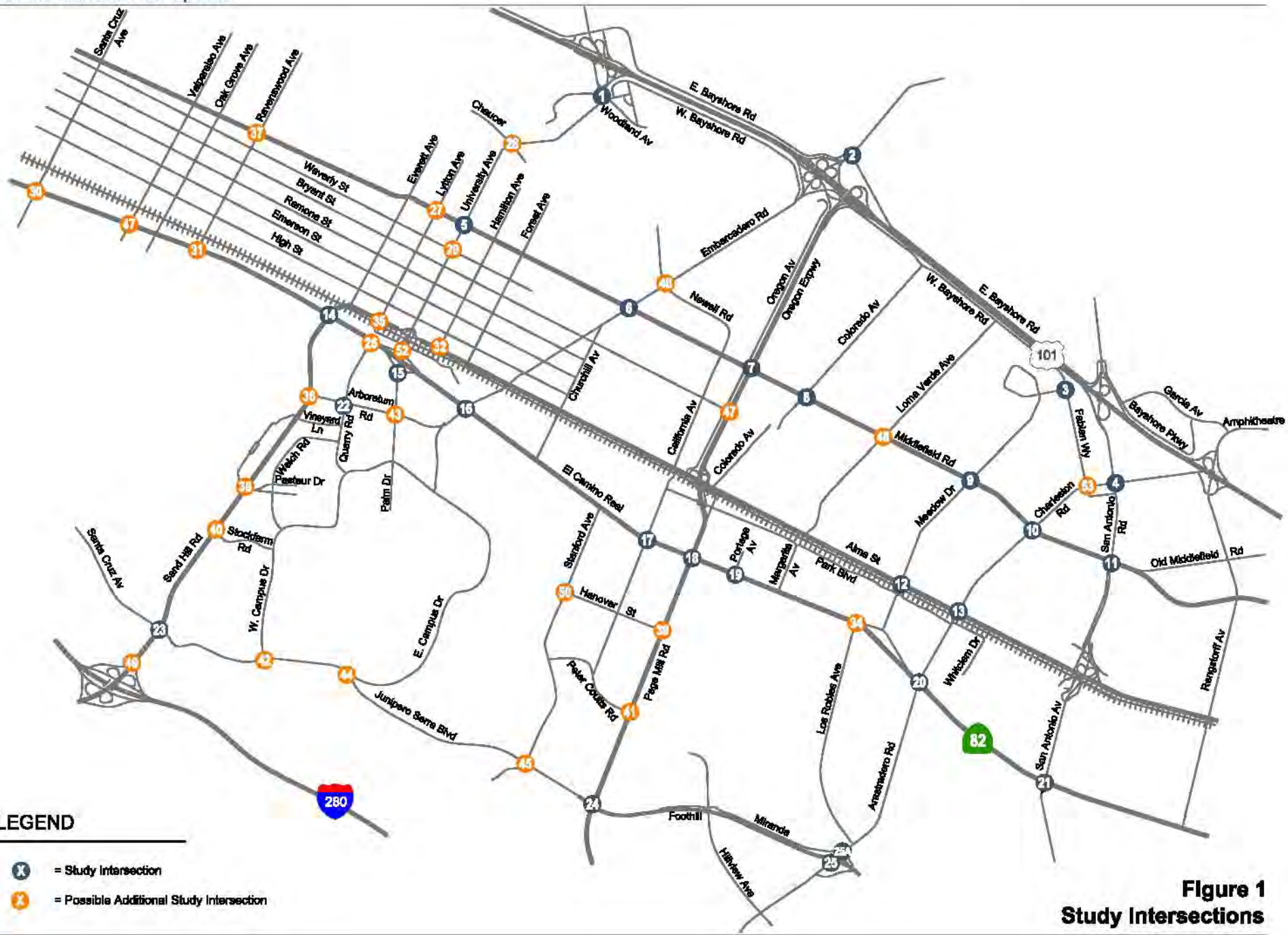
Table 2
Year 2010 Employment Data

Land Use Variable	VTA/ABAG	City of Palo Alto	Delta
Total Employment	90,886	88,865	-2,021
Agriculture Employment	276	23	-253
Manufacturing Employment	19,327	8,144	-11,183
Retail Employment	9,631	9,897	266
Wholesale Employment	4,007	982	-3,025
Services Employment	47,733	31,974	-15,759
Other Employment	9,912	37,844	27,932

Note: "VTA/ABAG refers to the ABAG Socio-economic projections for City of Palo Alto and relates to year 2010. "City of Palo Alto" refers to City of Palo Alto's local planning database as of 2013.

Highway Model Validation

Highway assignment validation is the process in which the traffic volumes estimated by the model are compared with observed traffic count data. Traffic counts were collected at various intersections throughout the city, as shown on Figure 1. The 2013 model validation presented in this memo provides two levels of checks: system-level validation of the peak hour volumes by facility type (freeways, expressways, arterials and collectors), and a validation of peak-hour traffic at six screen line locations.



LEGEND

= Study Intersection

= Possible Additional Study Intersection

Figure 1
Study Intersections

NORTH
Not to Scale

System Level Validation Targets

For the system-level validation, criteria were used from FHWA recommendations that were also used by VTA. Criteria were used for both overall volumes and volumes stratified by facility type. The following highway assignment validation goals were established:

- Freeways: less than 7 percent error compared to observed counts. Examples include I-280 and US 101.
- Expressway: less than 10 percent error compared to observed counts. Examples include Foothill Expressway and Oregon Expressway.
- Arterials: less than 10 percent error compared to observed counts. Examples include El Camino Real, Alma Ave, Churchill Ave, Middlefield Rd, Page Mill Rd, E Bayshore Rd, Embarcadero Rd, Quarry Rd, Arboretum Rd, University Ave, Arastradero Ave.
- Collectors: less than 25 percent error compared to observed counts. Examples include California Ave, W Bayshore Rd, Meadow Dr, Loma Verde Ave.
- All Facility Types: less than 5 percent error compared to observed counts

Screen Line Validation Targets

Screen lines are imaginary lines that cut through a set of parallel roadways, intercepting travel across them. The purpose of using a set of screen lines is to provide a systematic comparison of model estimated versus observed travel through different parts of the city, regardless of the individual route choice. A total of three screen lines were used to validate the PATM. Each screen line was evaluated by direction, for a total of 6 metrics.

The locations of the screen lines are shown on Figure 2. A typical goal is for model estimated traffic volumes to be within 10 to20 percent of the traffic counts on each screen line. Development of the highway model validation is an iterative process where the model results (by facility type and at the screen lines) are compared to the traffic counts after each model run. Analysis of the results leads to making further adjustments until most or all of the validation target values are achieved.

During the model validation process, adjustments are typically made to the roadway's speed and capacity assumptions, the location of centroid connectors, trip rates, and peak-hour factors. The starting point for the PATM validation was the 2010 VTA model. During the validation process the following adjustments were made:

- Several local roadways were added to the transportation network,
- the time-of-day factors for the peak AM and peak PM periods were increased in order to capture local traffic patterns in Palo Alto,
- The free-flow speed and capacity assumptions were changed to better reflect traffic operating conditions, and
- The Akcelic travel time functions were used to calculate the travel times on the links for successive iterations during the highway assignment process.

During the model validation, it appeared that the PATM overestimated traffic on some facilities and underestimated traffic on other facilities. The underestimated traffic was more significant in magnitude than the overestimated traffic. A possible explanation for the initial model volumes being lower than the count volumes is that when the model was initially developed and validated against earlier count data throughout the County by VTA, there may have been more peak spreading occurring than is characteristic of Palo Alto -- or peak spreading may be more pervasive in other parts of Santa Clara County than in Palo Alto. This tendency for underestimated trips is dealt with primarily through adjusting the peak-hour factors between

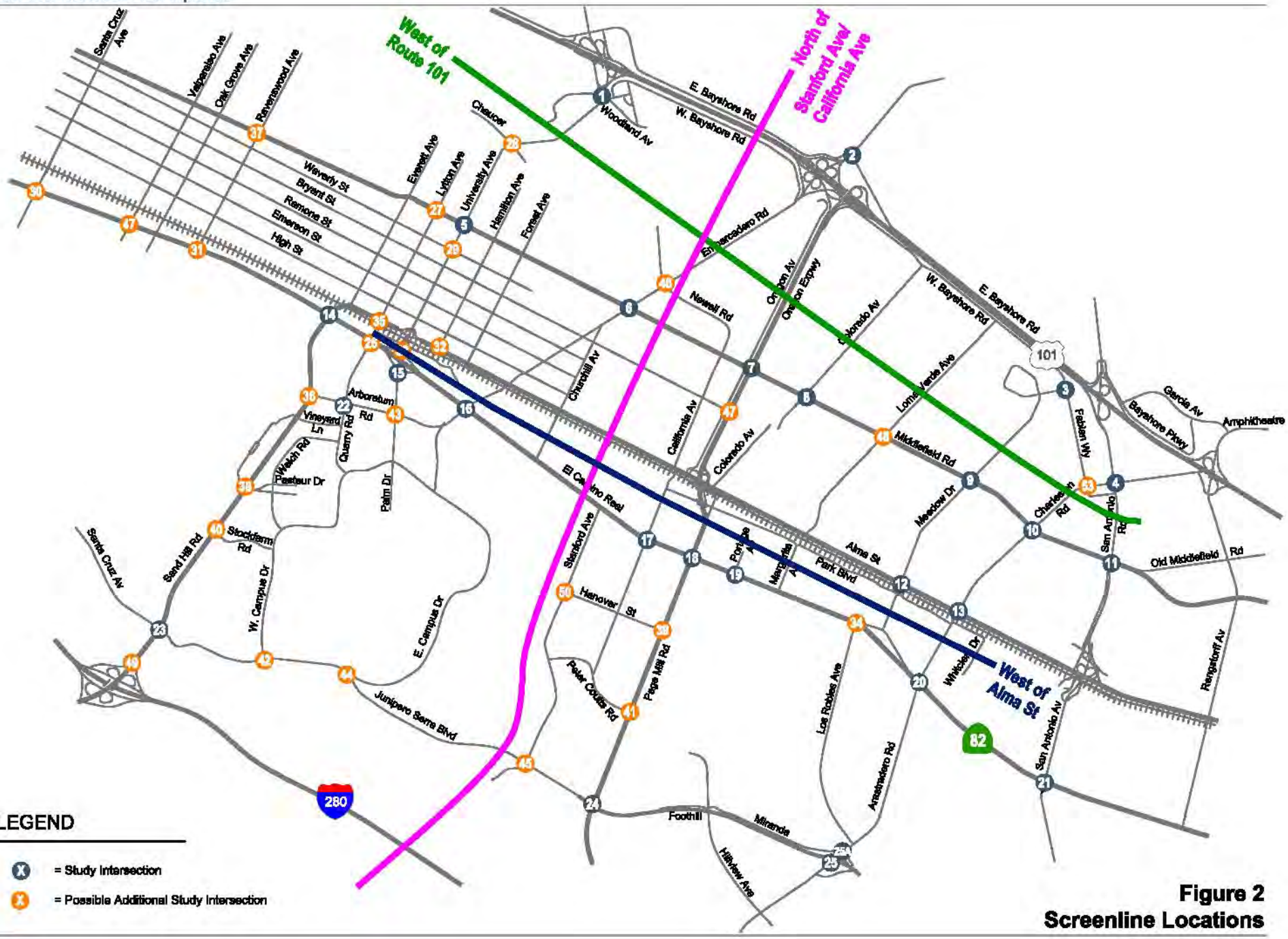


Figure 2
Screenline Locations

NORTH
Not to Scale

counties and super districts. This process applies increased proportions of trips, by trip purposes, that are occurring within the AM and PM four-hour windows.

AM and PM Peak Hour Validation Results

System wide highway validation results for the AM and PM peak 4-hour traffic assignments are summarized in Tables 3 and 4, respectively. The peak 4-hour model volumes are compared to the counts, stratified by facility type.

Table 3
Comparison of AM Peak 4-Hour Counts and Model Volumes by Facility Type

Facility	Count Volume	Model Volume	Difference	Target
Freeways	377,558	365,821	3%	+/- 7 %
Expressways	68,752	90,603	-24%	+/- 10 %
Arterials	201,251	202,592	-1%	+/- 15 %
Collectors	22,680	24,945	-9%	+/- 25 %

Table 4
Comparison of PM Peak 4-Hour Counts and Model Volumes by Facility Type

Facility	Count Volume	Model Volume	Difference	Target
Freeways	413,943	409,425	1%	+/- 7 %
Expressways	91,881	117,946	-22%	+/- 10 %
Arterials	295,675	287,402	3%	+/- 15 %
Collectors	38,854	38,758	0%	+/- 25 %

The tables show that the validation targets were met for all facilities except expressways, during both the AM and PM Peak 4-hour periods. Even though the expressway validation target was not met, the validation for the other facility types were actually much tighter than the target values, suggesting that the overall validation is reasonably acceptable. Also, the expressway facilities account for a fairly limited portion of the roadway system in Palo Alto. The screen line validation results are presented in Tables 5 and 6 for the AM and PM peak 4 hour periods, respectively.

The screen line validation shows that the model matches the 30% target at 5 of the 6 screen lines (3 of 3 in the AM and 2 of 3 in the PM).

Table 5
Comparison of Counts and Model Estimated Volumes at Screen Lines - AM

Screenline Name	Model Volume	Count Volume	Difference		Target Met
			Numeric	Percent	
North of Stanford Ave/California Ave	86,708	93,153	-6445	-6.9%	Yes
West of Route 101	20,928	28,286	-7358	-26.0%	Yes
West of Alma Ave	18,656	14,521	4135	28.5%	Yes
Total	126,292	135,960	-9668	-7.1%	Yes

Table 6
Comparison of Counts and Model Estimated Volumes at Screen Lines - PM

Screenline Name	Model Volume	Count Volume	Difference		Target Met
			Numeric	Percent	
North of Stanford Ave/California Ave	104,187	110,333	-6146	-5.6%	Yes
West of Route 101	33,070	24,703	8367	33.9%	no
West of Alma Ave	21,688	22,514	-826	-3.7%	Yes
Total	158,945	157,550	1395	0.9%	Yes

These comparisons show that the volumes at 1 of the 3 (33%) screen lines in the AM and 2 out of 3 (67%) screen lines in the PM are within 10% of the screen line counts.

Highway validation results for the AM and PM peak 4-hour traffic assignments for several local roadway corridors are presented in Table 7. The peak hour model volumes are compared to the VTA model results.

Table 7
Model Volume Comparisons on Local Streets (City of Palo Alto and VTA Models)

Roadway	Segment	AM Peak Hour			PM Peak Hour		
		VTA Model Volume	CPA 2013 Count Volume	CPA 2013 Model Raw Volume	VTA Model Volume	CPA 2013 Count Volume	CPA 2013 Model Raw Volume
University Avenue	between Bryant St and Waverly St	1716	908	591	1955	828	734
	between Waverly St and Middlefield Rd	1647	947	698	1999	913	801
	between Middlefield Rd and Chaucer St	1206	1026	776	1774	1044	778
Loma Verde Avenue	between Alma St and Middlefield Rd	54	701	123	47	462	172
	between Middlefield Rd and Bayshore Rd	55	649	136	95	473	190
Meadow Drive	between El Camino Real and Alma St	582	882	1731	743	783	1217
	between Alma St and Middlefield Rd	44	977	316	78	850	341
	between Middlefield Rd and Fabian Wy	130	585	222	269	420	282
Charleston Road	between El Camino Real and Alma St	784	1161	1032	1265	1100	615
	between Alma St and Middlefield Rd	1201	960	2303	1632	964	1290
	between Middlefield Rd and Fabian Wy	857	1346	1216	761	1231	1319
Stanford Avenue	between Junipero Serra Blvd and Peter Courtts Rd	262	773	631	637	684	215
	between Peter Coutts Rd and Hanover St	247	670	455	322	754	697
	between Hanover St and El Camino Real	314	583	246	539	685	335
Middlefield Road	between Everett Ave and Lytton Ave	1497	1437	1640	1913	1636	1666
	between Lytton Ave and University Ave	1535	1044	638	1934	1314	912
	between University Ave and Hamilton Ave	939	877	749	1667	1212	891
	between Colorado Ave and Loma Verde Ave	320	1394	296	813	1575	1077
	between Loma Verde Ave and Meadow Dr	385	1451	389	806	1717	1090
	between Meadow Dr and Charleston Rd	402	1687	596	884	1941	1208
Bryant Street	between Oregon Expwy and N California Ave	1	194	404	13	233	971
	between Oregon Expwy and Colorado Ave	1	147	59	88	132	52
Miranda Avenue	north of Arastradero Rd	104	628	83	58	691	107
	south of Arastradero Rd	13	379	32	13	148	17

Notes: Directional volumes from both models were added together to yield two-way volumes.
CPA 2013 Raw Model Volumes and VTA Volumes were converted from 4 hour model output to 1 hour volume by applying factors of 2.793 (AM) and 3.584 (PM).

Conclusions

Even though the expressway validation target was not met, there are several reasons why the validation is considered acceptable:

- The validation for the facility types of freeways, arterials, and collectors were actually much tighter and within a significantly lower deviation than the target values,
- The target values by facility type are goals as opposed to requirements and are not based on measurements,
- There are fewer expressway lane miles than arterial lane miles, collector lane miles, or freeway lane miles regarding the roadway system in Palo Alto, and
- For purposes of using the model for actual analysis on projects such as the Comprehensive Plan Update, the model forecasts get adjusted using actual traffic count data.

For these reasons, the PATM validation is considered acceptable as a tool to forecast traffic for analyzing transportation projects and development projects.

Attachment A-8

MOTT MACDONALD

CITY OF PALO ALTO

Existing Conditions Report Draft

City of Palo Alto Rail Program Management

November 2, 2017

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City of Palo Alto Rail Program Management

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Abbreviations/Acronyms

ADA .....American Disabilities Act

ADT.....Average Daily Traffic

BAAQMD .....Bay Area Air Quality Management District

BPTP .....Bicycle and Pedestrian Transportation Plan

BTG .....Bicycle Technical Guidelines

CAP .....Climate Action Plan

CBOSS .....Communications Based Overlay Signal System

CHSRA .....California High-Speed Rail Authority

CMP.....Congestion Management Program

CPP .....Climate Protection Plan

CTC .....California Transportation Commission

EMU.....Electrical Multiple Unit

FTA.....Federal Transit Administration

GHG.....Greenhouse Gas

HCM.....Highway Capacity Manual

HSR .....High-Speed Rail

LOS.....Level of Service

MTC.....Metropolitan Transportation Commission

PCEP .....Peninsula Corridor Electrification Project

PTC.....Positive Train Control

SCCBP.....Santa Clara Countywide Bicycle Plan

VTA.....Santa Clara Valley Transportation Authority

1 Introduction

The City of Palo Alto (referred to as the "City") is preparing for increases in passenger rail service along the existing Caltrain rail corridor and potential impacts to existing at-grade crossings associated with service increases. Passenger rail service changes will be a result of the Peninsula Corridor Electrification Project (PCEP) and potentially the California High-Speed Rail (HSR) project.

The City of Palo Alto is bisected by the Caltrain rail corridor and enjoys both the benefits as well as the impacts associated with rail service: train noise and vibration, traffic congestion around grade crossings, and community safety concerns. These impacts are expected to grow as train service in the corridor increases regardless of whether or not the state's HSR project comes to fruition. As a result, the City is conducting a study to assess grade separation alternatives and minimize the impact of increased rail services on local traffic, the basis of which is referred to as the "Rail Program" throughout this document.

In 2010, the City Council initiated the Palo Alto Rail Corridor Study to evaluate land use, transportation, and urban design elements of the rail corridor, particularly in response to potential improvements to passenger rail service on the Caltrain corridor. The study report, as a result of a two-year process, includes an analysis of those elements and their potential impacts from the range of possible rail improvements, including Caltrain upgrades, such as electrification and/or grade separations, and/or the potential options for the HSR project[1]. In early 2014, the City conducted a study for conceptual grade separation alternatives for a portion of the Caltrain right-of-way encompassing three existing at-grade crossings: Charleston Road, Meadow Drive, and Churchill Avenue[2]. This study provided preliminary information on the potential impacts and costs of construction (by order of magnitude) for various roadway depression and trenching of the railroad alternatives. A railroad trench alternative would place the railroad tracks and rail operations below street-level, thus separating train traffic from motor vehicles, pedestrian, and bicyclist activity at the street-level. The study was not definitive in determining an ultimate configuration, but provided a starting point for dialogue on the issue, and indicated that roadway depression alternatives would require significant property acquisitions, while trenching alternatives would not. The study also concluded that while not all of the roadway depressions could maintain turning movements along Alma Street, the trenching alternatives could do so.

1.1 Purpose

The purpose of this Existing Conditions report is to examine the current conditions relevant to the Palo Alto Rail Corridor Circulation Study. This report includes sections on the policy framework for the Palo Alto Rail Program, overview of the study area, bike and pedestrian access, transportation networks, traffic conditions, and existing transit services in the City.

[1] Palo Alto Rail Corridor Study, 2013 https://www.cityofpaloalto.org/civicax/filebank/documents/38025

[2] Palo Alto Grade Separation and Trenching Study, 2014 https://www.cityofpaloalto.org/civicax/filebank/documents/44211

2 Policy Framework

The City of Palo Alto is the lead agency for the Rail Program, and as such this section summarizes City policies that govern the Rail Corridor Circulation Study. The purpose of this review is to ensure that the Circulation Study is consistent with existing and planned future transportation and development policies and strategies.

2.1 Palo Alto Policies

The Circulation Study process builds upon the City's previous planning efforts to accommodate future transit growth along the existing Caltrain corridor, brought about by the California High-Speed Rail (HSR) project, the Peninsula Corridor Electrification Project (PCEP), and the growing population of the San Francisco Bay Area. Existing plans, policies, and guidelines set the foundation for the corridor planning process and the development of an implementable document. Key City documents include the Palo Alto Bicycle and Pedestrian Transportation Plan, the Palo Alto Climate Protection Plan, the City of Palo Alto Municipal Code, the Rail Corridor Study, and the Transportation Element of the City of Palo Alto Comprehensive Plan. The Rail Corridor Study was developed by the Rail Corridor Task Force to generate a community vision for land use, transportation, and urban design opportunities along the Caltrain corridor. This policy document was incorporated into the Comprehensive Plan in 2013 and provides land use and transportation policies under a variety of scenarios. It is the intention of this study to build on the outcomes of the Rail Corridor Study.

2.1.1 Palo Alto Comprehensive Plan – Transportation Element

The City of Palo Alto Comprehensive Plan was last revised in 2007 and is currently in the process of being updated. It is the primary document guiding the City's planning decisions. The Transportation Element of the existing Palo Alto Comprehensive Plan includes 10 goals to guide the development of the City's transportation programs and facilities (see Table 2-1). A total of 57 policies and 58 programs are identified in the current Comprehensive Plan's transportation chapter to further focus and carry out these goals.

Table 2-1: Summary of Transportation Goals from Comprehensive Plan

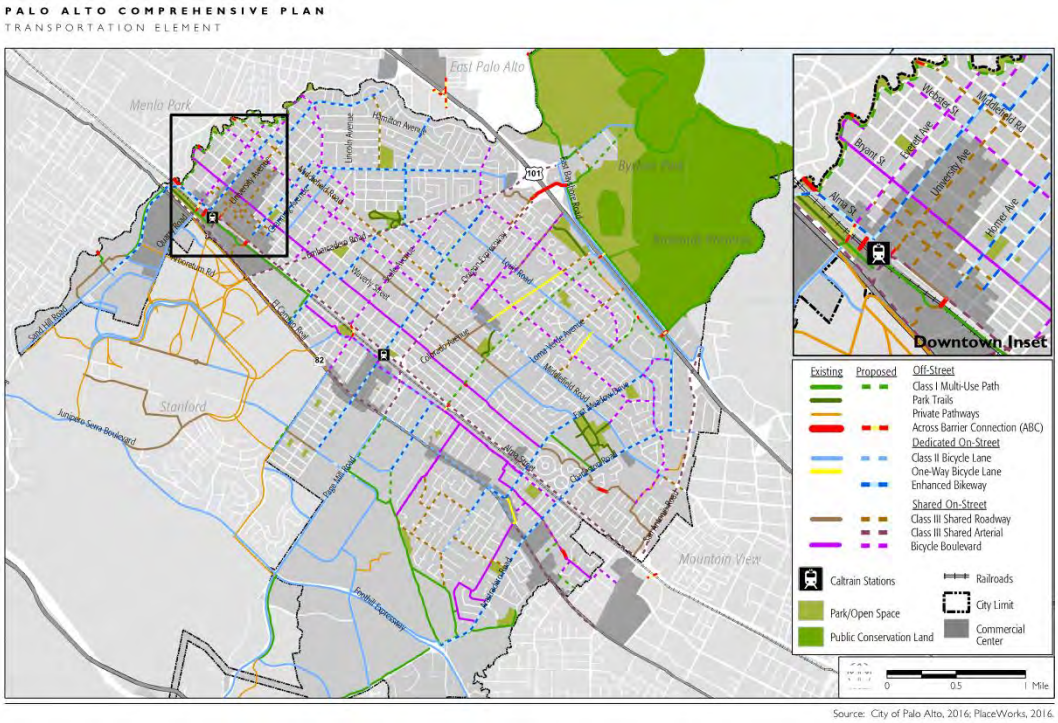
Goal Number	Transportation Goals
Goal T-1	Less reliance on Single-Occupant Vehicles
Goal T-2	A convenient, efficient public transit system that provides a viable alternative to driving
Goal T-3	Facilities, services, and programs that encourage and promote walking and bicycling
Goal T-4	An efficient roadway network for all users
Goal T-5	A transportation system with minimal impact on residential neighbourhoods
Goal T-6	A high level of safety for motorists, pedestrians, and bicyclists on Palo Alto Streets
Goal T-7	Mobility for people with special needs
Goal T-8	Attractive, convenient public and private parking facilities
Goal T-9	An influential role in shaping and implementing regional transportation decisions
Goal T-10	A local airport with minimal off-site impacts

Source: City of Palo Alto Comprehensive Plan 2007

The updated plan, Our Palo Alto 2030 Comprehensive Plan, will carry over and update the current plan's transportation goals and include an emphasis on reducing congestion. Related to

this study, the new Comprehensive Plan will include a policy supporting Caltrain modernization and a policy identifying grade separations as a city priority.

Figure 2-1: City of Palo Alto Comprehensive Plan – Bikeways in Palo Alto



Source: City of Palo Alto, Comprehensive Plan Transportation Element Draft 2017

2.1.2 Palo Alto Bicycle and Pedestrian Transportation Plan

The Palo Alto 2012 Bicycle and Pedestrian Transportation Plan (BPTP 2012) was adopted in July 2012 and builds upon the 2003 Bicycle Transportation Plan by adding coverage of pedestrian issues, priorities, and design standards. The BPTP 2012 contains the policy vision, design guidance, and specific recommendations to increase walking and biking rates over the next decade and beyond – rates that will be instrumental in helping to address the impacts of regional growth while maintaining mobility. Objective One in the BPTP 2012 aims to "double the rate of bicycling for both local and total work commutes by 2020 (to 15 percent and 5 percent, respectively.)" This objective supports Goals T-1 and T-3 of the City's Comprehensive Plan. Objective Four, which aims to "plan, construct, and maintain 'Complete Streets' that are safe and accessible to all modes and people of all ages and abilities," supports and expands Goal T-3 of the City's current Comprehensive Plan.

2.1.3 Palo Alto Climate Protection Plan

The City of Palo Alto adopted a Climate Protection Plan (CPP) in December 2007. The City then updated the mid-term and long-term Greenhouse Gas (GHG) emissions reduction goals for both municipal and community-wide GHG emissions in 2010. Overall GHG emissions in 2013 within the City were estimated to have decreased 29 percent from 2005 levels, which exceeds the City's goal of 15 percent reduction below 2005 levels by 2020. The CPP contains a range of goals and actions that target GHG emissions reductions from the transportation sector, including measures to promote alternative fuels, facilitate increased biking and walking, increase mass transit availability, and encourage electronic alternatives to travel. In 2015, the City began the preparation of a Sustainability and Climate Action Plan (S/CAP) and adopted a

new GHG reduction goal of 80 percent below 1990 levels by 2030, otherwise referred to as the "80x30" goal.

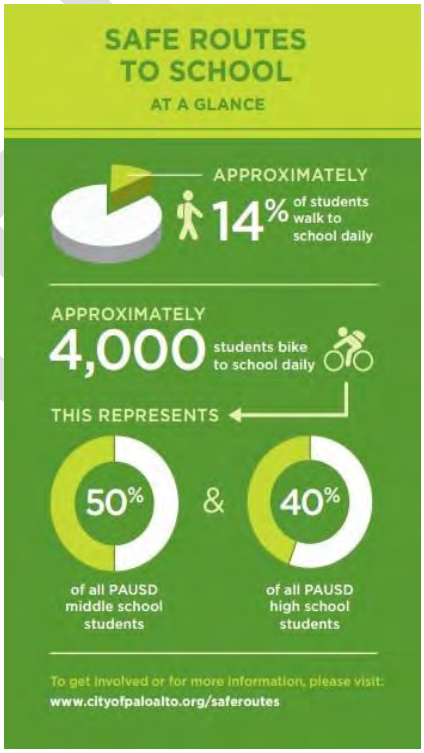
2.1.4 Palo Alto Municipal Code

The purpose of the City's Municipal Code is to protect and promote the public's health and safety through ordinances and regulations. Title 10 regulates vehicle and traffic operations within the City, including traffic-control devices, pedestrian safety, bicycling safety and routes, and general vehicle and traffic safety. For example, chapter 10.32 establishes pedestrian safety regulations, such as the establishment and appropriate usage of crosswalks. Chapter 10.36 addresses general parking regulations, such as where parking is permitted.

2.1.5 Safe Routes to School

The Safe Routes to Schools (SRTS) Program is a collaborative effort between the City of Palo Alto and the Palo Alto Unified School District (PAUSD). Its goal is to improve safety for school commuters and to reduce school commute-related congestion on city streets. Approximately 14 percent of Palo Alto's students walk to school daily, while 4,000 students from the PAUSD bike to school, as shown in Figure 2-2.

Figure 2-2: Safe Routes to School Statistics



Source: City of Palo Alto, Safe Routes to School

The program is consistent with key transportation goals outlined in the City's Comprehensive Plan, including giving priority to facilities, services, and programs that encourage and promote walking and bicycling, and providing a high level of safety for motorists, pedestrians, and bicyclists. Specific policies and programs include[3]:

- Policy T-14: Improve pedestrian and bicycle access to and between local destinations, including public facilities, schools, parks, open space, employment districts, shopping centers, and multi-modal transit stations.
- Policy T-39: To the extent allowed by law, continue to make safety the first priority of citywide transportation planning.
- Policy T-40: Continue to prioritize the safety and comfort of children on school travel routes. This includes program T-45, which calls for providing adult crossing guards at school crossings that meet adopted criteria, and T-46, which encourages the City-sponsored bicycle education programs in the public schools.

The SRTS Program produced 18 Walk and Roll maps that outline suggested bicycle and pedestrian paths around a one-mile radius of a school within PAUSD. Among the 18 Walk and Roll Maps, four maps designate suggested routes that cross two of the four identified at-grade crossings within the Study Area. These four Walk and Roll Maps are:

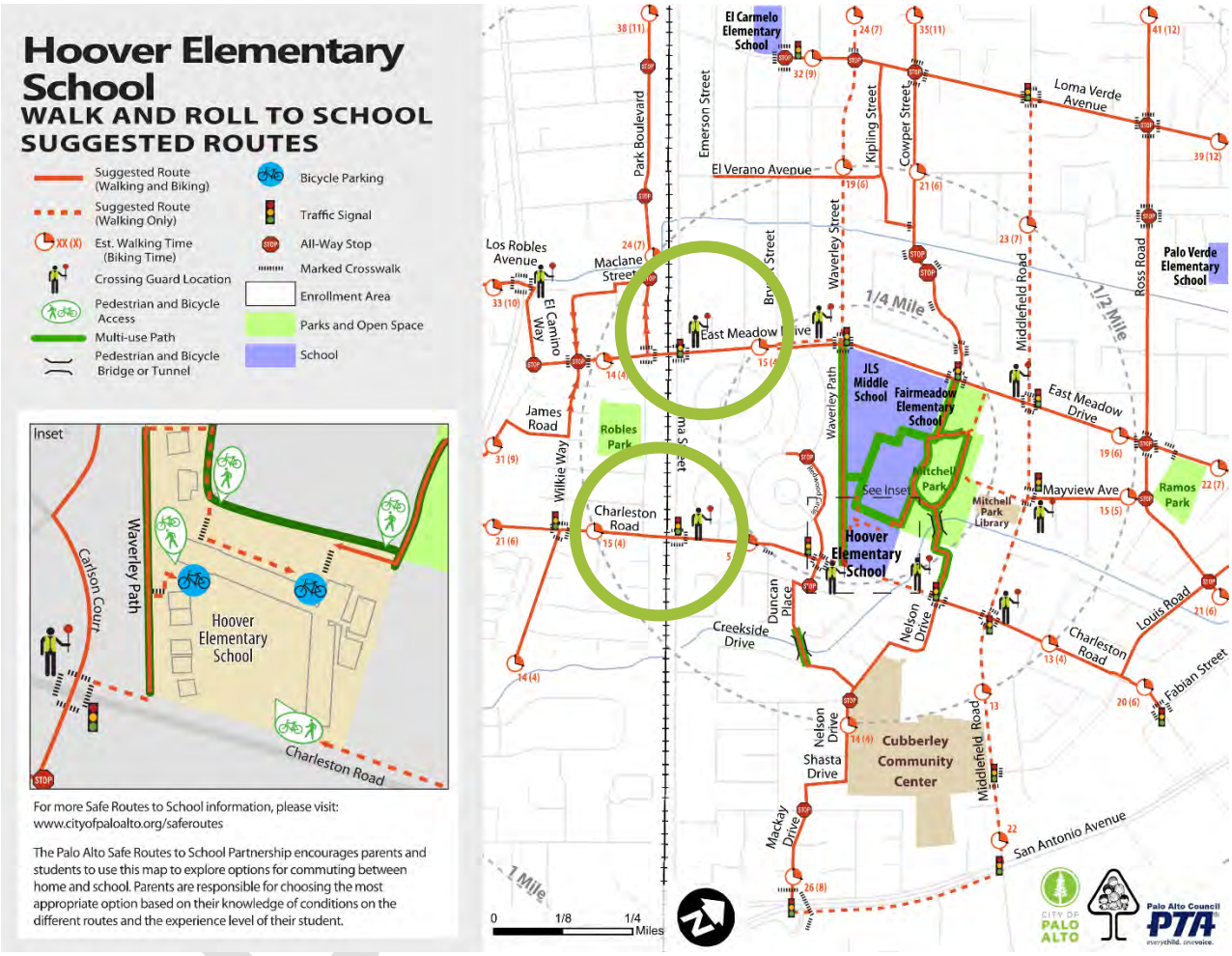
- Briones Elementary School
- Gunn High School

[3] https://paloaltocityca.iqm2.com/Citizens/FileOpen.aspx?Type=30&ID=9461&MeetingID=2088

- Hoover Elementary School
- Terman Middle School

All four maps for the above schools suggest routes that cross both Meadow Drive and Charleston Road railroad crossings, and crossing guards are assigned to these locations to help ensure the safety of students and guardians on their routes to school. An example of one of the Walk and Roll maps is shown in Figure 2-3.

Figure 2-3: Walk and Roll Map Example – Hoover Elementary School



Source: City of Palo Alto, Safe Routes to School

The SRTS Program includes an ongoing, year-round program with both engineering and programmatic elements. A timeline of recently completed and upcoming infrastructure projects, as they relate to the four aforementioned schools, is presented in Table 2-2.

Table 2-2: SRTS Infrastructure Project Timeline

Project	School Routes to be Improved	Completion Date or Future Construction Start
Georgia Ave High Visibility Crosswalk	Terman MS, Gunn HS	Completed Summer 2016
Los Robles Bikeway Enhancements	Briones ES, Terman MS, Gunn HS	Completed Summer 2016
Donald/Arastradero Intersection Spot Improvements	Terman MS	Summer 2017
Bryant Street Bicycle Boulevard Upgrade	Gunn HS	Summer 2017
Louis Road-Montrose Ave Bicycle Boulevard	Gunn HS	Summer 2017
Ross Road Bicycle Boulevard	Gunn HS	Summer 2017
Charleston/Arastradero Corridor Plan	Briones ES, Hoover ES, Terman MS, Gunn HS	Winter 2017/2018
Bryant Street Bicycle Boulevard Extension	Hoover ES, Gunn HS	Summer 2018
Maybell Avenue Bicycle Boulevard	Briones ES, Terman MS, Gunn HS	Summer 2018
Park Blvd/Wilkie Way Bicycle Boulevard	Briones ES, Terman MS, Gunn HS	Summer 2018
East Meadow Drive and Fabian Enhanced Bikeways	Hoover ES, Gunn HS	January 2020 (Pending VERBS Funding)

Source: Planning and Community Environment Department, April 2017

2.2 Stakeholder Agencies

Stakeholder agencies with potential impact on the City's Rail Program include:

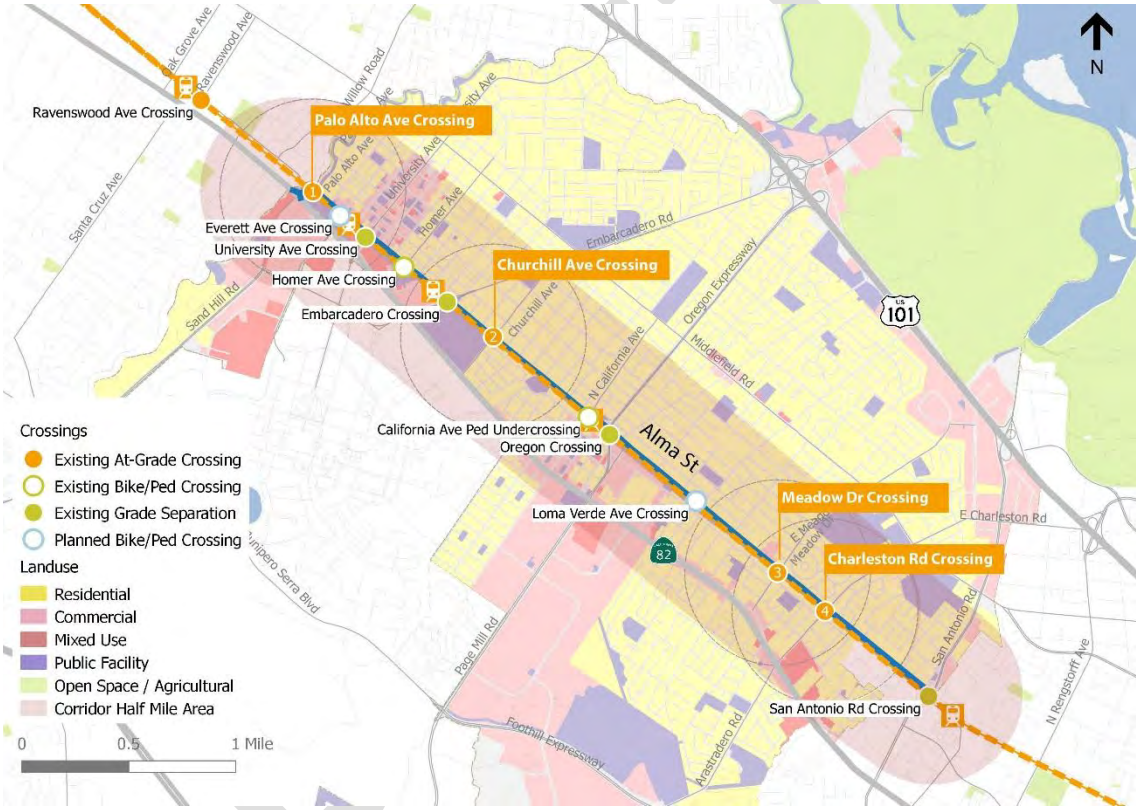
- Association of Bay Area Governments (ABAG)
- Bay Area Air Quality Management District (BAAQMD)
- California Department of Transportation (Caltrans)
- California High Speed Rail Authority (CHSRA)
- California Transportation Commission (CTC)
- California Public Utilities Commission (CPUC)
- Federal Highway Administration (FHWA)
- Federal Railroad Administration (FRA)
- Metropolitan Transportation Commission (MTC)
- Peninsula Corridor Joint Powers Board (PCJPB), aka Caltrain (and Samtrans)
- Santa Clara Valley Transportation Authority (VTA)
- Santa Clara County
- Union Pacific Railroad
- Other:
  - Americans with Disabilities Act (ADA)
  - California legislation, such as SB 743 (CEQA LOS Alternative) and AB 1358 (Complete Streets)

A summary review of applicable Federal, State, and Regional agency policies and stakeholders is included in Appendix A — Federal, State and Regional Policy and Framework Review.

3 Study Area

The study area is defined as the half-mile area centered around the rail corridor in the City, including the four existing at-grade crossings. The rail corridor in the City spans approximately four miles in length, and includes three train stations: Palo Alto Station, Stanford Station, and California Ave Station. The major arterial that runs parallel to the rail line is Alma Street. There are five existing grade separations in the City, including University Ave, Homer Ave (bike/ pedestrian undercrossing), Embarcadero Road, Oregon Expressway, and California Ave (bike/ pedestrian undercrossing), and a portion of the San Antonio Road separation touches the City boundary as well. The study area map is shown in Figure 3-1.

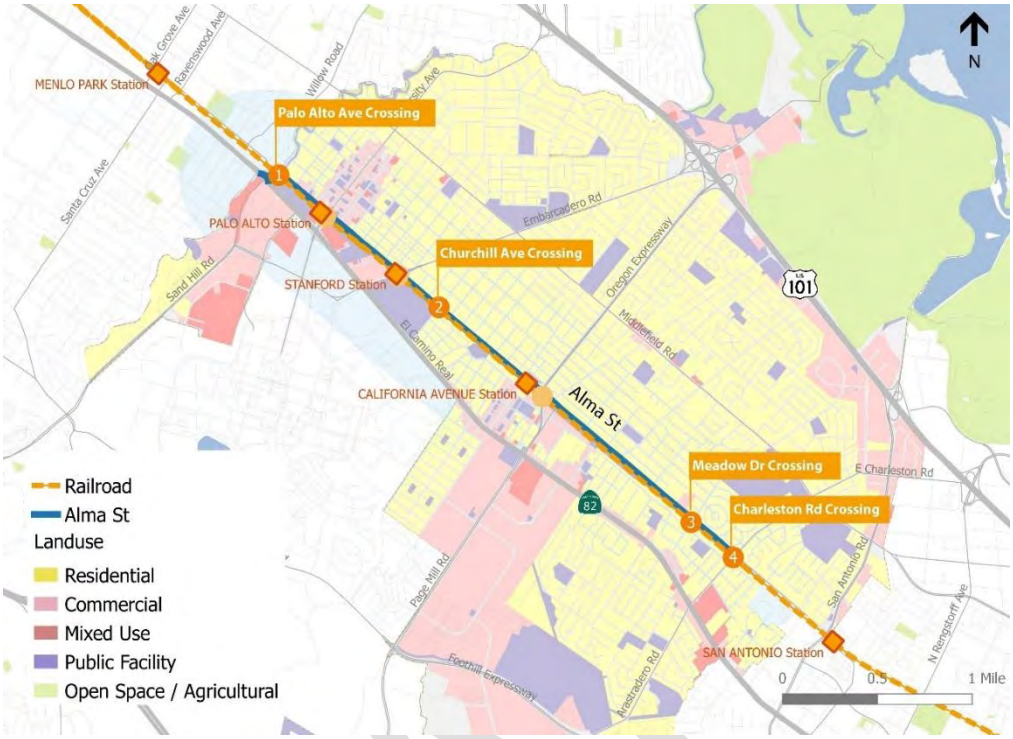
Figure 3-1: Study Area Map



3.1 Land Use

The existing land uses within the study area are shown in Figure 3-2. The updated Comprehensive Plan will focus on ensuring that public services can adequately serve new housing development and that sufficient land for neighborhood-serving retail uses is preserved.

Figure 3-2: Overall Land Use Map



3.2 Demographics

The City of Palo Alto is located in the northwest portion of Santa Clara County in the San Francisco Bay Area. The community is largely residential with sizeable employment in the management, business, science, and arts industries. Approximately 65 percent of residents commute to work by driving alone and almost six percent of residents take transit. In comparison, 76 percent of Santa Clara County residents commute by driving alone and less than four percent of residents take transit, as detailed in Table 3-1. The City is one of the most bike-friendly cities in the nation, and this is reflected in the rate of residents who use bicycles as their primary commute mode. Over nine percent of Palo Alto residents commute locally by bicycle currently, and the BPTP 2012 seeks to increase this rate to 15 percent by 2020 under the plan's Objective One.

Table 3-1: Commute Modes

Commute Mode	City of Palo Alto	Santa Clara County
Drive Alone	64.6%	76.0%
Carpool	6.6%	10.4%
Transit	5.8%	3.9%
Walk	5.2%	2.0%
Bicycle	9.2%	1.9%
Taxi, Motorcycle, Other	0.9%	1.3%
Work at Home	7.8%	4.6%

Source: US Census ACS 5-Year, 2015

3.3 At-Grade Crossings

The following section presents each of the four at-grade crossings, with a discussion of physical attributes and surrounding land uses. An at-grade crossing is an intersection of a roadway or path and a railroad at the same level, as opposed to the railroad crossing over or under via a bridge or tunnel. Information included in the following sections was sourced from the February 2016 Caltrain Grade Crossing Hazards Analysis.

3.3.1 Palo Alto Avenue

The Palo Alto Avenue at-grade crossing is the northernmost crossing within the City. Palo Alto Avenue is a minor two-lane collector street that connects El Camino Real (State Route 82) with Alma Street. The Palo Alto Avenue approach is stop-sign controlled at Alma Street, just east of the railroad. Palo Alto Avenue extends northwest of Alma Street as an at-grade crossing over the railroad tracks, and extends west to connect to form a signalized intersection at El Camino Real/Sand Hills Road approximately 300 feet west of the railroad crossing. The Palo Alto segment through the railroad crossing has a general two-lane cross-section, with Class II bike lanes and a sidewalk/pedestrian path on the north side of the road. Class II bike lanes are on-street marked bike lanes for the exclusive use of bicycles. Currently, Palo Alto Avenue carried an average weekday traffic volume of approximately 16,200 vehicles and 550 bicycles per day across the at-grade crossing. Weekday pedestrian and bicycle volumes for this crossing are summarized in Table 3-2.

Figure 3-3: Palo Alto Avenue At-Grade Crossing

Source: Google Earth 2016

Table 3-2: Pedestrian and Bicycle Volumes at Palo Alto Avenue Crossing

Direction	Pedestrians			Bicycles		
	Total Weekday	Peak Hour / Time		Total Weekday	Peak Hour / Time	
Eastbound	152	12	08:00 – 09:00	276	40	17:00 – 18:00
Westbound	147	15	08:00 – 09:00	274	49	08:30 – 09:30

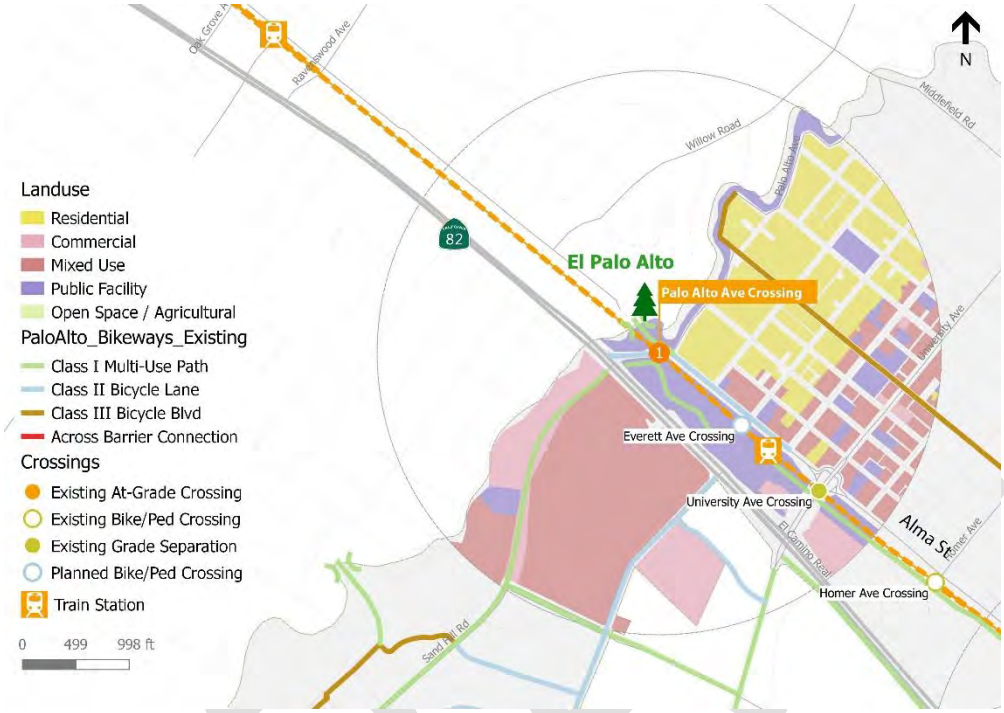
Source: Caltrain Grade Hazard Analysis Final Report, Feb 2016

Land Use

The Palo Alto Avenue at-grade crossing is in proximity to a few major landmark destinations within the City, including El Palo Alto, the historic tree and City's namesake shown in Figure 3-3.

To the southwest of the crossing is the mixed-use complex of Stanford Shopping Center, in addition to the El Camino Park. The Palo Alto Transit Center is approximately 2,000 feet away to the south of the crossing, and northeast of the transit center is the major commercial corridor of Downtown Palo Alto along University Avenue.

Figure 3-4: Palo Alto Avenue Grade Crossing Land Use



3.3.2 Churchill Avenue

Churchill Avenue is an east-west local collector street that provides a connection between El Camino Real (State Route 82) and Embarcadero Road, through Old Palo Alto. The roadway has a general two-lane cross-section, with Class II bike lanes and sidewalks. Within the vicinity of the Churchill Avenue crossing, Churchill Avenue forms a signalized intersection with Alma Street, and unsignalized intersections (i.e. side-street stop-controlled) at Mariposa Avenue.

Figure 3-5: Churchill Avenue At-Grade Crossing

Source: Google Earth 2016

The Churchill Avenue/Alma Street intersection is an existing at-grade signalized intersection located within close proximity (less than 50 feet) from the railroad crossing, and as such represents the key intersection that influences at-grade railroad crossing operations. In 2015, the City of Palo Alto, Caltrain, Caltrans Rail Division, and the California Public Utilities Commission (CPUC) met to review the Churchill Avenue crossing to determine possible funding of safety improvements through the Federal Section 130 funds. Currently, Churchill Avenue

carried an average weekday traffic of approximately 9,200 vehicles and 1,020 bicycles per day across the at-grade crossing[4]. Weekday pedestrian and bicycle volumes for this crossing are summarized in Table 3-3.

Table 3-3: Pedestrian and Bicycle Volumes at Churchill Avenue Crossing

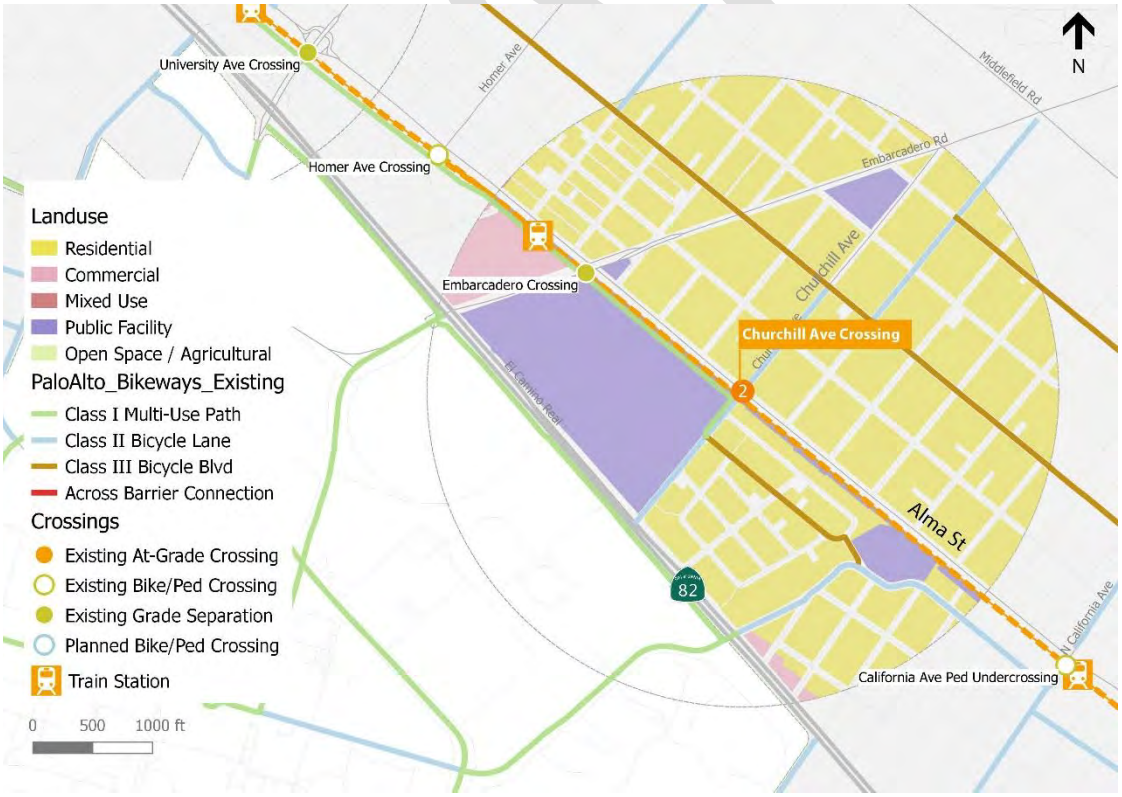
Direction	Pedestrians			Bicycles		
	Total Weekday	Peak Hour / Time		Total Weekday	Peak Hour / Time	
Eastbound	139	36	13:45 – 14:45	541	202	13:45 – 14:45
Westbound	131	36	07:45 – 08:45	481	265	07:30 – 08:30

Source: Caltrain Grade Hazard Analysis Final Report, Feb 2016

Land Use

As shown in Figure 3-6, land use around the Churchill Avenue crossing is mostly residential, except for the southwest corner which borders a stadium and school facilities owned by the Palo Alto Unified School District. Nearby land uses are primarily comprised of low-density residential communities and schools such as Palo Alto High School and the Castilleja School. The Stanford Caltrain Station, is a special station only utilized during Stanford University special events and football games. Access to these platforms is provided through the Embarcadero Road grade separation structure.

Figure 3-6: Churchill Avenue Grade Crossing Land Use Map



[4] Grade Crossing Hazard Analysis Final Report, Caltrain, 2016

3.3.3 Meadow Drive

Figure 3-7: Meadow Drive At-Grade Crossing

Source: Google Earth 2016

The Meadow Drive at-grade crossing is located approximately 1,200 feet north of the Charleston Road arterial at-grade crossing. Meadow Drive is an east-west local street/collector that provides local connection between El Camino Way and Louis Road, through the south-central part of the City. The roadway has a general two-lane cross-section, with Class II bike lanes and sidewalks. Within the vicinity/influence of the Meadow railroad crossing, Meadow Drive forms a signalized intersection with Alma Street, and unsignalized intersections (i.e. side-street stop-controlled) at Park Boulevard, Wilkie Way, and Ramona Street. The Meadow Drive/Alma Street intersection is an existing at-grade signalized intersection located within close proximity (less than 50 feet) from the railroad crossing, and as such represents the key intersection that influences at-grade railroad crossing operations. Currently, Meadow Drive carried an average weekday traffic of approximately 8,900 vehicles and 900 bicycles per day across the at-grade crossing of the railroad. Weekday pedestrian and bicycle volumes for this crossing are summarized in Table 3-4.

Table 3-4: Pedestrian and Bicycle Volumes at Meadow Drive Crossing

Direction	Pedestrians			Bicycles		
	Total Weekday	Peak Hour / Time		Total Weekday	Peak Hour / Time	
Eastbound	93	15	07:45 – 08:45	413	38	17:15 – 18:15
Westbound	88	14	07:45 – 08:45	483	274	07:45 – 08:45

Source: Caltrain Grade Hazard Analysis Final Report, Feb 2016

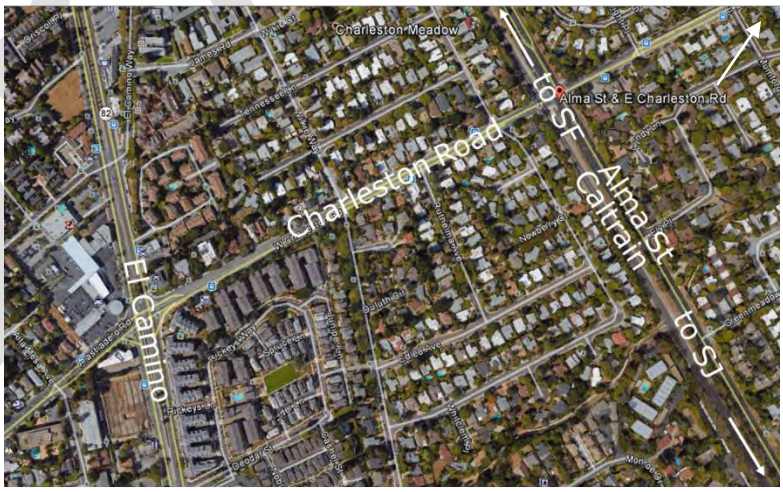
Land Use

The designated land uses around Meadow Drive Crossing are primarily residential with nearby schools and neighborhood-retail shops and public recreational facilities such as Mitchell Park Library and the Magical Bridge Playground within Mitchell Park near JLS Middle School (see Figure 3-8).

Figure 3-8: Meadow Drive Crossing Land Use Map

3.3.4 Charleston Road

Figure 3-9: Charleston Road At-Grade Crossing



Source: Google Earth 2016

Charleston Road is an east-west residential arterial facility through the City, that provides cross-town circulation between the El Camino Real (State Route 82) corridor to the west and the US 101/Rengstorff Avenue interchange to the east. The roadway has a general four-lane cross-section with left-turn channelization at key intersections. Through the crossing of the railroad, Charleston Road has a four-lane undivided section with Class II bike lanes and sidewalks on both sides. The crossing is provided with crossing/gate appurtenances and marked for 25 mph speed limit.

Within the vicinity/influence of the railroad crossing, Charleston Road forms a signalized intersection with Alma Street, and unsignalized intersections (i.e. side-street stop-controlled) at Park Boulevard, Wilkie Way and Wright Place. The Charleston Road/Alma Street intersection is

an existing at-grade signalized intersection located within close proximity (less than 50 feet) from the railroad crossing, and as such represents the key intersection that influences at-grade railroad crossing operations. In 2013, Charleston Road carried an average weekday traffic of approximately 17,900 vehicles and 240 bicycles per day across the at-grade crossing of the railroad[5]. Weekday pedestrian and bicycle volumes for this crossing are summarized in Table 3-5.

Table 3-5: Pedestrian and Bicycle Volumes at Charleston Road Crossing

Direction	Pedestrians			Bicycles		
	Total Weekday	Peak Hour / Time		Total Weekday	Peak Hour / Time	
Eastbound	61	8	12:00 – 13:00	105	25	08:15 – 09:15
Westbound	79	11	12:00 – 13:00	139	48	07:45 – 08:45

Source: Caltrain Grade Hazard Analysis Final Report, Feb 2016

Land Use

The land uses surrounding the Charleston Road crossing are illustrated in Figure 3-10. The immediate surrounding area around Charleston Road crossing is predominantly residential, similar to the area surrounding the Meadow Drive railroad crossing. It should be noted that approximately half a mile north from the crossing is the Magical Bridge Playground, Mitchell Park, and the Mitchell Park Library, which could attract traffic from beyond the immediate surrounding.

Figure 3-10: Charleston Road Crossing Land Use Map

[5]Grade Crossing Hazard Analysis Final Report, Caltrain, 2016

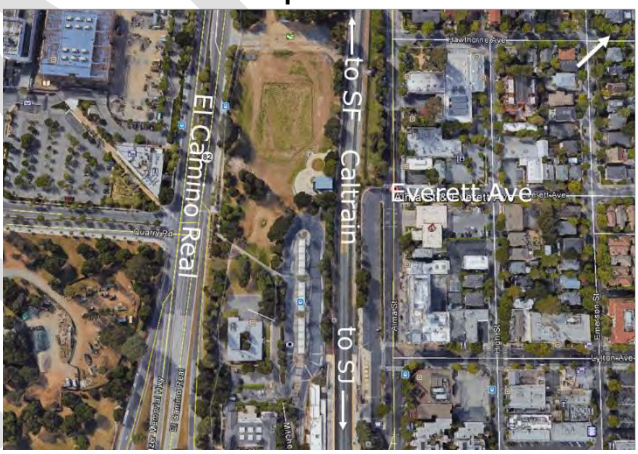
3.4 Grade-Separated Crossings

There are eight existing or planned grade-separated crossings along the rail corridor within the Study Area. This section describes the existing and future grade-separated crossings and serves to provide context on rail improvements in the corridor to illustrate what has been accomplished to date and what could be done in the future to improve safety and operability.

- Everett Avenue – Planned bicycle/pedestrian undercrossing
- University Avenue – Existing grade separation
- Homer Avenue – Existing bicycle/pedestrian undercrossing
- Embarcadero Road – Existing grade separation
- Seale Avenue – Planned bicycle/pedestrian crossing
- California Avenue – Existing bicycle/pedestrian undercrossing
- Oregon Expressway – Existing grade separation
- Loma Verde Avenue – Planned bicycle/pedestrian crossing
- San Antonio Road – Existing grade separation

3.4.1 Everett Avenue

Figure 3-11: Everett Avenue Planned Grade Separation



Source: Google Earth 2016

The planned grade separation of Everett Avenue would connect Quarry Road (at the north end of the Stanford University campus) with the Bryant Street bicycle boulevard and the Palo Alto Caltrain Station. Everett Avenue is one of 15 priority crossings identified by the Palo Alto Rail Task Force. The Palo Alto 2012 BPTP identified opportunities to improve linkages to services and enhance the bicycle and pedestrian connections. The resulting improvements that were proposed include installing additional traffic circles and wayfinding improvements along Everett Avenue to designate it as a "complete" bicycle boulevard. Bicycle boulevards are signed, shared roadways with low vehicle volume which prioritize convenient and safe bicycle travel through the use of traffic calming strategies.

Currently, the lack of a grade-separated crossing somewhat isolates the El Camino Park, shown in Figure 3-11 from the Downtown North neighborhoods in Palo Alto. The nearest railroad crossings are the Palo Alto Avenue grade crossing to the north and the University Avenue grade-separated crossing to the south. By implementing a grade-separated crossing at Everett Avenue, there could be opportunities to provide connections between the Park, the surrounding communities, Stanford University, the Stanford University Medical Center, and the Stanford Shopping Center.

Pedestrian and bicycle access will most likely be accomplished through a grade-separated underpass where vehicles would be prohibited. Coordination between the City, Caltrain, Peninsula Corridor Joint Powers Board, and other agencies would be required to implement this project.

3.4.2 University Avenue

The existing University Avenue grade-separated crossing allows for vehicular, pedestrian, and bicycle connections between the commercial corridor along University Avenue to the Stanford University campus southwest of the rail line. Sidewalks under the tunnel are grade separated from the street to offer more protection to pedestrians and bicycles are permitted in the underpass alongside vehicles. The underpass was constructed in 1936 in response to public safety concerns. The intersection itself, shown in Figure 3-12, is complex due to the convergence of the multi-modal Palo Alto station, El Camino Real, and the gateway to both the university and Downtown Palo Alto. This station is a critical connection for transit vehicles and is served by VTA, SamTrans, and Stanford University Marguerite shuttles.

Figure 3-12: University Avenue Grade Separation

Source: Google Earth 2016

The grade separation caters primarily to vehicular traffic, with four lanes and no Class II bicycle lanes, however there is adequate pedestrian access through the underpass and cyclists are permitted on University Avenue (Figure 3-13 and Figure 3-14). Currently, traffic volumes along University Avenue remain relatively manageable at 19,000 ADT. Opportunities exist to improve the underpass as “gateway” by enhancing wayfinding and placemaking strategies, as well as creating safer bicyclist and pedestrian passage through the underpass.

Figure 3-13: University Avenue Underpass, Looking West

Source: Google Earth 2016

Figure 3-14: University Avenue Underpass, Looking East

Source: Google Earth 2016

3.4.3 Homer Avenue

Completed in 2005 for $4.1 million, the Homer Avenue underpass (Figure 3-15 and Figure 3-16) connects Homer Avenue residential communities to the Embarcadero bike path that runs parallel to the Caltrain tracks. The pedestrian and bicycle underpass is a high-quality and fully accessible crossing. The Palo Alto Medical Foundation is also located west of the crossing, and thus the tunnel was designed with ramp users in mind (shown in Figure 3-17). There are minor opportunities for improvement, including increasing visibility from the tunnel and enhancing the safety of Alma Street crossings.

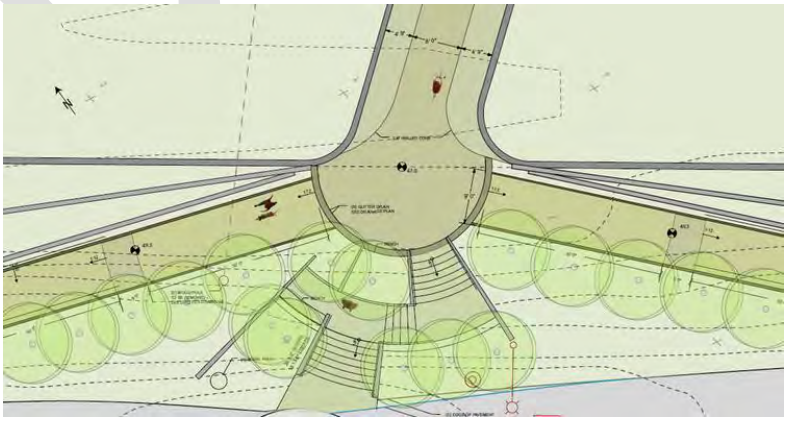
Figure 3-15: Homer Avenue Tunnel, Looking East

Source: Google Earth 2016

Figure 3-16: Homer Avenue and Alma Street Bike and Pedestrian Undercrossing

Source: Google Earth 2016

Figure 3-17: Homer Avenue Undercrossing Design



Source: Steven Grover & Associates

3.4.4 Embarcadero Road

The Embarcadero Road grade-separated crossing (shown in Figure 3-18) allows for vehicular, pedestrian, and bicycle access. Its proximity to the Palo Alto High School, the Palo Alto School District, Stanford University, and neighborhood retail center, Town & Country Village, make it a popular route for pedestrian and bicycle traffic during peak hours. Currently, average daily traffic volumes can reach up to 25,000 vehicles per day. While commuters see the benefits of this safe railroad underpass, some pedestrian and vehicle conflicts in the Alma Street interchange remain. At this point, Alma Street transitions from a high-speed arterial to a neighborhood street.

Figure 3-18: Embarcadero Grade Separation

Source: Google Earth 2016

3.4.5 Seale Avenue

The Seale Avenue grade-separated crossing was proposed by the BPTP 2012 to connect Peers Park with the northeastern neighborhoods and create a link between the east-west bikeways along Park Boulevard and Stanford Avenue across Caltrain. If established, the connection could trigger the implementation of Seale Avenue as a bicycle boulevard and further enhance safe access to the schools and parks along these routes.

Figure 3-19: Seale Ave Proposed Bike/Ped Crossing

Source: Google Earth 2016

3.4.6 California Avenue

The California Avenue grade-separated pedestrian/bicycle underpass allows for access under the railroad just northwest of the California Avenue Caltrain Station (Figure 3-20). The existing tunnel is not ADA accessible and the tunnel itself is dark and narrow. Widening the tunnel and improving the tunnel lighting may increase visibility and meet ADA standards while potentially mitigating the risk of bicycle-pedestrian conflicts.

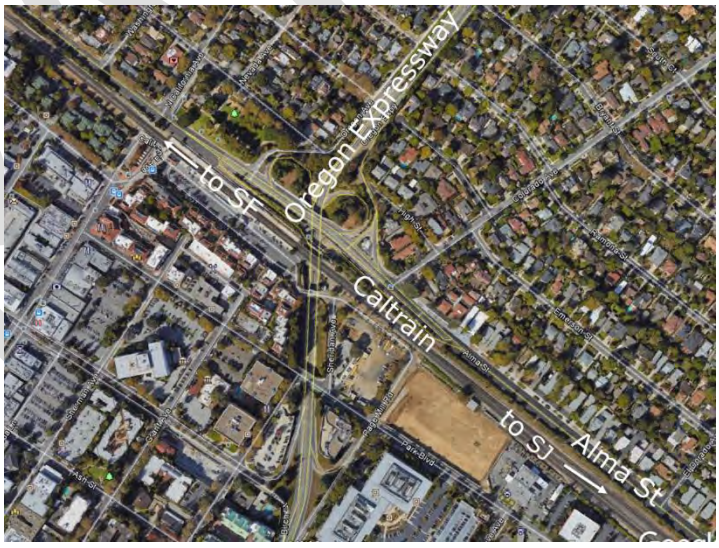
Figure 3-20: California Ave Bike/Ped Crossing

Source: Google Earth 2016

3.4.7 Oregon Expressway

The existing Oregon Expressway grade separation, shown in Figure 3-21, allows for vehicular and bicycle crossings under both the railroad and Alma Street. The Oregon Expressway is a high-volume arterial currently carrying an average daily traffic volume of 31,000 vehicles per day, and the Alma Street interchange poses some minor pedestrian and vehicular conflicts. In addition, this particular underpass has been prone to flooding during rainy seasons due to issues with the drainage system.

Figure 3-21: Oregon Expressway Grade Separation



Source: Google Earth 2016

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Bicycles are permitted to travel through Oregon Expressway, but the fast-moving traffic along Oregon Expressway and the lack of Class II bicycle lanes within the 4-lane underpass may encourage bicyclists to seek an alternate route.

Figure 3-22: Oregon Expressway Underpass, Looking West

Source: Google Earth 2016

Figure 3-23: Oregon Expressway Underpass, Looking East

Source: Google Earth 2016

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3.4.8 Loma Verde Avenue

The planned pedestrian and bicycle underpass at Loma Verde Avenue is in its early conceptual phase. It is predominantly surrounded by residential uses. The intersection at Alma Street is unsignalized and crosswalks are not marked. The nearest railroad crossing is Meadow Drive to the south and Oregon Expressway to the north.

Figure 3-24: Loma Verde Avenue

Source: Google Earth 2016

3.4.9 San Antonio Road

The San Antonio Road grade separation allows for vehicular travel over the railroad tracks. Most of the separation falls within the City of Mountain View; however, a portion of the San Antonio Road overpass falls within the City of Palo Alto, as shown in Figure 3-25. The San Antonio Caltrain Station lies less than 500 feet southeast of the crossing and is surrounded by a mix of commercial offices, educational facilities, and medium-density residential communities. Pedestrians and bicyclists are prohibited on the San Antonio Road overpass; however, they may access the opposite side of the railroad tracks via the San Antonio Caltrain Station. The current high volume of average daily traffic, approximately 36,000 vehicles per day, may be intimidating to pedestrians and bicyclists on the surrounding streets. Opportunities exist to improve connectivity at this grade separation by adding a new bicycle crossing, although special attention should be paid to conflicts between vehicles, pedestrians, and bicycles in the area.

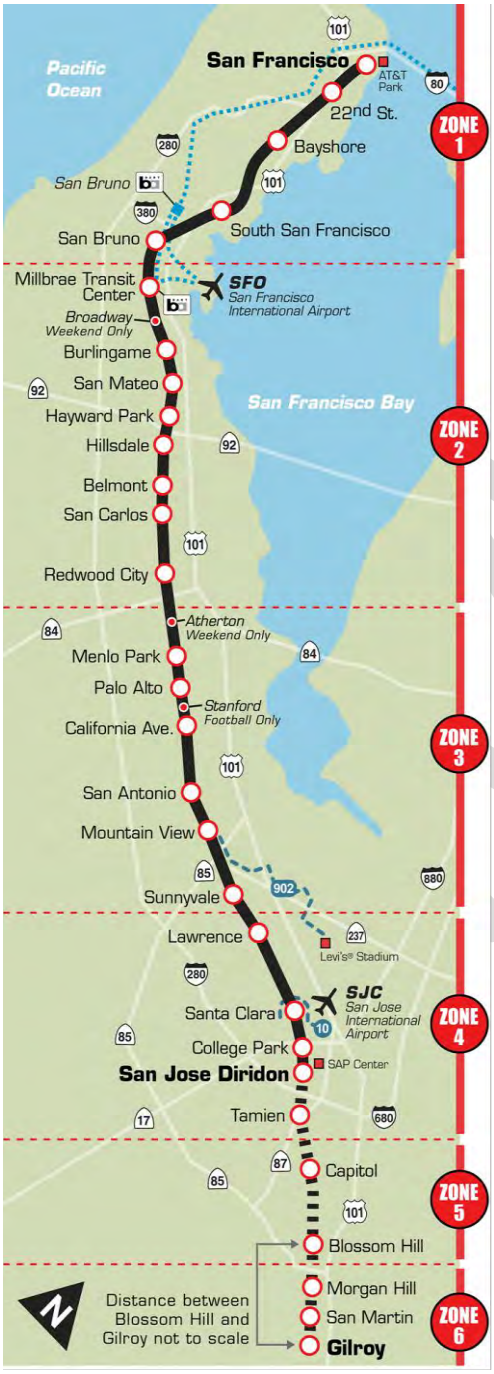
Figure 3-25: San Antonio Road Grade Separation

Source: Google Earth 2016

4 Caltrain

4.1 Caltrain Operations

Figure 4-1: Caltrain System Map



Source: Caltrain Website 2017

Since 1992, the Peninsula Corridor Joint Powers Board (PCJPB) has provided commuter rail, Caltrain service along the San Francisco Peninsula, from San Francisco 4th and King to San Jose Diridon and Gilroy stations, as illustrated in Figure 4-1.

In 2016, Caltrain service carried 62,416 riders on an average weekday, which represented a 7.2 percent increase from 2015 ridership, an 83 percent increase since 2010, and a 161 percent increase compared to ridership in 2004. Most riders continue to travel during peak commute hours, with 9.6 percent increase from 29,143 riders in 2015 to 31,948 in 2016. Caltrain also saw a 3.8 percent growth in reverse peak riders, from 18,842 in 2015 to 19,564 in 2016. Since 2010, Caltrain has experienced significant ridership growth, as seen in Figure 4-2.

Caltrain currently operates 92 weekday trains, 36 Saturday trains, and 32 Sunday trains. Palo Alto has two Caltrain stations that operate seven days per week: the Palo Alto station is located at 95 University Avenue, and the California Avenue station is located at 101 California Avenue. Additionally, there is a station at 100 Embarcadero Road for Stanford University football games only.

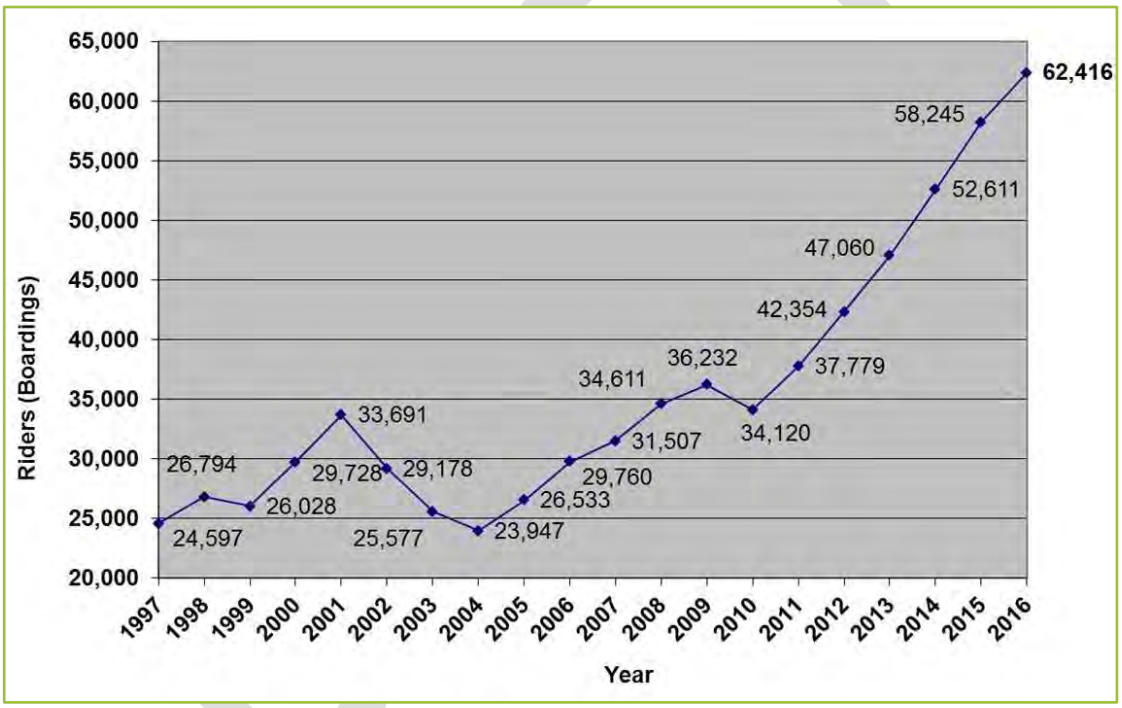
There are a total of 42 rail and highway at-grade crossings between Mission Bay Drive (San Francisco) on the north and Virginia Ave (San Jose) on the south. Caltrain operations are summarized below.

Table 4-1: Caltrain Operations

Trains Per Weekday	92 trains per weekday (46 trains in each direction)
Express Trains	22 express trains (11 trains in each direction)
Max Speed	79 mph
Termini	San Francisco and San Jose
Special Event Trains	Sporting events: Giants, Sharks, Stanford Football, etc.
Freight	Union Pacific Railroad: up to 6 trains per day during non-peak hours and evenings
Other Tenant Railroads	Altamont Commuter Express, Capital Corridor, and Amtrak West operate between Santa Clara and Tamien Stations

Source: Caltrain Website 2017

Figure 4-2: Change in Caltrain Average Weekday Ridership 1997-2016



Source: Caltrain Annual Ridership 1997-2016

4.1.1 Caltrain Stations

Within the City of Palo Alto, there are two Caltrain stations and one special event station. The Palo Alto Caltrain Station has the second highest average weekday ridership (AWR) within the Caltrain system, as shown Table 4-2. Between 2015 and 2016, ridership at the Palo Alto Caltrain Station increased by over three percent over the same period.

Table 4-2: Average Weekday Ridership for Major Caltrain Stations

Station	2015 AWR	% of Total AWR	2016 AWR	% of Total AWR	% Increase
San Francisco*	13,571	23.3%	14,769	23.7%	8.8%
Palo Alto*	7,197	12.4%	7,424	11.9%	3.2%
San Jose Diridon*	4,160	7.1%	4,712	7.5%	13.3%
Mountain View*	4,570	7.8%	4,659	7.5%	1.9%
Redwood City*	3,233	5.6%	3,814	6.1%	18.0%
Millbrae*	3,536	6.1%	3,606	5.8%	2.0%
Sunnyvale+	2,881	4.9%	3,190	5.1%	10.7%
Hillsdale+	2,706	4.6%	2,958	4.7%	9.3%
San Mateo+	2,061	3.5%	2,179	3.5%	5.7%
Menlo Park+	1,762	3.0%	1,796	2.9%	1.9%
Total	**45,677**	**78.4%**	**49,107**	**78.7%**	**7.5%**

Source: Caltrain Ridership Counts 2015-2016
*Baby Bullet station served by all express train service
+Served by some express trains

The Palo Alto Caltrain Station is served by 43 trains each weekday, with 11 of these being "baby bullet" trains with limited stop service through the corridor. The Caltrain schedule for trains stopping at the Palo Alto and California Ave Stations during in the northbound and southbound directions is included in Appendix B – Caltrain Weekday Train Schedule.

Palo Alto Caltrain Station

The **Palo Alto Caltrain Station** provides 178 bike racks and indoor bicycle parking for up to 96 bikes at the Bikestation, which offers 24-hour key access, bike repairs, accessory sales, and a changing room. Paid parking is available for up to 389 vehicles. Service headways vary during the peak period with trains coming every 10-30 minutes, and Baby Bullet trains every 20-30 minutes; off-peak service is hourly. Transit connections from this station can be made to SamTrans (Lines ECR, 280, 281, 297, and 397), shuttles (Deer Creek, Stanford Marguerite, and Crosstown/ Embarcadero), and VTA (Routes 22, 35, 522, DB Express). The Palo Alto Station has the second highest Caltrain ridership, following San Francisco, accounting for 11.9 percent in 2016.

Figure 4-3: Palo Alto Caltrain Station

Source: Jeremiah Cox, 2014

California Avenue Caltrain Station

The **California Ave Caltrain Station** provides 33 bike racks, paid parking for up to 185 vehicles, and 42 bike lockers, although some lockers were removed recently as part of the California Avenue Streetscape Improvements Project. There was an average of 1,628 weekday passenger boardings at California Avenue Caltrain Station in February 2016, which represents an increase of 4.8 percent over the previous year in the same period.[6] Passengers can connect to VTA bus route 89 at the station or walk ½-mile to El Camino Real to connect with VTA routes 22, 522, and the Dumbarton (DB) Express.

Figure 4-4: California Ave Caltrain Station

Source: Jeremiah Cox, 2014

Stanford Caltrain Station

The **Stanford Caltrain Station** is located at Embarcadero Road and Alma Street, in between Palo Alto Station and California Ave Station, and is utilized only during Stanford football game days. There are two side platforms with pedestrian ramps leading below to Embarcadero Road. The Stanford Stadium is located within a ½-mile walk from the station platform.

Figure 4-5: Stanford Caltrain Station

Source: Jeremiah Cox, 2014

4.2 Grade Crossing Inventory Checklist from Caltrain Hazard Analysis

Caltrain produces inventory summaries of all rail crossings along their corridor. Table 4-3 and Table 4-4 present summary sheets for the grade crossings within the Study Area.

[6] Caltrain 2016 Annual Passenger Counts

Table 4-3: At-Grade Crossing Intersection Inventory

Street Name	Palo Alto Ave	Churchill Ave	Meadow Dr	Charleston Road
Milepost	29.76	31.01	33.00	33.33
Emergency Notification Sign Installed	Yes	Yes	Yes	Yes
Railroad Operating Company	XTAS	XTAS	XTAS	XTAS
Total Trains Per Day	91	96	94	93
Passenger Trains Per Day	92	92	92	92
Gate Down (secs)	43 (25-75)	39 (30-78)	39 (20-74)	40 (22-76)
Total Switching Trains	2	0	0	0
Total Daylight Trains (6AM-6PM)	65	65	65	65
Passenger Max Speed	79	79	79	79
Freight Max Speed	50	50	50	50
Typical Train Speed Range Over Crossing	40-79 mph	40-79 mph	40-79 mph	40-79 mph
Number of Tracks	2	2	2	2
Train Detection	Constant Warning Time	Constant Warning Time	Constant Warning Time	Constant Warning Time
Roadway Classification	Urban Other Principal	Urban Collector	Urban Collector	Urban Minor Arterial
Number of Traffic Lanes	2	2	2	2
Posted Speed Limit	25 mph	25 mph	25 mph	25 mph
2017 ADT (veh/day)	16,200	9,200	8,900	17,900
Transit Crossing Per Day	33	7	11	45
School Bus Crossing Per Day	0	64	48	20
2017 Heavy Trucks Percentage	<1%	<1%	<1%	<1%
Other RR Operators Over Track at Crossing	Union Pacific	Union Pacific	Union Pacific	Union Pacific

Source: 2017 ADT data from February 2017, as provided by City of Palo Alto; All other data from the Grade Crossing Hazard Analysis Final Report, Caltrain, 2016

Table 4-4: At-Grade Crossing Intersection Inventory

Street Name	Palo Alto Ave		Churchill Ave		Meadow Dr		Charleston Road	
	#	Existing	#	Existing	#	Existing	#	Existing
Vehicle Gates	2	✓	2	✓	2	✓	2	✓
Pedestrian Guardrails	2	✓	4	✓	4	✓	4	✓
Sidewalk	-	✓	-	✓	-	✓	-	✓
RR Advance Warning Signs (W10-1)	4	✓	3	✓	3	✓	3	✓
24" Stopline Pavement Markings	2	✓	2	✓	2	✓	2	✓
R&R Pavement Markings	2	✓	6	✓	2	✓	9	✓
12" Pedestrian Delineation Line	-	✓	-	✓	-	✓	-	✓
Advanced Signal Preemption	None		Advanced Preemption		Advanced Preemption		Simultaneous Preemption	

Source: Grade Crossing Hazard Analysis Final Report, Caltrain, 2016

4.3 Caltrain Capital Projects

The information on the following Caltrain capital projects was primarily sourced from the February 2016 Caltrain Grade Crossing Hazards Analysis.

4.3.1 Signal Preemption Improvement Project

The Signal Preemption Improvement Project will upgrade the interface between the Caltrain grade crossing warning system and the traffic signal control system at five grade crossings in three cities and the County of Santa Clara. New traffic signal equipment and roadway improvements will be constructed at Brewster Avenue in Redwood City, and Rengstorff Avenue and Castro Street in Mountain View. Electrical upgrades and improvements to the pedestrian crossing system will be constructed at Churchill Avenue and East Meadow Drive in Palo Alto. At all locations, the preemption interface between the grade crossing warning system and traffic signal control system will be upgraded to a new 10-wire preemption circuit to provide improved preemption safety at the grade crossings. The upgraded systems will provide increased capability to clear vehicle traffic and exchange information between systems, in addition to improving ADA access for pedestrians and normal traffic operation of the intersections.

4.3.2 CBOSS Positive Train Control System

Caltrain has developed specifications for an enhanced Positive Train Control (PTC) system, referred to as Communications Based Overlay Signal System (CBOSS), which incorporate the essential functions of positive train separation, over-speed enforcement, and roadway worker protection, plus other capabilities specifically designed to improve grade crossing performance. CBOSS is a vital overlay of the existing wayside signal system, providing a transition from Caltrain's Centralized Traffic Control (CTC) block signal system. In addition, CBOSS will allow Caltrain to reduce the peak minimum operating headway to five minutes, greatly increasing system capacity. CBOSS is specified to be compliant with the requirements of the Rail Safety Improvement Act of 2008 and all relevant regulations provided by 49 CFR 236. Furthermore, Caltrain is participating in discussions with the interchanging railroads to achieve a PTC system solution that is interoperable with freight operator systems.

Caltrain has been working to implement PTC on its corridor for several years to achieve the resulting safety and performance benefits. CBOSS will prevent over-speed-related derailments and collisions between trains under normal "signaled moves". When PTC enforcement cannot be sustained, CBOSS provides contingency operating modes that allow operations to be conducted with reduced risk by enabling the train engineer to revert to CTC operations through the temporary use of the wayside signals. CBOSS also provides a "Restricted Manual" operating mode to enhance safety when the wayside signal system is unable to display permissive signals. While in Restricted Manual mode, CBOSS enforces the Restricted Speed to ensure that collisions at elevated speed do not occur.

The CBOSS system will provide a crossing inhibit function, whereby a train which is making a station stop will not activate the grade crossing warning system, including advance preemption, as the train is approaching the station with an enforced stop short of the crossing. The CBOSS system will then provide an operator initiated start to the crossing and traffic signal preemption circuits prior to departing the station.

4.3.3 Peninsula Corridor Electrification Project (PCEP)

The Peninsula Corridor Electrification Project (PCEP) would electrify the Caltrain Corridor from San Francisco's 4th and King Station to the Tamien Station in San Jose, convert diesel-hauled to Electric Multiple Unit (EMU) trains, and increase service to up to six Caltrain trains per peak

hour per direction by 2021. Initially, service between San Francisco and San Jose would include a mixed fleet of EMU's and diesel locomotives. Eventually diesel locomotives would be replaced with EMUs over time as they reach the end of their service life. Caltrain's diesel-powered locomotive service would continue to be used to provide service between the San Jose Diridon and Gilroy stations. The PCEP will allow Caltrain to operate quieter, cleaner, more frequent train service to more riders. Increased capacity and improved service will help Caltrain meet increasing ridership demand. Estimated ridership increases for 2020 and 2040 are shown in Table 4-5.

Table 4-5: Estimated Ridership with Proposed Caltrain Electrification Project

Estimated Ridership with the Proposed Project			
	2013	**2020**	**2040**
Existing/No Project	47,000	57,000	84,000
With Project	N/A	69,000	111,000

Source: Caltrain Ridership Technical Memorandum, 2014

4.3.4 PCEP Relation to the High-Speed Rail Project

The electrification system envisioned for the corridor would be configured in such a way that it would support the future operation of California HSR. Twenty-five-kV, 60-Hz single-phase AC electrification would be the power supply system of choice for a steel-wheel-on-steel-rail high-speed train operation. The Caltrain corridor is currently only rated for a maximum of 79 mph and, thus, there would be a need for track and other system upgrades to support higher speeds than at present. The Proposed PCEP includes electrification infrastructure that would first be used by Caltrain and could later be used for high-speed trains. However, the proposed project does not include other improvements necessary for high-speed trains such as platform improvements, high-speed rail maintenance facilities, passing tracks or other Core Capacity projects. The proposed project does not include improvements to support speeds greater than 79 mph or high-speed rail operations on the Caltrain corridor at speeds up to 110 mph. High-speed rail construction and operations would be the subject of a later, separate environmental analysis to be conducted by CHSRA and the Federal Railroad Administration (FRA).

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5 Traffic Operational Analysis

This section describes the existing intersection and roadway traffic operating conditions at the at-grade roadway crossings of the railroad, within the limits of the City of Palo Alto.

5.1 Vehicular Level of Service Methodology and Standards

Level of service (LOS) is a qualitative description of vehicular traffic operating conditions ranging from LOS A, or free-flow conditions with little or no delay, to LOS F, or jammed conditions with excessive delays. The Santa Clara Valley Transportation Authority (VTA) Congestion Management Program (CMP) guidelines dictate the use of the 2000 Highway Capacity Manual (HCM) methodology to analyze intersections. The City of Palo Alto uses the same methodology to evaluate its intersections. The 2000 HCM operations method evaluates signalized intersection operations based on average control delay time for all vehicles at the intersection.

Consistent with operations analysis software used in prior planning studies prepared for the railroad corridor (such as the Peninsula Corridor Electrification Plan Environmental Impact Report, Transportation Chapter, 2015) this study utilized Synchro/SimTraffic 8 software based implementation of the more current 2010 HCM methods for purposes of quantifying traffic operating conditions at the study intersections. Note that the Synchro/SimTraffic software is a widely-recognized software (including by agencies such as Caltrans) that is relatively more reliable for purposes of assessing operational characteristics of closely spaced intersections, including signalized intersections located in close proximity to at-grade railroad crossings.

The City of Palo Alto LOS standard for signalized non-CMP intersections is LOS D or better. For CMP intersections, the City's LOS standard is LOS E or better, meaning that only LOS F is considered unacceptable. The exception is the intersection of Foothill Expressway and Page Mill Road, which has a grade of LOS F and is considered acceptable by VTA. This is because it has operated at LOS F in the 1991 baseline conditions and thus the City of Palo Alto has not adopted the CMP standards for that particular intersection.

The LOS definitions for signalized intersections are shown in Table 5-1. Motor vehicle level of service D and E are typical at intersections in many urban areas where a high volume of vehicles pass through an intersection that is physically constrained by existing adjacent structures.

Table 5-1: LOS Definition for Intersection Control Delay (sec/veh)

LOS	Description	Signal Control	2-Way Stop or All-Way Stop Control
A	Signal progression is extremely favorable. Most vehicles arrive during the green phase and do not stop at all. Short cycle length may also contribute to the very low vehicle delay.	10.0 or less	0 – 10
B	Operations characterized by good signal progression and/or short cycle lengths. More vehicles stop than LOS A, causing higher levels of average vehicle delay.	10.1 to 20.0	> 10 – 15
C	Higher delays may result from fair signal progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, though may still pass through the intersection without stopping.	20.1 to 35.0	> 15 – 25

LOS	Description	Signal Control	2-Way Stop or All-Way Stop Control
D	The influence of congestion become more noticeable. Longer delays may result from the same combination of unfavorable signal progression, long cycle lengths, or high V/C ratios. Many vehicle stops and individual cycle failures are not noticeable.	35.1 to 55.0	> 25 – 35
E	This is considered the limit of acceptable delay. These high delay values generally indicate poor signal progression, long cycle lengths and high V/C ratios. Individual cycle failures occur frequently.	55.1 to 80.0	> 35 – 50
F	This level of delay is considered unacceptable by most drivers. This condition often occurs without oversaturation, that is, when arrival flow rates exceed the capacity of the intersection. Poor progression and long cycle lengths may also be major contributing causes of such delay levels.	Greater than 80.0	> 50

Source: Transportation Research Board, 2000 and 2010

The LOS descriptions in Table 5-1 are framed entirely from the perspective of motor vehicle drivers and their passengers. VTA's Transportation Impact Analysis (TIA) Guidelines require the consideration of other modes of travel when recommending changes to improve an intersection's motor vehicle level of service. Senate Bill 743 created a process to change the way that transportation impacts are analyzed under CEQA and requires an alternative LOS for evaluating transportation impacts. This is described in further detail in Appendix A — Federal, State and Regional Policy and Framework Review.

5.2 Significant Impact Criteria

Significance criteria are used to establish what constitutes an impact at an intersection. The City of Palo Alto uses the same impact criteria as the CMP. A project is deemed to create a significant adverse impact on traffic conditions at a signalized intersection in the City of Palo Alto if for either peak hour:

a. the level of service at the intersection degrades from an acceptable level of service (LOS D or better for non-CMP intersections, and LOS E or better for CMP intersections) to an unacceptable level of service; and
b. the intersection is already operating at an unacceptable level of service (LOS E or F for non-CMP intersections and LOS F for CMP intersections), and the project causes both the average control delay for the critical movements at the intersection to increase by four or more seconds and the critical volume-to-capacity ratio (V/C) to increase by one percent (0.01) or more.

For both CMP and non-CMP intersections, if an intersection is operating at an unacceptable level of service and the change in critical delay is negative (i.e., decreases), a significant impact is said to occur if the project causes the V/C ratio to increase by 0.01 or more. This can occur if the critical movements at an intersection change.

5.3 Traffic Signal Warrant Analysis Criteria

A traffic signal warrant analysis was also completed per criteria contained in the California Manual on Uniform Traffic Control Devices (CA-MUTCD, 2014 Edition, Chapter 4C). The peak-hour volume Warrant 3 (urban areas) analysis was completed as a representative warrant analysis to determine if "significance" should be associated with unsignalized operations. Other signal warrant criteria, including Warrant 9: Intersection Near a Grade Crossing, will also be evaluated for key study intersections where applicable. Note that the CA-MUTCD indicates that

"the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal."

5.4 Traffic Count Data

Intersection turning movement and vehicular traffic volume counts were collected by the City on Thursday, February 16, 2017, under AM peak hour, mid-day peak hour, and PM peak hour conditions, at key study intersections along each of the at-grade crossing corridors. For the purposes of this study, AM peak hour is defined as one hour of peak traffic flow between 7:30 and 9:30 AM on a typical weekday, mid-day peak hour is defined as one hour of peak traffic flow between 2:30 and 4:30 PM on a typical weekday, and PM peak hour is defined as one hour of peak traffic flow between 4:30 and 6:30 PM on a typical weekday.

The intersection traffic counts were obtained at a total of thirteen (13) study intersections listed as follows:

1. Charleston Road / Alma Street
2. Charleston Road / Park Blvd.
3. Charleston Road / Wilkie Way
4. Charleston Road / Wright Place
5. Meadow Drive / Alma Street
6. Meadow Drive / Park Blvd.
7. Meadow Drive / Wilkie Way
8. Meadow Drive / Ramona St.
9. Churchill Avenue / Alma Street
10. Churchill Avenue / Mariposa Ave.
11. Churchill Avenue / Madrono Ave.
12. Palo Alto Avenue / Alma Street
13. Palo Alto Avenue / El Camino Real

contains the raw traffic count data. For a graphical illustration of the existing traffic volumes at the study intersections, refer to **Error! Reference source not found.**.

5.4.1 Intersection Traffic Operations

The Existing Conditions delay and LOS operations for study intersections are summarized in Table 5-2. Note that this table summarizes traffic operating conditions under normal/typical operating conditions within the typical weekday AM, midday and PM peak hour periods at the study intersections when the railroad gates are "open", meaning there is no railroad-related interruption of vehicular traffic flow on the roadway crossings.

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Table 5-2: Existing Conditions: Intersections Level of Service – Typical Operations

#	Study Intersection	Control Type	AM PEAK HOUR			MID-DAY PEAK HOUR			PM PEAK HOUR		
			Delay (sec/veh)	LOS	Signal Warrant Met?	Delay (sec/veh)	LOS	Signal Warrant Met?	Delay (sec/veh)	LOS	Signal Warrant Met?
101	Charleston Rd / Alma St	Signal	40.9	D	-	45.6	D	-	46.6	D	-
102	Charleston Rd / Park Blvd	TWSC	23.5	C	No	19.1	C	No	25.6	D	No
103	Charleston Rd / Wilkie Way	Signal	31.9	C	-	30.4	C	-	31.5	C	-
104	Charleston Rd / Wright Pl	TWSC	15.2	C	No	18.6	C	No	16.4	C	No
105	Meadow Dr / Alma St	Signal	34.2	C	-	33.5	C	-	33.0	C	-
106	Meadow Dr / Park Blvd	TWSC	10.2	B	No	11.0	B	No	10.5	B	No
107	Meadow Dr / Wilkie Way	AWSC	9.6	A	No	10.1	B	No	11.8	B	No
108	Meadow Dr / Ramona St	TWSC	12.4	B	No	13.1	B	No	17.5	C	No
109	Churchill Ave / Alma St	Signal	28.1	C	-	28.9	C	-	27.3	C	-
110	Churchill Ave / Mariposa Ave	TWSC	10.1	B	No	12.5	B	No	13.1	B	No
111	Churchill Ave / Madrono Ave	TWSC	12.0	B	No	13.4	B	No	11.9	B	No
112	Palo Alto Ave / Alma St	TWSC	15.7	C	No	15.8	C	No	19.4	C	No
113	Palo Alto Ave / El Camino Real / Sand Hill Ave	Signal	19.4	B	-	30.1	C	-	48.9	D	-

Notes:

AWSC = All-Way Stop Control, TWSC = Two-Way Stop Control

Operating conditions indicated in this table refer to typical (non railroad pre-empted) signal operations.

For TWSC intersections, worst-case movement/approach delay are reported. For signalized and AWSC intersections, average control delays for the whole intersection are reported. All reported delay and LOS values are computed values from Synchro 8 software.

Signal Warrant = California-MUTCD (November 2014) Chapter 4C 'Peak Hour Warrant 3' (Urban/Rural Areas)

Source: Mott MacDonald, 2017

Intersection Operations during Railroad-related Signal Pre-emption Cycles: Per the Caltrain schedule, currently up to six (6) trains (three northbound trains and three southbound) may traverse the railroad segment across the study at-grade crossings within the "one hour" of AM and PM peak of vehicular traffic demand. Each train arrival will trigger a railroad gate closing, which will impact at least one (1) full signal cycle and up to two (2) cycles at the adjacent Alma Street corridor signalized intersection, therefore up to twelve (12) signal cycles could be impacted in one hour. At a minimum of 100 seconds cycle length, there are approximately 36 signal cycles in a single hour. With up to approximately 12 out of the 36 signal cycles (33 percent of the cycles) impacted by railroad gate closures, the average peak "one hour" intersection delays at the Alma Street signalized study intersections (as reported in Table 5-2) in fact could be significantly higher (by 33 percent or more) should railroad gate closures be factored in the average peak hour delay estimates.

5.4.2 Roadway Traffic Counts and Traffic Operations

The City of Palo Alto provided roadway traffic counts collected from Thursday, February 23, 2017 through Sunday, February 26, 2017 for the following four at-grade roadway crossing segments:

- Charleston Road west of Alma Street
- Churchill Avenue west of Alma Street
- Meadow Drive west of Alma Street
- Palo Alto Avenue west of Alma Street

The count data included continuous 24-hour bi-directional counts recorded at 15-minute intervals. FHWA-definitions based axle-classified count data were also provided for Palo Alto Avenue, Churchill Avenue, and Meadow Drive segments.

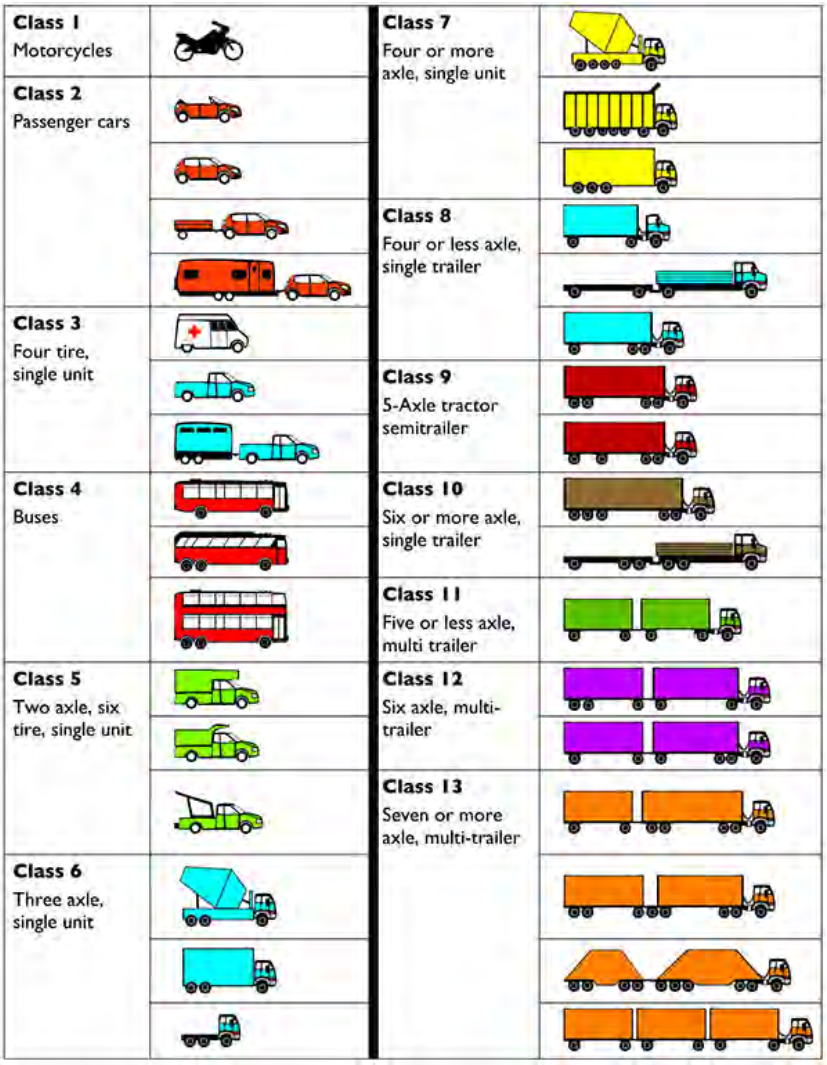
The roadway crossing traffic count data (total of eastbound and westbound directions) is graphically illustrated by time-of-day from Thursday, February 23, 2017 through Sunday, February 26, 2017 and is shown in Figure 5-1.

Figure 5-1: Vehicle Total Counts (Eastbound & Westbound)

Source: City of Palo Alto, 2017

The FHWA axle-classification definitions that were used in the traffic counts provided for this study are illustrated in Figure 5-2.

Figure 5-2: FHWA Vehicle Classifications



Source: Federal Highway Administration, DATE

For the purposes of this report, vehicle classes 5 through 7 are considered light trucks and vehicle classes 8 through 13 are considered heavy trucks in Table 5-3, Table 5-4, and Table 5-5, which depict average weekday and average weekend vehicle counts by type. Vehicle count data by type was not available for the Charleston Road segment west of Alma Street (Table 5-5). Meadow Drive showed the highest rate of truck traffic out of the three available data sets of vehicle type counts despite not having the highest vehicle volume out of the three intersections. Heavy trucks are not permitted on Churchill Avenue, which shows the lowest rate of truck volumes.

Table 5-3: Palo Alto Avenue Railroad Crossing Traffic Volumes

Palo Alto Avenue (west of Alma Street)	FHWA Axle-Class	Weekday ADT			Weekend ADT		
		EB	WB	Total	EB	WB	Total
Motorcycles	1	94	97	**191**	66	72	**138**
Passenger Cars	2	6,286	7,854	**14,140**	5,647	6,687	**12334**
Pick-up Trucks	3	736	964	**1,700**	507	532	**1039**
Buses	4	17	15	**32**	16	10	**26**
Light Trucks	5 thru 7	83	22	**105**	46	16	**62**
Heavy Trucks	8 thru 13	11	10	**21**	6	8	**14**
Total ADT		**7,227**	**8,962**	**16,189**	**6,288**	**7,325**	**13,613**
% Heavy Trucks		0.15%	0.11%	0.13%	0.10%	0.11%	0.10%

Notes:

ADT = Average Daily Traffic (estimated annual average) EB = Eastbound WB = Westbound

The weekday ADT reported herein are based on counts from Thursday, February 23, 2017

The weekend ADT reported herein are based on counts from Saturday, February 25, 2017

FHWA Axle-Class 3 includes Emergency Vans

Source: City of Palo Alto, 2017

Table 5-4: Churchill Avenue Railroad Crossing Traffic Volumes

Churchill Avenue (west of Alma Street)	FHWA Axle-Class	Weekday ADT			Weekend ADT		
		EB	WB	Total	EB	WB	Total
Motorcycles	1	43	46	**89**	34	19	**53**
Passenger Cars	2	3,574	4,743	**8,317**	3,188	3,895	**7,083**
Pick-up Trucks	3	273	404	**677**	192	200	**392**
Buses	4	18	26	**44**	10	2	**12**
Light Trucks	5 thru 7	29	16	**45**	12	5	**17**
Heavy Trucks	8 thru 13	9	7	**16**	4	2	**6**
Total ADT		**3,946**	**5,242**	**9,188**	**3,440**	**4,123**	**7,563**
% Heavy Trucks		0.23%	0.13%	0.17%	0.12%	0.05%	0.08%

Notes:

ADT = Average Daily Traffic (estimated annual average) EB = Eastbound WB = Westbound

The weekday ADT reported herein are based on counts from Thursday, February 23, 2017

The weekend ADT reported herein are based on counts from Saturday, February 25, 2017

FHWA Axle-Class 3 includes Emergency Vans

Source: City of Palo Alto, 2017

Table 5-5: Meadow Drive Railroad Crossing Traffic Volumes

Meadow Drive (west of Alma Street)	FHWA Axle-Class	Weekday ADT			Weekend ADT		
		EB	WB	Total	EB	WB	Total
Motorcycles	1	103	169	**272**	67	104	**171**
Passenger Cars	2	3,522	4,076	**7,598**	3,052	3,365	**6,417**
Pick-up Trucks	3	475	464	**939**	401	299	**700**
Buses	4	13	12	**25**	6	10	**16**
Light Trucks	5 thru 7	17	28	**45**	6	10	**16**
Heavy Trucks	8 thru 13	7	15	**22**	4	7	**11**
Total ADT		**4,137**	**4,764**	**8,901**	**3,536**	**3,795**	**7,331**
% Heavy Trucks		0.17%	0.31%	0.25%	0.11%	0.18%	0.15%

Notes:

ADT = Average Daily Traffic (estimated annual average) EB = Eastbound WB = Westbound

The weekday ADT reported herein are based on counts from Thursday, February 23, 2017

The weekend ADT reported herein are based on counts from Saturday, February 25, 2017

FHWA Axle-Class 3 includes Emergency Vans

Source: City of Palo Alto, 2017

Table 5-6: Charleston Road Railroad Crossing Traffic Volumes

Charleston Road (west of Alma Street)	FHWA Axle-Class	Weekday ADT			Weekend ADT		
		EB	WB	Total	EB	WB	Total
Total ADT		9,258	8,603	17,861	7,325	6,617	13,942

Notes:

ADT = Average Daily Traffic (estimated annual average) EB = Eastbound WB = Westbound

The weekday ADT reported herein are based on counts from Thursday, February 23, 2017

The weekend ADT reported herein are based on counts from Saturday, February 25, 2017

FHWA Axle-classification data was not available for this segment.

Source: City of Palo Alto, 2017

5.4.3 Roadway Intersection Collision Data

For study intersections along Alma Street, roadway collision data from the Statewide Integrated Traffic Records System (SWITRS) database was compiled and provided by the City of Palo Alto. The SWITRS is a statewide database maintained by the California Highway Patrol (CHP) that collects and processes accident data for use by local and state agencies throughout the state.[7] Table 5-7 summarizes the most recent collision reports from 2011 to 2015. While Palo Alto Avenue experiences relatively high traffic volume, it shows the least number of collisions out of the four intersections.

[7] California Highway Patrol, SWITRS

Table 5-7: Study Area Intersection Roadway Collision Data 2011-2015

	Alma St & Palo Alto Ave	Alma St & Churchill Ave	Alma St & Meadow Dr	Alma St & Charleston Rd
Total Collisions	**6**	**30**	**25**	**27**
Injury Collisions	**1**	**10**	**11**	**10**
Fatal Collisions	**0**	**0**	**0**	**1**

Source: SWITRS data provided by City of Palo Alto, 2017

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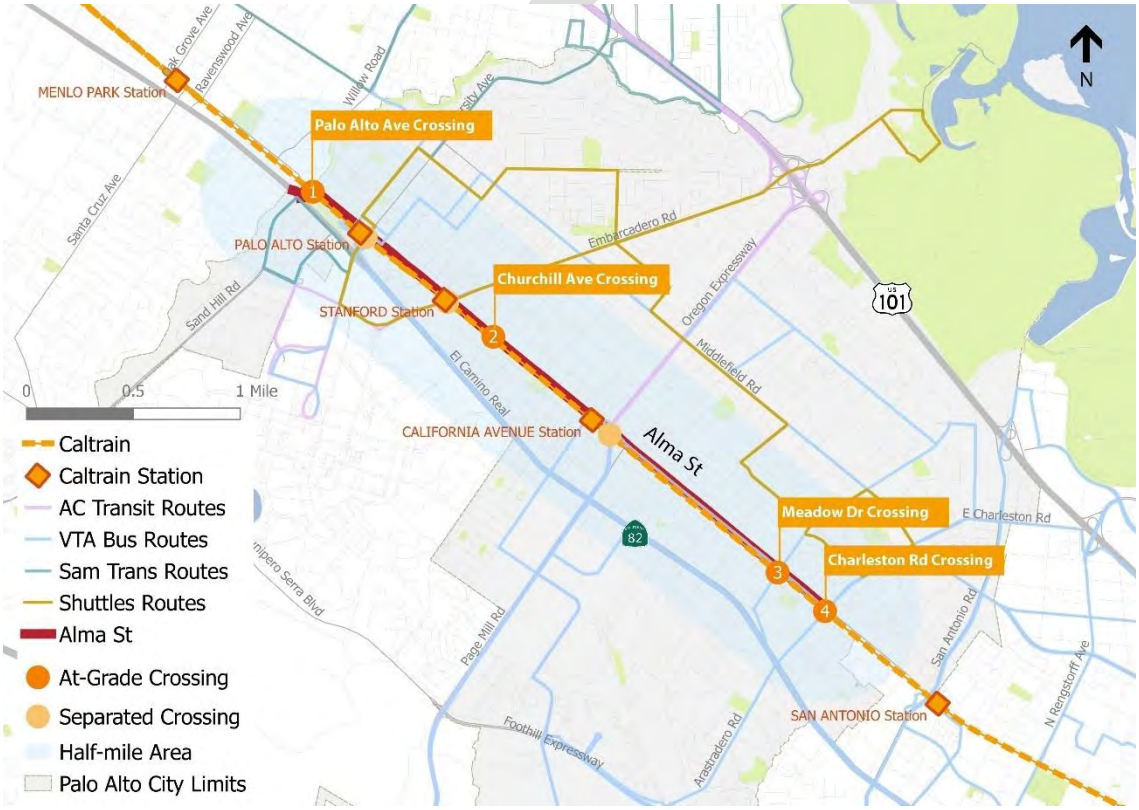
6 Other Transit Services

6.1 Overview

In addition to Caltrain, Santa Clara Valley Transportation Authority (VTA), San Mateo County Transit District (SamTrans), and Alameda-Contra Costa Transit (AC Transit) all provide transit service to and from Palo Alto, as illustrated in Figure 6-1. Additionally, the City of Palo Alto operates a free, public shuttle service to points throughout the City, and Stanford University's Marguerite Shuttle provides free public bus service to destinations on the Stanford campus and at the Stanford Shopping Center. Details of the service provided by each transit operator are described below. Furthermore, the Palo Alto Transit Center, located on University Avenue between El Camino Real and Alma Street, is a regional transit hub, providing numerous connections to neighboring communities and the wider Bay Area.

Figure 6-1: Exiting Transit Services Map



6.2 Santa Clara Valley Transportation Authority

The VTA provides bus service throughout the cities of Campbell, Cupertino, Fremont, Gilroy, Los Altos, Los Altos Hills, Milpitas, Morgan Hill, Mountain View, Palo Alto, San Jose, San Martin, Santa Clara, Saratoga, Sunnyvale, as well as Stanford. The VTA operates 14 bus routes in Palo Alto as listed below, providing connections to VTA light rail, Caltrain, Altamont Corridor Express (ACE), and AMTRAK Capitol Corridor. Times vary by weekday and weekend on each route; however, each route generally operates from the early morning hours to evening

hours, with some routes operating overnight. A sample of the routes serving the City is illustrated in Figure 6-2.

Figure 6-2: VTA Bus Route Map - Palo Alto

Source: Santa Clara Valley Transportation Authority, 2017

- **Line 22** provides service between the Palo Alto Transit Center and the Eastridge Transit Center via El Camino Real
- **Line 32** provides service between the San Antonio Shopping Center and the Santa Clara Transit Center
- **Line 35** provides service between Downtown Mountain View and the Stanford Shopping Center
- **Line 88/L/M** provides varying service between the Palo Alto Veterans Hospital and Middlefield & Colorado
- **Line 89** currently provides service between the California Avenue Caltrain Station and the Palo Alto Veterans Hospital, but will be eliminated due to duplicated service
- **Line 101** provides express bus service between Camden & Highway 85 and Palo Alto
- **Line 102** provides express bus service between South San Jose and Palo Alto
- **Line 103** provides express bus service between the Eastridge Transit Center and Palo Alto
- **Line 104** provides express bus service between the Penitencia Creek Transit Center and Palo Alto
- **Line 182** provides express bus service between Palo Alto and IBM & Bailey Avenue

- **Line 522** provides limited stop bus service between the Palo Alto Transit Center and the Eastridge Transit Center
- **Line 824** provides service between the Great America ACE Station and Meadow Drive & Meadow Circle

6.3 SamTrans

SamTrans operates 73 bus routes throughout San Mateo, San Francisco, and Santa Clara counties, including parts of Palo Alto. SamTrans regularly provides more than 1,000 trips per day using a fleet of 296 fixed-route revenue vehicles, comprised of 55 articulated coaches, 237 standard coaches, and 4 mini coaches. Additionally, SamTrans operates a fleet of 83 paratransit vehicles, including buses, vans, and sedans. SamTrans Lines 280, 281, 297, 397 provide service to Palo Alto residents. A description of each route is provided below.

- **Line 280** provides eastbound and westbound service between the Stanford Shopping Center, Palo Alto Transit Center, Manhattan Avenue/O'Conner Street, Wisteria Drive/Camellia Drive, and Purdue Avenue/Fordham Street.
- **Line 281** provides eastbound and westbound service between Onetta Harris Community Center, Newbridge Street/Willow Road, Bay Road/University Avenue, University Avenue/Woodland Avenue, Palo Alto Transit Center, and Stanford Shopping Center.
- **Line 297** provides northbound and southbound service between Redwood Transit Center, Middlefield Road/5th Avenue, Bay Road/University Avenue, and the Palo Alto Transit Center.
- **Line 397** provides northbound and southbound service to and from San Francisco, including the San Francisco International Airport, as well as the Millbrae Transit Center, Burlingame, Redwood City Transit Center, and the Palo Alto Transit Center.
- Line ECR provides northbound and southbound service between the Daly City BART train station and the Palo Alto Transit Center along El Camino Real.

6.4 AC Transit

The Alameda-Contra Costa Transit District (AC Transit) provides weekday bus service on Line U between the Fremont Bay Area Rapid Transit (BART) train station and Stanford University. Six weekday trips are offered and Table 6-1 shows the times for only the major stops along the route.

Figure 6-3: AC Transit Line U

Source: AC Transit, 2017

Table 6-1: AC Transit - Line U Schedule

Stanford Oval	Stanford Shopping Center	Embarcadero Road & Wildwood Lane	Ardenwood Park & Ride	Fremont/ Centerville Amtrak	Fremont BART
245p	253p	304p	329p	342p	352p
345p	353p	404p	429p	442p	452p
415p	423p	434p	459p	512p	522p
445p	453p	504p	529p	542p	552p
515p	523p	534p	559p	612p	622p
555p	603p	614p	639p	652p	702p

Source: AC Transit, 2017

6.5 Shuttles

The City of Palo Alto, along with transit service providers such as VTA and Caltrain, and major community stakeholders such as Stanford University and others, offer a range of shuttle services within the City. All shuttles are wheelchair accessible, equipped with bicycle racks on the exterior of the vehicle, and can accommodate up to two conventional bicycles.

The Embarcadero Shuttle

Operated by the Caltrain Commuter Shuttle Program, the Embarcadero Shuttle provides peak hour service between the University Avenue Caltrain Station and the Baylands Business Parks east of Highway 101/Embarcadero. Local schools and community facilities are also served along the route including Palo Alto High School and Castilleja School. The Embarcadero Shuttle runs approximately every 20 minutes, Monday through Friday from the Palo Alto Caltrain Station to the Embarcadero/Baylands during peak commute hours and is coordinated with the Caltrain schedule.

The Crosstown Shuttle

Operated by MV Transportation, Inc. and managed by the City of Palo Alto, the Crosstown Shuttle connects the University Avenue/Downtown to South Palo Alto at Charleston Road. The Crosstown Shuttle traverses several residential neighborhoods, schools, senior residences, libraries, recreation centers, and commercial districts helping to link public service areas within the community. A Special School run operates during the morning and afternoons to help encourage alternative transportation options for students.

Marguerite Shuttle

Operated by Stanford University, the Marguerite Shuttle service is free and open to the public. The main shuttle lines traverse the campus Monday through Friday all year (except university holidays). Evening and weekend services are available from mid-September to mid-June with Lines N, O, OCA, and Shopping Express. The Marguerite service to the Caltrain stations are made possible, in part, by grants from the BAAQMD Transportation Fund for Clean Air and the PCJPB. Local businesses and organizations also contribute financially to the service.

DRAFT

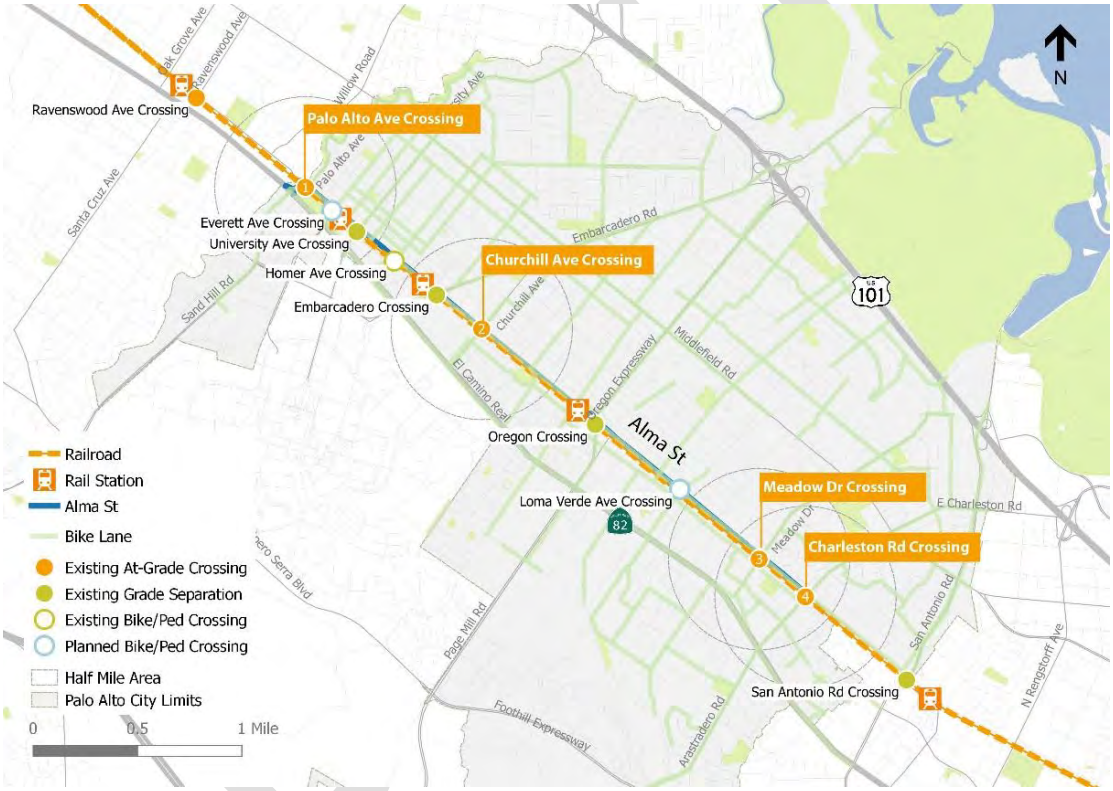
7 Bicycle and Pedestrian Network

7.1 Overview

In the 2000s, the City of Palo Alto released the 2003 Bicycle Transportation Plan, improvements through the Safe Routes to School program, and land use planning reforms, which all encouraged the creation of a bicycle and pedestrian friendly built environment. The existing Bicycle and Pedestrian network in the City is largely based on of the recommendations of the 2012 City of Palo Alto Bicycle + Pedestrian Transportation Plan.

The existing bicycle network in the Study Area is shown in Figure 7-1. All four at-grade crossings are currently connected to roadways with bike lanes.

Figure 7-1: Existing Bicycle Network within Study Area



7.2 2012 City of Palo Alto Bicycle + Pedestrian Transportation Plan

The 2012 City of Palo Alto Bicycle and Pedestrian Transportation Plan (BPTP) updates the initiatives outlined in the 2003 Bicycle Transportation Plan and provides strategic guidance to the public and private non-motorized transportation investment in facilities and related programs. The Palo Alto BPTP not only reaffirms city-wide goals of increasing pedestrian and bicycle usage over the next decade (see Table 7-1), it also takes into account relevant City plans, surrounding community plans, and state and regional bicycle and pedestrian plans to create a larger picture.

The Palo Alto BPTP includes five key objectives which are extensions of the transportation element of the City of Palo Alto Comprehensive Plan, to provide a focus on non-motorized

transportation modes. Each objective includes its rationale, consistency with the Comprehensive Plan, key strategies of implementation and benchmarks to measure progress.

Table 7-1: City of Palo Alto Bicycle + Pedestrian Transportation Plan Objectives

Objectives
1. Double the rate of bicycling for both local and total work commutes by 2020 (to 15% and 5%, respectively).
2. Convert discretionary vehicle trips into walking and bicycling trips in order to reduce City transportation-related greenhouse gas (GHG) emissions 15% by 2020.
3. Develop a core network of shared paths, bikeways, and traffic-calmed streets that connects business and residential districts, schools, parks, and open spaces to promote healthy, active living.
4. Plan, construct, and maintain 'Complete Streets' that are safe and accessible to all modes and people of all ages and abilities.
5. Promote efficient, sustainable, and creative use of limited public resources through integrated design and planning.

Source: 2012 City of Palo Alto Bicycle + Pedestrian Transportation Plan

7.3 Safe Routes to Schools

The Safe Routes to Schools program is a collaborative effort between the City of Palo Alto and the Palo Alto Unified School District (PAUSD), with the goal to improve safety for school commuters and to reduce school commute-related congestion on city streets. Approximately 14 percent of Palo Alto's students walk to school daily, while 4,000 students from the PAUSD bike to school. The Safe Routes to Schools program produced a series of Walk and Roll maps that outline suggested bicycle and pedestrian paths around a one-mile radius around a school within PAUSD, as described in Section 2.1.5.

7.4 Bicycle Facilities

The Palo Alto Caltrain Station has had a Bikestation since 2007 which utilizes a former baggage building at the historical train depot. Bikestations offer 24-hour indoor, secure bike parking facilities. Some locations include restrooms, showers, and/or changing rooms and repair and rental services. The Palo Alto Bikestation provides bicycle parking for 96 bikes, recreational rentals, bike repairs, accessory sales, a changing room, and an outdoor seating area with concessions.

The Palo Alto Caltrain Station also has bikeshare, provided by Bay Area BikeShare. This is a shared use service for passengers who wish to travel short distances with a bike. Bicycles can be rented from this station and returned to another BikeShare dock within the area. This program will soon transition into Ford GoBike, which is set to launch June 2017. The San Antonio Caltrain Station is also a bikeshare station.

In addition, the three Caltrain stations in Palo Alto provide ample bicycle racks and locker spaces (detailed in Table 7-2: Bicycle Facilities) which can be rented and reserved in advance. The locker spaces at Palo Alto and California Ave Caltrain Stations are typically fully reserved.

Table 7-2: Bicycle Facilities

Palo Alto	California Ave	San Antonio
178 Bicycle Rack Spaces	33 Bicycle Rack Spaces	18 Bicycle Rack Spaces
94 Locker Spaces	42 Locker Spaces	38 Locker Spaces

Appendix A — Federal, State and Regional Policy and Framework Review

Federal

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) of 1990 provides comprehensive rights and protections to individuals with disabilities. The goal of the ADA is to assure equality of opportunity, full participation, independent living, and economic self-sufficiency for people with disabilities. To implement this goal, the US Access Board, an independent federal agency created in 1973 to ensure accessibility for people with disabilities, has created accessibility guidelines for public rights-of-way. While these guidelines have not been formally adopted, they have been widely followed by jurisdictions and agencies nationwide in the last decade. The guidelines, last revised in July 2011, address various issues, including roadway design practices, slope and terrain issues, and pedestrian access to streets, sidewalks, curb ramps, street furnishings, pedestrian signals, parking, and other components of public rights-of-way. These guidelines would apply to proposed roadways in Palo Alto.

Federal Highway Administration

The Federal Highway Administration (FHWA) is the agency of the United States (US) Department of Transportation (DOT) responsible for the federally funded roadway system, including the interstate highway network and portions of the primary State highway network, such as Interstate 280 (I-280) and U.S Highway 101 (US 101).

Federal Railroad Administration

The Federal Railroad Administration (FRA) was created by the Department of Transportation Act of 1966. The FRA's mission is to enable the safe, reliable, and efficient movement of people and goods for a strong America, now and in the future. In 2008, Congress required Class I railroad main lines handling hazardous materials and railroad main lines with regularly scheduled intercity and commuter rail passenger service to fully implement Positive Train Control (PTC) by December 31, 2015. PTC uses communication-based/processor-based train control technology that provides a system capable of reliably and functionally preventing train-to-train collisions, overspeed derailments, incursions into established work zone limits, and the movement of a train through a main line switch in the wrong position. The deadline was extended to December 31, 2018, with the possibility for two additional years if certain requirements are met. The Peninsula Corridor Joint Powers Board (Caltrain) is slated to reaching full PTC implementation by the end of 2017.[8] The PTC implementation status as of December 2016 for PCJPB is shown in Figure 0-1.

[8] FRA.dot.gov; https://www.fra.dot.gov/Media/File/1109

Figure 0-1: PTC Implementation for Caltrain

Source: FRA, 2016

Union Pacific Railroad

The Union Pacific Railroad (UPRR) is a national freight hauling railroad and operates on the largest railroad network in the county and one of the largest transportation companies in the world. The UPRR does operate freight rail service through the Caltrain corridor, which is owned by the PCJPB, and there are UPRR properties along the right-of-way within the City of Palo Alto[9].

State

California Complete Streets Act of 2008 (AB 1358)

Originally passed in 2008, California's Complete Streets Act came into force in 2011 and requires local jurisdictions to plan for land use transportation policies that reflect a "complete streets" approach to mobility as a result of Assembly Bill 1358. The Complete Streets approach is essentially a suite of policies and street design guidelines which provide for the needs of all road users, including pedestrians, bicyclists, transit operators and riders, children, the elderly, and the disabled. From 2011 onward, any local jurisdiction—county or city—that undertakes a substantive update of the circulation element of its general plan must consider complete streets and incorporate corresponding policies and programs.

California Department of Transportation

The California Department of Transportation, or Caltrans, is the primary State agency responsible for transportation issues. One of its duties is the construction and maintenance of the state highway system. Caltrans approves the planning, design, and construction of improvements for all State-controlled facilities including I-280, US 101, and the associated interchanges for these facilities located in Palo Alto. Caltrans' jurisdiction includes State Route 82 (SR 82), El Camino Real, in Palo Alto. Caltrans has established standards for roadway traffic flow and developed procedures to determine if state-controlled facilities require improvements. For projects that may physically affect facilities under its administration, Caltrans requires encroachment permits before any construction work may be undertaken. For projects that would not physically affect facilities, but may influence traffic flow and levels of services at such facilities, Caltrans may recommend measures to mitigate the traffic impacts of such projects. The following Caltrans procedures and directives are relevant to the proposed Comprehensive Plan update, particularly State roadway facilities:

[9] Calhsr.com, Caltrain ROW Maps; http://calhsr.com/resources/caltrain-row-maps/

- **LEVEL OF SERVICE TARGET.** Caltrans maintains a minimum level of service (LOS) at the transition between LOS C and LOS D for all of its facilities. Where an existing facility is operating at less than the LOS C/D threshold, the existing measure of effectiveness should be maintained.
- **CALTRANS PROJECT DEVELOPMENT PROCEDURES MANUAL.** This manual outlines pertinent statutory requirements, planning policies, and implementing procedures regarding transportation facilities. It is continually and incrementally updated to reflect changes in policy and procedures. For example, the most recent revision incorporates the Complete Streets policy from Deputy Directive 64-R1, which is detailed below.
- **CALTRANS DEPUTY DIRECTIVE 64.** This directive requires Caltrans to consider the needs of non-motorized travelers, including pedestrians, bicyclists, and persons with disabilities, in all programming, planning, maintenance, construction. This includes incorporation of the best available standards in all of Caltrans' practices.
- **CALTRANS DEPUTY DIRECTIVE 64-RI.** This directive requires Caltrans to provide for the needs of travelers of all ages and abilities in all planning, programming, design, construction, operations, and maintenance activities and products on the State highway system. Caltrans supports bicycle, pedestrian, and transit travel with a focus on "complete streets" that begins early in system planning and continues through project construction and maintenance and operations.
- **CALTRANS DIRECTOR'S POLICY 22.** This policy establishes support for balancing transportation needs with community goals.

Caltrans seeks to involve and integrate community goals in the planning, design, construction, and maintenance and operations processes, including accommodating the needs of bicyclists and pedestrians.

California Public Utilities Commission

The California Public Utilities Commission (CPUC) serves the public interest by protecting consumers and ensuring the provision of safe, reliable utility service and infrastructure. The CPUC regulates utility services, stimulates innovation, and promotes competitive markets, where possible, in the communications, energy, transportation, and water industries. In addition, the CPUC administers funding programs for railroad crossings: Section 130, Section 190, and Maintenance Fund.

The Section 130 Grade Crossing Hazard Elimination Program provides federal funds to local agencies (cities and counties) and railroads to eliminate hazards at existing at-grade public highway-rail crossings.

The Section 190 Grade Separation Program provides state funds to local agencies to grade-separate at-grade crossings, or to improve grade-separated crossings. The program typically provides approximately $15 million distributed among three or four projects each fiscal year.[10] Eligible projects include the alteration or reconstruction of existing separations and the construction of new grade separations to eliminate existing grade crossings.

[10] CPUC, Railroad Crossing Funding Programs; http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=2722

The Railroad Crossing Automatic Warning Device Maintenance Fund provides funds to railroads to pay for the local government's share of the costs of maintaining automatic warning devices at railroad crossings.

California Transportation Commission

The California Transportation Commission (CTC) administers the public decision-making process that sets priorities and funds projects envisioned in long-range transportation plans. The CTC's programming includes the State Transportation Improvement Program (STIP), a multi-year capital improvement program of transportation projects on and off the State highway system, funded with revenues from the state highway account and other funding sources. The California Department of Transportation (Caltrans) manages the operation of state highways.

Senate Bill 743 (Steinberg, 2013)

Senate Bill 743 (SB 743) requires the California Governor's Office of Planning and Research (OPR) to amend the CEQA Guidelines to provide an alternative to LOS as the metric for evaluating transportation impacts under CEQA. Particularly within areas served by transit, the alternative criteria must promote the reduction of greenhouse gas (GHG) emissions, development of multimodal transportation networks, and diversity of land uses. Measurements of transportation impacts may include VMT, VMT per capita, automobile trip generation rates, or automobile trips generated. Once alternative criteria are incorporated into the CEQA Guidelines, auto delay will no longer be considered a significant impact under CEQA. SB 743 also amended State congestion management law to allow cities and counties to opt out of LOS standards in certain infill areas.

Regional and Local

Association of Bay Area Governments

The Association of Bay Area Governments (ABAG) is comprised of the Bay Area's local governments as a result of state legislation that would have supplanted local control over all bridges, ports, and transit operations in the Bay Area. ABAG provides planning and research resources related to land use, housing, environmental and water resource protection, disaster resilience, energy efficiency and hazardous waste mitigation, risk management, financial services and staff training to local cities, and towns. ABAG's planning and research programs are committed to addressing sustainability, resilience and equity in the region.

Metropolitan Transportation Commission

The Metropolitan Transportation Commission (MTC) is the transportation planning, coordinating, and financing agency for the nine-county Bay Area, including Santa Clara County. It also functions as the federally mandated metropolitan planning organization (MPO) for the region. It is responsible for regularly updating the Regional Transportation Plan (RTP), a comprehensive blueprint for the development of mass transit, highway, airport, seaport, railroad, bicycle, and pedestrian facilities. With the passage of Assembly Bill (AB) 32, the Global Warming Solutions Act of 2006, the State of California committed itself to reducing statewide GHG emissions to 1990 levels by 2020. Subsequent to adoption of AB 32, the State adopted Senate Bill 375 (SB 375) as the means for achieving regional transportation-related GHG targets. Among the requirements of SB 375 is the adoption of targets to be met by 2020 and 2035 for each MPO in

the State, as well as the creation of a Sustainable Communities Strategy (SCS) that provides a plan for meeting regional targets. The SCS and the RTP must be consistent with one other, including action items and financing decisions. MPOs must use transportation and air emissions modeling techniques consistent with guidelines prepared by the State CTC.

The current RTP, Plan Bay Area: Strategy for a Sustainable Region, was adopted on July 18, 2013 and includes both the region's Sustainable Communities Strategy and the 2040 Regional Transportation Plan. Plan Bay Area was prepared by MTC in partnership with the Association of Bay Area Governments (ABAG) and cities and counties throughout the region. Plan Bay Area is an integrated long-range transportation and land-use/housing plan intended to support a growing economy, provide more housing and transportation choices, and reduce transportation-related pollution in the Bay Area. It also specifies a detailed set of investments and strategies to maintain, manage, and improve the region's transportation system, specifying how anticipated federal, State, and local transportation funds will be spent.

The MTC has established its policy on Complete Streets in the Bay Area. The policy states that projects funded all, or in part, with regional funds (e.g., federal, State Transportation Improvement Program, bridge tolls) must consider the accommodation of bicycle and pedestrian facilities, as described in Caltrans Deputy Directive 64. These recommendations do not replace locally adopted policies regarding transportation planning, design, and construction. Instead, these recommendations facilitate the accommodation of pedestrians, including wheelchair users, and bicyclists into all projects where bicycle and pedestrian travel is consistent with current adopted regional and local plans.

Bay Area Air Quality Management District

The air quality district that addresses air pollution in the Plan Area is the BAAQMD. Since a primary source of air pollution in the Palo Alto region is from motor vehicles, air district regulations affect transportation planning in the Plan Area. The BAAQMD is a public agency tasked with regulating air pollution in the nine-county Bay Area, including Santa Clara County. The BAAQMD's goals include reducing health disparities due to air pollution, achieving and maintaining air quality standards, and implementing exemplary regulatory programs and compliance of federal, State, and regional regulations.

California High-Speed Rail Authority

The California High Speed Rail Authority is responsible for the planning, designing, building and operation of the nation's first high-speed rail system. Their future corridor and planned service along Caltrain right-of-way makes them a key stakeholder in future corridor improvements.

Peninsula Corridor Joint Powers Board (Caltrain)

The Peninsula Corridor Joint Powers Board (PCJPB) is the governing body for the Caltrain commuter rail service that operates in the counties of San Francisco, San Mateo, and Santa Clara. The PCJPB was formed in 1987 to oversee the passenger rail service.

Santa Clara Valley Transportation Authority and the Congestion Management Plan

The MTC requires the local transportation authority, such as the Santa Clara Valley Transportation Authority (VTA), to establish transportation plans that can feed into the larger

RTP. In Santa Clara County, the VTA is the Congestion Management Agency (CMA) tasked with preparing the Congestion Management Plan (CMP) that describes the strategies to address congestion problems and monitoring compliance. The VTA works cooperatively with the MTC, transit agencies, local governments, the Caltrans and the BAAQMD. The CMP contains LOS standards for highways and arterials, multimodal performance standards, a capital improvement program, a program for analyzing land use decisions, and a travel demand management (TDM) program.

The minimum LOS standard for VTA-monitored CMP intersections is LOS E, except for facilities grandfathered in at LOS F, which states that intersections operating at LOS F at the baseline year for implementation of an LOS standard can be grandfathered in. The standards for Santa Clara County were established in October of 1991; thus, any intersection operating at LOS F prior to the established 1991 LOS standards are not held to the minimum standard of LOS E.3 Member Agencies, which include the cities and County of Santa Clara, must ensure that CMP roadways operate at or better than the minimum LOS standard. The VTA monitors the performance of CMP facilities at a minimum of every two years. If the minimum LOS standards are not met, Member Agencies plan for improvements to address the congestion. Palo Alto uses a minimum LOS standard of LOS D for its intersections not monitored as part of the VTA CPM program.

To manage the transportation system and monitor performance in relation to established LOS standards, the VTA has designated a CMP roadway system for Santa Clara County. The CMP roadway system contains 434.5 miles of roadways, of which: 267.4 miles (61 percent) are State highways, 58.7 miles (14 percent) are expressways, and 108.4 miles (25 percent) are city/county arterials.5 If adopted standards are not being maintained on a specific roadway in the designated system, actions must be taken to address problems on that facility or plans must be developed to improve the overall LOS of the system and improve air quality. The CMP roadway system is a subset of the broader Metropolitan Transportation System.

Santa Clara Valley Transportation Authority Bicycle Program

In 1998, the VTA implemented a comprehensive Bicycle Program to improve the bicycle infrastructure throughout the Santa Clara County, and to encourage people to utilize biking as a form of commute and recreation. The Bicycle Program provides facilities, services, and programs to make provide bikes a safer option for residents and visitors in Santa Clara County. Under the Bicycle Program, the VTA prepared a Countywide Bicycle Plan, and associated Bicycle Technical Guidelines.

Santa Clara County

Bicycle Plan

In 2008, VTA completed the Santa Clara Countywide Bicycle Plan (SCCBP), which provided a foundation for maintaining and enhancing the countywide bicycle network. The vision of the SCCBP is: To establish, protect and enhance bicycling as a viable transportation mode and to assure that bicycling is a practical and safe mode of travel, by itself and in combination with other modes. The SCCBP identifies existing and proposed cross county bicycle corridors, some which pass through Palo Alto, such as the Dumbarton East-West Connector Corridor, which stretches from North Palo Alto to Los Altos, and the Matadero Creek/Page Mill Trail,

which stretches from the southeast corner of the Foothill Expressway/Page Mill Road intersection along Page Mill Road to Arastradero Road. The SCCBP establishes several goals, and policies to achieve the vision through transportation planning and programming, land use and transportation integration, local ordinance and guidelines development, and design and construction. The VTA's Bicycle Expenditure Program (BEP) was created to provide a funding stream to implement the SCCBP.

Santa Clara County Bicycle Technical Guidelines

The VTA Bicycle Technical Guidelines (BTG) establish standards and guidance for planning, designing, operating, retrofitting and maintaining roadways and bikeways throughout Santa Clara County, including parts of Palo Alto. The BTGs are intended to improve the quality of bicycle facilities and to ensure countywide consistency in the design and construction of the countywide bicycle network, including roadways. The BTGs apply to projects that are a part of the countywide bicycle network. The BTGs are divided into the following four parts:

- Part 1 provides an introduction and general guidance, including purpose and policy guidance, as well as bicycle characteristics, such as bicyclist skill levels and facilities that best accommodate them.
- Part 2 includes the technical guidelines for roadways, including roadway design elements, construction zones and maintenance, intersections and interchanges, and signalized intersections.
- Part 3 establishes technical guidelines for on-road bikeways, including bikeways on major rural roads, and local roads.
- Part 4 includes technical guidelines for bike-only facilities, including bike paths, and bike bridges, as well as bike parking.

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Appendix B – Caltrain Weekday Train Schedule

Appendix B - Caltrain Station Schedules

AM Southbound - WEEKDAY SERVICE to SAN JOSE / GILROY

5:28 ▸ 5:33 / 7:02 ▸ 7:18 Timed transfers for local service. + Train may leave up to 5 minutes early. - Train bypasses station.

	Train No.	102	104	206	208	310	212	314	216	218	320	222	324	226	228	330	232	134	236	138	142
ZONE 1	San Francisco	4:55	5:25	6:05	6:15	6:35	6:45	6:59	7:05	7:15	7:35	7:45	7:59	8:05	8:15	8:35	8:45	9:00	9:45	10:00	11:00
	22nd Street	4:59	5:29	6:09	6:19	6:39	6:51	7:03	7:10	7:19	7:39	7:51	8:03	8:10	8:19	8:39	8:49	9:05	–	10:04	11:04
	Bayshore	5:04	5:34	–	6:24	–	–	–	–	7:24	–	–	–	–	8:24	–	–	9:10	–	10:09	11:09
	So. San Francisco	5:10	5:40	–	6:31	–	–	–	–	7:31	–	–	–	–	8:31	–	–	9:17	–	10:16	11:16
	San Bruno	5:14	5:44	–	6:35	–	–	–	7:20	7:35	–	–	–	8:20	8:35	–	–	9:21	9:57	10:20	11:20
	Millbrae	5:18	5:48	6:22	6:39	6:52	7:04	7:16	–	7:39	7:52	8:04	8:16	–	8:39	8:52	9:02	9:25	10:01	10:25	11:25
	Burlingame	5:22	5:53	6:26	6:44	–	–	–	7:27	7:44	–	–	–	8:27	8:44	–	–	9:29	10:06	10:29	11:29
	San Mateo	5:25	5:57	6:30	6:48	–	7:11	–	7:31	7:48	–	8:11	–	8:31	8:48	–	9:09	9:32	10:10	10:32	11:32
	Hayward Park	5:28	6:00	–	6:51	–	–	–	–	7:51	–	–	–	–	8:51	–	–	9:36	–	10:36	11:36
	Hillsdale	5:32	6:03	6:34	6:54	–	–	7:24	7:35	7:54	–	–	8:24	8:35	8:54	–	9:13	9:39	10:14	10:39	11:39
	Belmont	5:35	6:07	–	6:58	–	–	–	–	7:58	–	–	–	–	8:58	–	–	9:43	10:18	10:43	11:43
ZONE 2	San Carlos	5:38	6:10	6:39	7:02	–	7:18	–	7:40	8:02	–	8:18	–	8:40	9:02	–	9:18	9:46	10:21	10:46	11:46
	Redwood City	5:41	6:15	6:44	7:06	7:11	7:23	7:31	–	8:06	8:11	8:23	8:31	–	9:06	9:11	9:23	9:51	10:26	10:51	11:51
	Menlo Park	5:47	6:20	6:50	–	7:17	7:29	–	7:48	–	8:17	8:29	–	8:48	–	9:17	9:29	9:56	10:31	10:56	11:56
	Palo Alto	5:51	6:24	6:54	7:14	7:21	7:33	7:37	7:52	8:14	8:21	8:33	8:37	8:52	9:14	9:21	9:33	10:00	10:35	11:00	**12:00**
ZONE 3	California Avenue	5:55	6:28	6:57	–	–	7:37	–	–	–	–	8:37	–	–	–	–	9:37	10:04	10:38	11:04	**12:04**
	San Antonio	5:59	6:32	–	–	–	7:41	–	–	–	–	8:41	–	–	–	–	9:41	10:08	10:43	11:08	**12:08**
	Mountain View	6:04	6:37	7:04	–	7:28	7:46	7:50	7:59	–	8:28	8:46	8:50	8:59	–	9:28	9:46	10:13	10:47	11:13	**12:13**
	Sunnyvale	6:10	6:42	–	–	–	7:51	–	–	–	–	8:51	–	–	–	–	9:51	10:18	10:52	11:18	**12:18**
	Lawrence	6:15	6:46	7:09	–	–	7:56	–	8:07	–	–	8:56	–	9:07	–	–	9:56	10:22	10:56	11:22	**12:22**
	Santa Clara	6:22	6:51	–	7:27	–	8:03	–	–	8:27	–	9:03	–	–	9:27	–	10:03	10:27	11:02	11:28	**12:28**
ZONE 4	College Park	–	–	–	–	–	8:06	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	San Jose Diridon	6:31	7:01	7:19	7:36	7:43	8:12	8:05	8:20	8:38	8:43	9:12	9:05	9:20	9:36	9:43	10:11	10:35	11:12	11:35	**12:35**
ZONE X	Tamien		7:06			7:48					8:48					9:48			11:17		
	Capitol																				
	Blossom Hill																				
ZONE 5	Morgan Hill																				
ZONE 6	San Martin	AM																		AM	PM
	Gilroy																				

PM Southbound - WEEKDAY SERVICE to SAN JOSE / GILROY

100 Local | 200 Limited | 300 Baby Bullet

	Train No.	146	150	152	254	156	258	360	262	264	366	268	370	272	274	376	278	380	282	284	386	288	190	192	194	196	198
ZONE 1	San Francisco	12:00	1:00	2:00	2:43	3:00	3:34	4:12	4:23	4:32	4:38	4:58	5:16	5:27	5:32	5:38	5:58	6:16	6:23	6:32	6:38	6:58	7:30	8:30	9:30	10:40	12:05
	22nd Street	12:04	1:04	2:04	–	3:04	–	–	–	4:36	–	–	–	–	5:36	–	–	–	–	6:36	–	–	7:34	8:34	9:34	10:44	12:10
	Bayshore	12:09	1:09	2:09	–	3:09	–	–	–	4:41	–	–	–	–	5:42	–	–	–	–	6:41	–	–	7:39	8:39	9:39	10:49	12:15
	So. San Francisco	12:16	1:16	2:16	–	3:16	–	–	–	4:52	–	5:09	–	–	5:51	–	6:09	–	–	6:52	–	7:09	7:46	8:46	9:46	10:56	12:21
	San Bruno	12:20	1:20	2:20	2:55	3:20	3:46	–	4:36	4:55	–	–	–	5:40	5:55	–	–	–	6:36	6:55	–	–	7:50	8:50	9:50	11:00	12:25
	Millbrae	12:25	1:25	2:25	2:59	3:24	3:51	4:27	–	5:00	4:53	5:15	5:33	–	6:00	5:53	6:15	6:33	–	7:00	6:53	7:15	7:56	8:56	9:56	11:06	12:29
	Burlingame	12:29	1:29	2:29	3:04	3:29	3:56	–	4:42	5:05	–	–	–	5:46	6:05	–	–	–	6:42	7:05	–	–	8:01	9:01	10:01	11:11	12:33
	San Mateo	12:32	1:32	2:32	3:07	3:32	3:59	–	4:46	5:08	4:59	–	–	5:50	6:09	5:59	–	–	6:46	7:08	6:59	–	8:04	9:04	10:04	11:14	12:36
	Hayward Park	12:36	1:36	2:36	–	3:36	–	–	–	5:12	–	–	–	–	6:12	–	–	–	–	7:12	–	–	8:08	9:08	10:08	11:18	12:40
	Hillsdale	12:39	1:39	2:39	3:11	3:39	4:04	4:35	4:50	5:15	–	5:23	5:43	5:54	6:15	–	6:23	6:43	6:50	7:15	–	7:23	8:11	9:11	10:11	11:21	12:43
	Belmont	12:43	1:43	2:43	3:15	3:43	4:08	–	–	5:19	–	–	–	–	6:19	–	–	–	–	7:19	–	–	8:15	9:15	10:15	11:25	12:47
ZONE 2	San Carlos	12:46	1:46	2:46	3:18	3:46	4:11	–	4:56	5:22	–	–	–	6:00	6:22	–	–	–	6:56	7:22	–	–	8:18	9:18	10:18	11:28	12:50
	Redwood City	12:51	1:51	2:51	3:23	3:51	4:16	–	–	5:28	5:08	5:33	–	–	6:28	6:08	6:33	–	–	7:28	7:08	7:33	8:23	9:23	10:23	11:33	12:55
	Menlo Park	12:56	1:56	2:56	3:28	3:56	4:22	–	–	5:34	–	5:39	–	–	6:34	–	6:39	–	–	7:34	–	7:39	8:28	9:28	10:28	11:38	1:00
	Palo Alto	1:00	2:00	3:00	3:32	4:00	4:26	4:46	5:04	–	5:15	5:43	5:55	6:08	–	6:15	6:43	6:55	7:04	–	7:15	7:43	8:32	9:32	10:32	11:42	1:04
ZONE 3	California Avenue	1:04	2:04	3:04	3:36	4:04	4:29	–	5:08	–	5:18	5:46	–	6:12	–	6:18	6:46	–	7:08	–	–	7:46	8:35	9:35	10:35	11:45	1:07
	San Antonio	1:08	2:08	3:08	3:40	4:08	4:34	–	–	–	–	5:50	–	–	–	–	6:50	–	–	–	–	7:50	8:39	9:39	10:39	11:49	1:11
	Mountain View	1:13	2:13	3:13	3:45	4:13	4:38	4:55	5:15	5:42	–	5:55	6:02	6:19	6:42	–	6:55	7:02	7:15	7:43	–	7:55	8:44	9:44	10:44	11:54	1:16
	Sunnyvale	1:18	2:18	3:18	3:50	4:18	4:44	–	5:20	5:47	5:29	6:00	–	6:24	6:47	6:29	7:00	–	7:20	7:48	7:28	8:00	8:49	9:49	10:49	11:59	1:21
	Lawrence	1:22	2:22	3:22	3:54	4:23	4:48	–	–	–	–	6:05+	–	–	6:51	–	7:05+	–	–	–	–	8:05	8:53	9:53	10:53	12:03	1:25
	Santa Clara	1:28	2:28	3:28	3:59	4:28	4:53	–	5:27	5:54	–	6:12+	–	6:31	6:57	–	7:12+	–	–	7:55	–	8:10	8:58	9:58	10:58	12:08	1:30
ZONE 4	College Park	–	–	–	–	4:31	–	–	–	–	–	–	–	–	7:00	–	–	–	–	–	–	–	–	–	–	–	–
	San Jose Diridon	1:35	2:35	3:35	4:09	4:39	5:03	5:11	5:34	6:02	5:44	6:23	6:17	6:38	7:06	6:44	7:23	7:18	7:33	8:04	7:43	8:21	9:06	10:06	11:06	12:16	1:38
ZONE X	Tamien				4:14	4:43	5:08				5:49	6:27			7:10	6:49	7:28				7:48	8:26		10:11	11:11		
	Capitol					4:50						6:34			7:17												
	Blossom Hill					4:56						6:40			7:23												
ZONE 5	Morgan Hill					5:09						6:53			7:36												
ZONE 6	San Martin	PM				5:15						6:59			7:42									PM		AM	
	Gilroy					5:28						7:12			7:55												

FARES

Caltrain fares are based on the number of zones that are partially or wholly traveled through by the customer.

Ticket Type ▾	How to Buy	Travel within	1 Zone	2 Zones	3 Zones	4 Zones	5 Zones	6 Zones
One-way Valid 4 hours from time of purchase	Ticket Machine		$3.75	$5.75	$7.75	$9.75	$11.75	$13.75
	Clipper Card		$1.45	$2.75	$3.75	$4.75	$5.75	$6.75
			$3.20	$5.20	$7.20	$9.20	$11.20	$13.20
			$1.60	$2.60	$3.60	$4.60	$5.60	$6.60
Day Pass Valid the date of purchase, unlimited travel within zones indicated	Ticket Machine		$7.50	$11.50	$15.50	$19.50	$23.50	$27.50
			$3.75	$5.75	$7.75	$9.75	$11.75	$13.75
Zone Upgrade	Ticket Machine				$2.00	$1.00		
			Valid 4 hours from time of purchase, one way when accompanying another valid ticket (not valid with 8-ride Ticket)					
8-ride Valid 30 days from date of purchase	Clipper Card		$23.70	$38.50	$53.30	$68.10	$82.90	$97.70
			$11.85	$19.25	$26.65	$34.05	$41.45	$48.85
Monthly Pass Valid month of purchase	Clipper Card		$84.80	$137.80	$190.80	$243.80	$296.80	$349.80
			$42.40	$68.90	$95.40	$121.90	$148.40	$174.90

Eligible Discount Fare:
Seniors (65 years or older) and passengers with disabilities, who present a Regional Transit Connection Discount Card or a current Disabled Person Placard Identification card issued by the CA Department of Motor Vehicles or a valid transit discount card issued by another California transit agency which is equivalent to the RTCDC, or those who are **Medicare cardholders** may ride for a discounted fare. The conductor or fare inspector may ask to see a valid ID to verify eligibility or identity. An attendant accompanying a person with a disability also is eligible for this discount when indicated on the RTCDC. Passengers **18 years old and younger** qualify for a discount fare. One child four years old or younger may ride free when accompanied by a fare-paying adult. Other children must travel with Eligible Discount tickets.

▾ Full description of ticket types is available in the Caltrain Information Guide or at www.caltrain.com/tickettypes

Caltrain is a **Proof-of-Payment** system. **Tickets must be purchased and/or tagged (Clipper) before boarding the train.** Tickets must be presented for inspection on request. Passengers who do not have a valid ticket are subject to citation and fine.

READING THE TIMETABLE

1. Locate the box for weekday or weekend trains and the direction you want to travel (northbound or southbound).
2. Find the station where you wish to board. Then read to the right for departure times and choose when you wish to ride.
3. From the departure time you have chosen, read down the column for the station where you wish to get off the train. The time shown is when you will arrive.

Example: The 5:25 a.m. train leaving San Francisco on weekdays arrives in San Carlos at 6:10 a.m.
Note: - (dash) means that the train bypasses the station.

HOLIDAY SERVICE

Caltrain operates the Sunday schedule on the following holidays and observed holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. A Modified-Saturday schedule will be operated on Presidents Day and Day after Thanksgiving. Details are posted online two weeks in advance.

REMINDERS

- Remain behind the yellow line on the main platform until the train comes to a complete stop.
- Smoking is not permitted on trains and station property.
- Bike riding on platforms and ramps is prohibited.
- Roller blades/skates may not be worn onboard trains or on station property.
- All strollers must be folded/stored on the luggage rack.
- Personal items may be placed under the seat. Please store luggage in the designated areas.
- Keep vestibule, aisles and stairs clear.
- Don't put feet on the seats.
- Open alcoholic containers aren't permitted on trains beginning at 9 p.m. on special event nights.
- Keep cell phone use to a minimum and speak quietly when in use.
- In case of onboard emergency, the conductor will provide necessary instructions. Please follow these instructions for safety reasons.

Caltrain – Regional Rail Link

Transit Police: 1.877.723.7245
Regional transit info: 511 or 510.817.1717 • www.511.org
Clipper Customer Service: 1.877.878.8883 • custserv@clippercard.com

Para traducción llama al 1.800.660.4287
如需翻譯,請電 1.800.660.4287

Connecting transit services

ACE: 1.800.411.7245
Amtrak: 1.800.872.7245
BART: 511
Dumbarton Express: 511
SamTrans: 1.800.660.4287
Marguerite shuttle: 650.723.9362
VTA: 408.321.2300 or 1.800.894.9908 (650 area code and South Santa Clara County)
SFMTA (Muni): 415.673.6864

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Caltrain

TIMETABLE

Effective April 10, 2017

Regional Rail Link

San Francisco ↔ San Jose/Gilroy

www.caltrain.com
1.800.660.4287 • (TTY 650.508.6448)

AM Northbound - WEEKDAY SERVICE to SAN FRANCISCO

6:41 6:54 Timed transfers for local service. 4:24 4:40

+ Train may leave up to 5 minutes early.
• Train bypasses station.

	Train No.	101	103	305	207	309	211	313	215	217	319	221	323	225	227	329	231	233	135	237	139	143
ZONE 6	Gilroy									6:06		6:28			7:06							
ZONE 5	San Martin		AM							6:15		6:37			7:15							AM
	Morgan Hill									6:21		6:43			7:21							
	Blossom Hill									6:36		6:58			7:36							
	Capitol									6:42		7:04			7:42							
	Tamien		4:55		5:51	5:56			6:50	6:56	7:15				7:53	7:58		8:28		9:37		
ZONE 4	San Jose Diridon	4:28	5:03	5:45	5:59	6:04	6:23	6:49	6:54	6:59	7:04	7:23	7:49	7:54	7:59	8:04	8:23	8:36	9:13	9:50	10:13	11:13
	College Park	–	–	–	–	–	–	–	–	–	–	–	–	–	8:03	–	–	–	–	–	–	–
	Santa Clara	4:33	5:08	–	6:06	–	6:28	–	–	7:06	–	7:28	–	–	8:08	–	8:28	8:41	9:18	9:55	10:18	11:18
	Lawrence	4:39	5:13	–	6:12	–	–	–	–	7:12	–	7:33	–	–	8:14	–	–	8:47	9:24	10:00	10:24	11:24
	Sunnyvale	4:43	5:18	–	6:20	6:14	6:36	–	7:06	7:20	7:14	7:38	–	8:06	8:21	8:14	8:36	8:52	9:28	10:05	10:28	11:28
ZONE 3	Mountain View	4:48	5:23	6:00	6:25	–	6:42	7:04	7:11	7:25	–	7:44	8:04	8:11	8:27	–	8:42	8:57	9:33	10:10	10:33	11:33
	San Antonio	4:52	5:27	–	6:29	–	–	–	–	7:29	–	–	–	–	8:31	–	–	9:01	9:37	10:14	10:37	11:37
	California Avenue	4:57	5:31	–	6:34	–	6:48	–	7:17	7:34	–	7:49	–	8:17	8:35	–	–	9:06	9:41	10:18	10:42	11:41
	Palo Alto	5:01	5:36	6:06	6:38	6:26	–	7:12	7:21	7:38	7:26	–	8:12	8:21	8:40	8:26	–	9:11	9:46	10:23	10:47	11:46
	Menlo Park	5:04	5:39	–	6:41	–	6:54	–	–	7:41	–	7:54	–	–	8:43	–	8:51	9:14	9:49	10:26	10:50	11:49
	Redwood City	5:10	5:44	–	6:47	6:32	6:59	–	–	7:47	7:32	8:00	–	–	8:49	8:32	8:57	9:20	9:55	10:31	10:55	11:55
	San Carlos	5:15	5:49	–	–	–	7:04	–	7:29	–	–	8:05	–	8:29	–	–	9:02	9:24	9:59	10:36	10:59	11:59
ZONE 2	Belmont	5:18	5:52	–	–	–	7:07	–	–	–	–	8:08	–	–	–	–	9:05	9:28	10:03	10:39	11:03	**12:03**
	Hillsdale	5:22	5:56	6:18	6:54	–	7:11	7:23	7:34	7:54	–	8:12	8:23	8:34	8:57	–	9:09	9:31	10:06	10:43	11:06	**12:06**
	Hayward Park	5:25	5:59	–	–	–	7:14	–	–	–	–	8:15	–	–	–	–	9:12	–	10:09	–	11:09	**12:09**
	San Mateo	5:28	6:03	–	–	6:43	7:18	–	7:38	–	7:43	8:19	–	8:38	–	8:43	9:15	9:36	10:12	10:48	11:12	**12:12**
	Burlingame	5:32	6:06	–	–	–	7:21	–	7:43	–	–	8:22	–	8:43	–	–	9:19	9:39	10:15	10:51	11:15	**12:15**
	Millbrae	5:36	6:11	6:26	7:03	6:51	7:26	7:31	–	8:03	7:51	8:27	8:31	–	9:06	8:51	9:24	9:44	10:20	10:56	11:20	**12:20**
ZONE 1	San Bruno	5:41	6:16	–	–	–	7:30	–	7:50	–	–	8:31	–	8:50	–	–	9:28	9:49	10:25	11:01	11:25	**12:25**
	So. San Francisco	5:45	6:20	–	7:09	–	7:34	–	–	8:09	–	8:35	–	–	9:13	–	9:32	–	10:29	–	11:29	**12:29**
	Bayshore	5:51	6:26	–	–	–	7:41+	–	–	–	–	8:43+	–	–	–	–	9:39	–	10:35	–	11:35	**12:35**
	22nd Street	5:57	6:32	–	–	–	7:50+	–	–	–	–	8:51+	–	–	–	–	9:45	–	10:41	–	11:41	**12:41**
	San Francisco	6:03	6:38	6:47	7:24	7:08	7:57	7:51	8:07	8:24	8:11	8:58	8:51	9:07	9:29	9:11	9:52	10:05	10:48	11:16	11:48	**12:48**

PM Northbound - WEEKDAY SERVICE to SAN FRANCISCO

* Train departure may be delayed up to 15 minutes after Sharks games. 100 Local 200 Limited 300 Baby Bullet

	Train No.	147	151	155	257	159	261	263	365	267	269	371	273	375	277	279	381	283	385	287	289	191	193	195	197	*199
ZONE 6	Gilroy																									
ZONE 5	San Martin	PM																							PM	
	Morgan Hill																									
	Blossom Hill																									
	Capitol																									
	Tamien				2:16		3:32				4:32					5:32					6:33			8:37	9:37	
ZONE 4	San Jose Diridon	12:13	1:13	2:13	2:24	3:13	3:40	4:12	4:24	4:35	4:40	4:45	5:08	5:20	5:35	5:40	5:45	6:08	6:20	6:35	6:40	7:07	7:45	8:45	9:45	10:30
	College Park	–	–	–	–	3:16	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	Santa Clara	12:18	1:18	2:18	2:29	3:20	3:45	4:18	–	–	4:46	–	5:14	–	–	5:46	–	6:14	–	–	–	7:12	7:50	8:50	9:50	10:35
	Lawrence	12:24	1:24	2:24	2:34	3:25	3:50	–	–	4:44	4:54	–	–	–	5:44	5:54	–	–	–	6:44	6:48	7:18	7:55	8:55	9:55	10:40
	Sunnyvale	12:28	1:28	2:28	2:39	3:30	3:57	–	–	–	5:00	–	–	–	–	6:00	–	–	–	6:48	–	7:22	8:00	9:00	10:00	10:45
ZONE 3	Mountain View	12:33	1:33	2:33	2:44	3:35	4:02	–	4:36	4:51	5:05	4:57	–	5:32	5:51	6:05	5:57	–	6:32	6:53	6:56	7:27	8:05	9:05	10:05	10:50
	San Antonio	12:37	1:37	2:37	2:47	3:39	4:06	–	–	–	5:09	–	–	–	–	6:09	–	–	–	–	–	7:31	8:08	9:08	10:08	10:54
	California Avenue	12:41	1:41	2:41	2:52	3:43	4:11	–	–	–	5:14	–	–	–	–	6:14	–	–	–	–	7:02	7:35	8:13	9:13	10:13	10:59
	Palo Alto	12:46	1:46	2:46	2:56	3:47	4:15	4:33	4:44	4:59	5:20	5:05	5:29	5:40	5:59	6:20	6:05	6:29	6:40	7:01	7:06	7:40	8:17	9:17	10:17	11:04
	Menlo Park	12:49	1:49	2:49	2:59	3:51	4:19	–	4:47	5:02	5:23	–	–	5:43	6:02	6:23	–	–	6:43	7:04	7:09	7:43	8:20	9:20	10:20	11:07
	Redwood City	12:55	1:55	2:55	3:05	3:56	4:24	4:40	4:53	–	5:29	5:11	5:36	5:49	–	6:29	6:11	6:38	6:49	–	7:15	7:49	8:27	9:27	10:27	11:13
	San Carlos	12:59	1:59	2:59	3:09	4:01	4:29	4:44	–	5:10	5:33	–	5:40	–	6:10	6:33	–	6:40	–	7:12	7:19	7:53	8:31	9:31	10:31	11:17
ZONE 2	Belmont	1:03	2:03	3:03	3:13	4:04	–	4:47	–	–	–	–	5:43	–	–	–	–	6:43	–	–	–	7:57	8:35	9:35	10:35	11:21
	Hillsdale	1:06	2:06	3:06	3:16	4:08	–	4:51	–	5:14	–	5:18	5:47	–	6:14	–	6:18	6:47	–	7:16	7:24	8:00	8:38	9:38	10:38	11:24
	Hayward Park	1:09	2:09	3:09	–	4:11	–	4:54	–	–	–	–	5:50	–	–	–	–	6:50	–	–	–	8:03	8:41	9:41	10:41	11:27
	San Mateo	1:12	2:12	3:12	3:21	4:15	4:36	4:57	–	5:18	5:40	–	5:53	–	6:18	6:40	–	6:53	–	7:20	7:28	8:07	8:44	9:44	10:44	11:30
	Burlingame	1:15	2:15	3:15	3:24	4:18	–	5:01	–	5:22	–	–	5:57	–	6:22	–	–	6:57	–	7:24	7:32	8:10	8:48	9:48	10:48	11:34
	Millbrae	1:20	2:20	3:20	3:29	4:23	4:42	5:05	5:10	–	5:48	5:30	6:01	6:08	–	6:48	6:30	7:01	7:06	–	7:36	8:15	8:52	9:52	10:52	11:38
ZONE 1	San Bruno	1:25	2:25	3:25	3:33	4:28	–	5:10	–	5:29	–	–	6:06	–	6:29	–	–	7:06	–	7:31	–	8:20	8:57	9:57	10:57	11:42
	So. San Francisco	1:29	2:29	3:29	–	4:32	–	5:14	–	–	–	–	6:10	–	–	–	–	7:10	–	–	–	8:24	9:01	10:01	11:01	11:46
	Bayshore	1:35	2:35	3:35	–	4:38	–	5:21+	–	–	–	–	6:17+	–	–	–	–	7:17+	–	–	–	8:30	9:07	10:07	11:07	11:52
	22nd Street	1:41	2:41	3:41	–	4:44	4:56	5:30+	5:25	5:40	6:00	5:45	6:26+	6:21	6:40	7:00	6:45	7:26+	7:21	7:42	7:50	8:36	9:13	10:13	11:13	11:58
	San Francisco	1:48	2:48	3:48	3:50	4:50	5:02	5:36	5:31	5:47	6:06	5:51	6:33	6:27	6:47	7:06	6:51	7:33	7:27	7:49	7:57	8:42	9:20	10:20	11:20	12:05

Northbound - WEEKEND SERVICE to SAN FRANCISCO

400 Local 800 Baby Bullet

On weekends, a shuttle bus connects the Tamien and Diridon stations. Caltrain fare policies apply. Timetable subject to change without notice. * Train departure may be delayed up to 15 minutes after Sharks games.

	Train No.	SAT ONLY 421	423	425	427	801	429	431	433	435	437	439	441	803	443	445	447	449	SAT ONLY *451
	Shuttle Bus							AM	PM										
	Departs Tamien	–	7:33	8:33	9:33	10:10	10:33	11:33	12:33	1:33	2:33	3:33	4:33	5:10	5:33	6:33	7:33	8:33	–
	Arrives SJ Diridon	–	7:45	8:45	9:45	10:22	10:45	11:45	12:45	1:45	2:45	3:45	4:45	5:22	5:45	6:45	7:45	8:45	–
ZONE 4	San Jose Diridon	7:00	8:00	9:00	10:00	10:35	11:00	12:00	1:00	2:00	3:00	4:00	5:00	5:35	6:00	7:00	8:00	9:00	10:30
	Santa Clara	7:05	8:05	9:05	10:05	–	11:05	12:05	1:05	2:05	3:05	4:05	5:05	–	6:05	7:05	8:05	9:05	10:35
	Lawrence	7:10	8:10	9:10	10:10	–	11:10	12:10	1:10	2:10	3:10	4:10	5:10	–	6:10	7:10	8:10	9:10	10:40
	Sunnyvale	7:14	8:14	9:14	10:14	10:45	11:14	12:14	1:14	2:14	3:14	4:14	5:14	5:45	6:14	7:14	8:14	9:14	10:44
	Mountain View	7:19	8:19	9:19	10:19	10:50	11:19	12:19	1:19	2:19	3:19	4:19	5:19	5:50	6:19	7:19	8:19	9:19	10:49
	San Antonio	7:23	8:23	9:23	10:23	–	11:23	12:23	1:23	2:23	3:23	4:23	5:23	–	6:23	7:23	8:23	9:23	10:53
	California Ave	7:27	8:27	9:27	10:27	–	11:27	12:27	1:27	2:27	3:27	4:27	5:27	–	6:27	7:27	8:27	9:27	10:57
ZONE 3	Palo Alto	7:31	8:31	9:31	10:31	10:56	11:31	12:31	1:31	2:31	3:31	4:31	5:31	5:56	6:31	7:31	8:31	9:31	11:01
	Menlo Park	7:34	8:34	9:34	10:34	–	11:34	12:34	1:34	2:34	3:34	4:34	5:34	–	6:34	7:34	8:34	9:34	11:04
	Atherton	7:37	8:37	9:37	10:37	–	11:37	12:37	1:37	2:37	3:37	4:37	5:37	–	6:37	7:37	8:37	9:37	11:07
	Redwood City	7:41	8:41	9:41	10:41	11:04	11:41	12:41	1:41	2:41	3:41	4:41	5:41	6:04	6:41	7:41	8:41	9:41	11:11
	San Carlos	7:45	8:45	9:45	10:45	–	11:45	12:45	1:45	2:45	3:45	4:45	5:45	–	6:45	7:45	8:45	9:45	11:15
	Belmont	7:48	8:48	9:48	10:48	–	11:48	12:48	1:48	2:48	3:48	4:48	5:48	–	6:48	7:48	8:48	9:48	11:18
ZONE 2	Hillsdale	7:51	8:51	9:51	10:51	11:10	11:51	12:51	1:51	2:51	3:51	4:51	5:51	6:10	6:51	7:51	8:51	9:51	11:21
	Hayward Park	7:54	8:54	9:54	10:54	–	11:54	12:54	1:54	2:54	3:54	4:54	5:54	–	6:54	7:54	8:54	9:54	11:24
	San Mateo	7:57	8:57	9:57	10:57	11:14	11:57	12:57	1:57	2:57	3:57	4:57	5:57	6:14	6:57	7:57	8:57	9:57	11:27
	Burlingame	8:02	9:02	10:02	11:02	–	12:02	1:02	2:02	3:02	4:02	5:02	6:02	–	7:02	8:02	9:02	10:02	11:32
	Broadway	8:05	9:05	10:05	11:05	–	12:05	1:05	2:05	3:05	4:05	5:05	6:05	–	7:05	8:05	9:05	10:05	11:35
	Millbrae	8:10	9:10	10:10	11:10	11:23	12:10	1:10	2:10	3:10	4:10	5:10	6:10	6:23	7:10	8:10	9:10	10:10	11:40
ZONE 1	San Bruno	8:14	9:14	10:14	11:14	–	12:14	1:14	2:14	3:14	4:14	5:14	6:14	–	7:14	8:14	9:14	10:14	11:44
	So. San Francisco	8:19	9:19	10:19	11:19	–	12:19	1:19	2:19	3:19	4:19	5:19	6:19	–	7:19	8:19	9:19	10:19	11:49
	Bayshore	8:25	9:25	10:25	11:25	–	12:25	1:25	2:25	3:25	4:25	5:25	6:25	–	7:25	8:25	9:25	10:25	11:55
	22nd Street	8:30	9:30	10:30	11:30	–	12:30	1:30	2:30	3:30	4:30	5:30	6:30	–	7:30	8:30	9:30	10:30	12:00
	San Francisco	8:38	9:38	10:38	11:38	11:47	12:38	1:38	2:38	3:38	4:38	5:38	6:38	6:41	7:38	8:38	9:38	10:38	12:08

Southbound - WEEKEND SERVICE to SAN JOSE

400 Local 800 Baby Bullet

On weekends, a shuttle bus connects the Tamien and Diridon stations. Caltrain fare policies apply. Timetable subject to change without notice.

	Train No.	422	424	426	428	802	430	432	434	436	438	440	442	804	444	446	448	SATURDAY ONLY 450	454
ZONE 1	San Francisco	8:15	9:15	10:15	11:15	11:59	12:15	1:15	2:15	3:15	4:15	5:15	6:15	6:59	7:15	8:15	9:15	10:15	12:01
	22nd Street	8:20	9:20	10:20	11:20	–	12:20	1:20	2:20	3:20	4:20	5:20	6:20	–	7:20	8:20	9:20	10:20	12:06
	Bayshore	8:25	9:25	10:25	11:25	–	12:25	1:25	2:25	3:25	4:25	5:25	6:25	–	7:25	8:25	9:25	10:25	12:11
	So. San Francisco	8:31	9:31	10:31	11:31	–	12:31	1:31	2:31	3:31	4:31	5:31	6:31	–	7:31	8:31	9:31	10:31	12:17
	San Bruno	8:35	9:35	10:35	11:35	–	12:35	1:35	2:35	3:35	4:35	5:35	6:35	–	7:35	8:35	9:35	10:35	12:21
	Millbrae	8:39	9:39	10:39	11:39	12:15	12:39	1:39	2:39	3:39	4:39	5:39	6:39	7:15	7:39	8:39	9:39	10:39	12:25
	Broadway	8:43	9:43	10:43	11:43	–	12:43	1:43	2:43	3:43	4:43	5:43	6:43	–	7:43	8:43	9:43	10:43	12:29
	Burlingame	8:45	9:45	10:45	11:45	–	12:45	1:45	2:45	3:45	4:45	5:45	6:45	–	7:45	8:45	9:45	10:45	12:31
	San Mateo	8:51	9:51	10:51	11:51	12:23	12:51	1:51	2:51	3:51	4:51	5:51	6:51	7:23	7:51	8:51	9:51	10:51	12:37
	Hayward Park	8:54	9:54	10:54	11:54	–	12:54	1:54	2:54	3:54	4:54	5:54	6:54	–	7:54	8:54	9:54	10:54	12:40
	Hillsdale	8:57	9:57	10:57	11:57	12:27	12:57	1:57	2:57	3:57	4:57	5:57	6:57	7:27	7:57	8:57	9:57	10:57	12:43
	Belmont	9:00	10:00	11:00	12:00	–	1:00	2:00	3:00	4:00	5:00	6:00	7:00	–	8:00	9:00	10:00	11:00	12:46
	San Carlos	9:03	10:03	11:03	12:03	–	1:03	2:03	3:03	4:03	5:03	6:03	7:03	–	8:03	9:03	10:03	11:03	12:49
ZONE 2	Redwood City	9:09	10:09	11:09	12:09	12:35	1:09	2:09	3:09	4:09	5:09	6:09	7:09	7:35	8:09	9:09	10:09	11:09	12:55
	Atherton	9:13	10:13	11:13	12:13	–	1:13	2:13	3:13	4:13	5:13	6:13	7:13	–	8:13	9:13	10:13	11:13	12:59
	Menlo Park	9:16	10:16	11:16	12:16	–	1:16	2:16	3:16	4:16	5:16	6:16	7:16	–	8:16	9:16	10:16	11:16	1:02
	Palo Alto	9:19	10:19	11:19	12:19	12:41	1:19	2:19	3:19	4:19	5:19	6:19	7:19	7:41	8:19	9:19	10:19	11:19	1:05
	California Ave	9:23	10:23	11:23	12:23	–	1:23	2:23	3:23	4:23	5:23	6:23	7:23	–	8:23	9:23	10:23	11:23	1:09
ZONE 3	San Antonio	9:27	10:27	11:27	12:27	–	1:27	2:27	3:27	4:27	5:27	6:27	7:27	–	8:27	9:27	10:27	11:27	1:13
	Mountain View	9:31	10:31	11:31	12:31	12:49	1:31	2:31	3:31	4:31	5:31	6:31	7:31	7:49	8:31	9:31	10:31	11:31	1:17
	Sunnyvale	9:36	10:36	11:36	12:36	12:54	1:36	2:36	3:36	4:36	5:36	6:36	7:36	7:54	8:36	9:36	10:36	11:36	1:22
	Lawrence	9:40	10:40	11:40	12:40	–	1:40	2:40	3:40	4:40	5:40	6:40	7:40	–	8:40	9:40	10:40	11:40	1:26
ZONE 4	Santa Clara	9:45	10:45	11:45	12:45	–	1:45	2:45	3:45	4:45	5:45	6:45	7:45	–	8:45	9:45	10:45	11:45	1:31
	San Jose Diridon	9:53	10:53	11:53	12:53	1:05	1:53	2:53	3:53	4:53	5:53	6:53	7:53	8:05	8:53	9:53	10:53	11:53	1:39
	Shuttle Bus			AM	PM													PM	AM
	Departs SJ Diridon	10:00	11:00	12:00	–	1:13	2:00	3:00	4:00	5:00	6:00	7:00	–	8:13	9:00	10:00	–	–	–
	Arrives Tamien	10:10	11:10	12:10	–	1:23	2:10	3:10	4:10	5:10	6:10	7:10	–	8:23	9:10	10:10	–	–	–

Visit www.caltrain.com/stations for detailed station information and location.

Appendix C – Traffic Count Raw Data

Traffic Data Service -- San Jose, CA
Event Counts

EventCount-15055 -- English (ENU)

Datasets:

Site:	**[1EB] CHARLESTON RD W OF ALMA ST**
Input A:	2 - East bound. - Lane= 0, Added to totals. (/2.000)
Input B:	0 - Unused or unknown. - Lane= 0, Excluded from totals.
Data type:	Axle sensors - Separate (Count)

Profile:

Name:	Default Profile
Scheme:	Count events divided by setup divisor
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)

*** Thursday, February 23, 2017=9258, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
62	**16**	**10**	**14**	**30**	**64**	**141**	**451**	**729**	**680**	**553**	**577**	**510**	**582**	**581**	**760**	**746**	**669**	**697**	**491**	**366**	**327**	**130**	**76**	
27	8	2	2	4	9	29	86	130	**132**	153	157	134	154	124	193	**175**	134	194	153	88	91	51	27	28
12	2	2	6	7	11	26	92	**223**	213	134	121	118	141	158	183	**215**	194	173	122	99	93	29	17	12
11	3	4	3	11	20	31	116	**193**	155	136	132	124	135	144	**184**	166	203	156	128	99	79	35	20	14
12	3	2	3	8	25	56	157	**183**	181	131	168	136	153	156	**201**	191	139	175	89	81	66	16	13	7

AM Peak 0815 - 0915 (731), AM PHF=0.82 PM Peak 1530 - 1630 (774), PM PHF=0.90

*** Friday, February 24, 2017=9308, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
61	**23**	**11**	**15**	**28**	**59**	**131**	**446**	**700**	**610**	**587**	**617**	**540**	**635**	**558**	**729**	**663**	**709**	**626**	**589**	**334**	**314**	**227**	**102**	
28	8	2	3	3	11	20	56	**137**	136	155	151	125	160	113	**189**	154	156	133	151	101	93	63	25	37
12	2	3	4	4	11	29	95	**210**	177	148	156	143	152	142	**161**	187	203	186	162	84	94	77	28	17
14	5	2	5	10	19	33	120	**186**	141	140	165	132	167	154	**203**	147	185	176	144	81	68	50	26	14
7	8	4	3	11	18	50	**176**	168	157	145	146	141	157	150	**177**	176	166	133	132	68	60	38	23	11

AM Peak 0745 - 0845 (708), AM PHF=0.84 PM Peak 1500 - 1600 (729), PM PHF=0.90

*** Saturday, February 25, 2017=7325, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
79	**30**	**18**	**16**	**20**	**37**	**62**	**167**	**290**	**463**	**520**	**634**	**525**	**540**	**550**	**681**	**651**	**498**	**453**	**334**	**205**	**262**	**176**	**119**	
37	7	8	0	7	10	9	28	61	90	146	**141**	126	128	172	135	**208**	126	177	93	56	47	48	32	39
17	6	5	5	3	5	12	40	69	104	96	**182**	127	154	137	153	**181**	108	98	101	49	55	57	34	11
14	12	4	7	4	8	13	45	65	129	149	**166**	111	124	116	**173**	121	126	91	59	56	88	44	34	21
11	5	1	4	6	14	29	55	96	141	130	**146**	161	136	126	**220**	141	138	88	82	45	72	27	19	17

AM Peak 1100 - 1200 (634), AM PHF=0.87 PM Peak 1530 - 1630 (782), PM PHF=0.89

*** Sunday, February 26, 2017=6020, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
88	**24**	**14**	**9**	**11**	**21**	**53**	**107**	**274**	**408**	**497**	**512**	**514**	**534**	**518**	**513**	**488**	**437**	**287**	**242**	**174**	**159**	**87**	**54**	
39	6	6	0	4	3	4	24	45	99	112	127	**157**	129	**145**	121	160	116	88	64	55	46	28	20	13
11	6	4	2	1	5	11	22	51	94	117	**117**	116	129	**132**	125	116	118	74	70	45	40	18	15	17
21	5	2	4	4	7	17	26	66	86	138	**128**	115	**136**	115	132	102	98	70	55	33	44	19	12	6
17	7	2	3	2	6	21	35	113	130	130	**140**	126	**140**	126	136	111	106	56	54	42	29	22	7	3

AM Peak 1115 - 1215 (542), AM PHF=0.86 PM Peak 1330 - 1430 (553), PM PHF=0.95

Traffic Data Service -- San Jose, CA
Event Counts

EventCount-15054 -- English (ENU)

Datasets:

Site:	**[1WB] CHARESTON RD W OF ALMA ST**
Input A:	4 - West bound. - Lane= 0, Added to totals. (/2.000)
Input B:	0 - Unused or unknown. - Lane= 0, Excluded from totals.
Data type:	Axle sensors - Separate (Count)

Profile:

Name:	Default Profile
Scheme:	Count events divided by setup divisor
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)

*** Thursday, February 23, 2017=8603, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
33	**20**	**7**	**12**	**23**	**109**	**256**	**517**	**650**	**691**	**573**	**464**	**483**	**495**	**505**	**585**	**557**	**671**	**665**	**484**	**308**	**227**	**159**	**113**	
9	5	1	2	2	15	36	84	173	**170**	156	107	115	120	105	124	130	146	**181**	155	91	52	39	28	19
11	5	1	5	3	17	52	131	134	**178**	147	126	129	131	115	143	122	**188**	182	132	81	61	45	34	14
7	3	2	2	5	26	64	143	**179**	169	127	108	126	110	125	149	163	**175**	145	104	70	70	39	33	7
6	7	3	3	13	51	105	160	**165**	175	144	123	114	135	162	169	143	**163**	158	94	67	45	37	18	5

AM Peak 0830 - 0930 (691), AM PHF=0.97 PM Peak 1715 - 1815 (706), PM PHF=0.94

*** Friday, February 24, 2017=8536, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
45	**23**	**12**	**11**	**28**	**100**	**240**	**502**	**640**	**644**	**534**	**494**	**496**	**512**	**479**	**584**	**555**	**666**	**621**	**420**	**280**	**291**	**228**	**138**	
19	1	6	2	4	18	36	96	201	**165**	134	116	126	125	112	126	141	152	**177**	119	88	70	76	48	21
14	7	2	0	7	14	45	116	132	**163**	143	110	141	128	107	171	127	**187**	152	135	68	75	67	29	15
7	7	2	4	10	26	66	112	134	**161**	135	132	110	133	111	150	143	**166**	144	88	67	60	41	35	8
5	8	2	5	7	42	93	178	**173**	156	122	137	121	127	150	138	144	**162**	149	79	57	86	44	26	10

AM Peak 0845 - 0945 (661), AM PHF=0.96 PM Peak 1715 - 1815 (691), PM PHF=0.93

*** Saturday, February 25, 2017=6617, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
54	**39**	**36**	**11**	**13**	**39**	**80**	**163**	**313**	**410**	**414**	**452**	**489**	**583**	**486**	**589**	**496**	**502**	**371**	**322**	**237**	**198**	**196**	**130**	
21	13	9	3	2	3	11	36	57	79	103	106	**119**	105	**121**	127	122	111	98	80	57	54	47	40	21
15	10	17	3	2	4	14	38	65	96	98	118	**123**	**129**	122	127	130	113	82	95	60	39	46	41	12
8	6	6	2	3	11	21	44	82	99	109	105	**107**	**181**	131	125	115	143	107	67	54	51	54	29	17
10	10	4	3	6	21	34	45	110	138	105	**123**	140	**170**	113	210	130	135	85	81	67	55	50	21	6

AM Peak 1145 - 1245 (472), AM PHF=0.96 PM Peak 1315 - 1415 (599), PM PHF=0.83

*** Sunday, February 26, 2017=5519, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
56	**52**	**27**	**16**	**11**	**23**	**47**	**96**	**161**	**249**	**397**	**419**	**497**	**490**	**529**	**462**	**437**	**387**	**384**	**238**	**199**	**172**	**102**	**71**	
21	10	9	4	4	5	6	19	18	60	90	83	**95**	**130**	136	128	117	91	99	70	51	50	35	20	10
12	16	8	4	3	4	11	26	40	57	96	100	**134**	114	124	126	112	103	103	60	58	42	21	21	9
17	11	6	5	2	4	13	24	44	49	101	105	**132**	125	138	97	111	98	93	56	44	46	21	13	6
6	15	4	3	3	10	17	27	39	83	111	**132**	**136**	122	131	112	98	96	90	52	46	35	25	17	7

AM Peak 1145 - 1245 (493), AM PHF=0.92 PM Peak 1215 - 1315 (531), PM PHF=0.98

Traffic Data Service -- San Jose, CA
Class Report

CustomList-15062 -- English (ENU)

Datasets:
Site: **[3EB] CHURCHILL AVE W OF ALMA ST**
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: East (bound)
Name: Default Profile
Scheme: Vehicle classification (Scheme F)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)

Column Legend:
0 [Time] 24-hour time (0000 - 2359)
1 [Total] Number in time step
2 [Cls] Class totals

*** Thursday, February 23, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	12	0	12	0	0	0	0	0	0	0	0	0	0	0
0100	13	0	13	0	0	0	0	0	0	0	0	0	0	0
0200	8	1	5	2	0	0	0	0	0	0	0	0	0	0
0300	3	0	3	0	0	0	0	0	0	0	0	0	0	0
0400	5	0	5	0	0	0	0	0	0	0	0	0	0	0
0500	20	0	15	3	0	1	1	0	0	0	0	0	0	0
0600	51	0	38	13	0	0	0	0	0	0	0	0	0	0
0700	154	0	138	16	0	0	0	0	0	0	0	0	0	0
0800	204	1	181	19	2	0	0	1	0	0	0	0	0	0
0900	183	1	168	14	0	0	0	0	0	0	0	0	0	0
1000	204	1	180	20	0	1	2	0	0	0	0	0	0	0
1100	228	3	200	24	0	0	1	0	0	0	0	0	0	0
1200	224	1	193	26	2	2	0	0	0	0	0	0	0	0
1300	262	5	231	25	1	0	0	0	0	0	0	0	0	0
1400	352	7	317	23	2	1	1	0	0	0	1	0	0	0
1500	306	5	263	28	2	0	3	2	3	0	0	0	0	0
1600	340	5	311	14	5	1	2	1	0	0	1	0	0	0
1700	326	6	300	8	2	2	2	2	4	0	0	0	0	0
1800	291	2	275	10	1	0	2	1	0	0	0	0	0	0
1900	219	0	206	12	1	0	0	0	0	0	0	0	0	0
2000	205	0	196	9	0	0	0	0	0	0	0	0	0	0
2100	166	2	160	4	0	0	0	0	0	0	0	0	0	0
2200	117	2	115	0	0	0	0	0	0	0	0	0	0	0
2300	53	1	49	3	0	0	0	0	0	0	0	0	0	0
07-19	**3074**	**37**	**2757**	**227**	**17**	**7**	**13**	**7**	**7**	**0**	**2**	**0**	**0**	**0**
06-22	**3715**	**39**	**3357**	**265**	**18**	**7**	**13**	**7**	**7**	**0**	**2**	**0**	**0**	**0**
06-00	**3885**	**42**	**3521**	**268**	**18**	**7**	**13**	**7**	**7**	**0**	**2**	**0**	**0**	**0**
00-00	**3946**	**43**	**3574**	**273**	**18**	**8**	**14**	**7**	**7**	**0**	**2**	**0**	**0**	**0**

Peak step 14:00 (352) **AM Peak step** 11:00 (228) **PM Peak step** 14:00 (352)

*** Friday, February 24, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	25	0	25	0	0	0	0	0	0	0	0	0	0	0
0100	14	0	13	1	0	0	0	0	0	0	0	0	0	0
0200	6	0	5	1	0	0	0	0	0	0	0	0	0	0
0300	4	0	4	0	0	0	0	0	0	0	0	0	0	0
0400	6	1	3	1	0	0	1	0	0	0	0	0	0	0
0500	23	0	19	2	0	1	1	0	0	0	0	0	0	0
0600	54	0	40	10	2	2	0	0	0	0	0	0	0	0
0700	127	0	107	19	0	0	0	1	0	0	0	0	0	0
0800	186	1	164	21	0	0	0	0	0	0	0	0	0	0
0900	190	2	164	22	1	1	0	0	0	0	0	0	0	0
1000	212	1	196	13	2	0	0	0	0	0	0	0	0	0
1100	235	2	198	33	0	0	2	0	0	0	0	0	0	0
1200	262	2	233	26	1	0	0	0	0	0	0	0	0	0
1300	265	4	239	20	0	2	0	0	0	0	0	0	0	0
1400	326	8	291	23	1	0	1	1	0	0	0	1	0	0
1500	317	4	273	31	0	1	4	2	1	0	1	0	0	0
1600	319	6	289	17	3	1	3	0	0	0	0	0	0	0
1700	314	4	281	12	6	0	4	5	2	0	0	0	0	0
1800	317	6	291	9	2	0	4	1	3	0	0	1	0	0
1900	237	2	219	15	0	0	0	0	1	0	0	0	0	0
2000	191	0	185	6	0	0	0	0	0	0	0	0	0	0
2100	212	1	205	5	0	0	0	1	0	0	0	0	0	0
2200	124	0	122	2	0	0	0	0	0	0	0	0	0	0
2300	65	1	59	5	0	0	0	0	0	0	0	0	0	0
07-19	**3070**	**40**	**2726**	**246**	**16**	**5**	**18**	**10**	**6**	**0**	**1**	**2**	**0**	**0**
06-22	**3764**	**43**	**3375**	**282**	**18**	**7**	**18**	**11**	**7**	**0**	**1**	**2**	**0**	**0**
06-00	**3953**	**44**	**3556**	**289**	**18**	**7**	**18**	**11**	**7**	**0**	**1**	**2**	**0**	**0**
00-00	**4031**	**45**	**3625**	**294**	**18**	**8**	**20**	**11**	**7**	**0**	**1**	**2**	**0**	**0**

Peak step 14:00 (326) **AM Peak step** 11:00 (235) **PM Peak step** 14:00 (326)

*** Saturday, February 25, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	28	0	26	2	0	0	0	0	0	0	0	0	0	0
0100	17	1	16	0	0	0	0	0	0	0	0	0	0	0
0200	13	0	13	0	0	0	0	0	0	0	0	0	0	0
0300	1	0	0	1	0	0	0	0	0	0	0	0	0	0
0400	6	0	5	1	0	0	0	0	0	0	0	0	0	0
0500	9	0	7	2	0	0	0	0	0	0	0	0	0	0
0600	28	0	22	6	0	0	0	0	0	0	0	0	0	0
0700	65	0	56	9	0	0	0	0	0	0	0	0	0	0
0800	123	0	112	11	0	0	0	0	0	0	0	0	0	0
0900	160	0	147	13	0	0	0	0	0	0	0	0	0	0
1000	190	1	183	6	0	0	0	0	0	0	0	0	0	0
1100	222	5	207	10	0	0	0	0	0	0	0	0	0	0
1200	267	2	245	19	1	0	0	0	0	0	0	0	0	0
1300	289	2	268	17	0	1	1	0	0	0	0	0	0	0
1400	259	6	231	16	3	0	2	0	1	0	0	0	0	0
1500	356	9	320	21	1	0	2	1	1	0	0	0	0	1
1600	301	3	279	15	3	0	0	0	1	0	0	0	0	0
1700	213	0	205	7	0	0	1	0	0	0	0	0	0	0
1800	243	2	231	6	2	1	1	0	0	0	0	0	0	0
1900	223	2	209	12	0	0	0	0	0	0	0	0	0	0
2000	115	0	109	6	0	0	0	0	0	0	0	0	0	0
2100	137	1	130	6	0	0	0	0	0	0	0	0	0	0
2200	113	0	109	2	0	1	0	1	0	0	0	0	0	0
2300	62	0	58	4	0	0	0	0	0	0	0	0	0	0
07-19	**2688**	**30**	**2484**	**150**	**10**	**2**	**7**	**1**	**3**	**0**	**0**	**0**	**0**	**1**
06-22	**3191**	**33**	**2954**	**180**	**10**	**2**	**7**	**1**	**3**	**0**	**0**	**0**	**0**	**1**
06-00	**3366**	**33**	**3121**	**186**	**10**	**3**	**7**	**2**	**3**	**0**	**0**	**0**	**0**	**1**
00-00	**3440**	**34**	**3188**	**192**	**10**	**3**	**7**	**2**	**3**	**0**	**0**	**0**	**0**	**1**

Peak step 15:00 (356) **AM Peak step** 11:00 (222) **PM Peak step** 15:00 (356)

*** Sunday, February 26, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	39	0	36	3	0	0	0	0	0	0	0	0	0	0
0100	19	0	17	2	0	0	0	0	0	0	0	0	0	0
0200	11	0	10	1	0	0	0	0	0	0	0	0	0	0
0300	7	0	7	0	0	0	0	0	0	0	0	0	0	0
0400	5	0	4	1	0	0	0	0	0	0	0	0	0	0
0500	9	0	8	1	0	0	0	0	0	0	0	0	0	0
0600	15	0	15	0	0	0	0	0	0	0	0	0	0	0
0700	51	0	45	6	0	0	0	0	0	0	0	0	0	0
0800	85	0	77	8	0	0	0	0	0	0	0	0	0	0
0900	139	0	132	7	0	0	0	0	0	0	0	0	0	0
1000	174	3	162	9	0	0	0	0	0	0	0	0	0	0
1100	188	5	175	7	0	0	1	0	0	0	0	0	0	0
1200	224	6	202	15	0	0	1	0	0	0	0	0	0	0
1300	271	5	250	12	1	0	2	0	1	0	0	0	0	0
1400	212	1	200	11	0	0	0	0	0	0	0	0	0	0
1500	249	4	231	12	0	0	2	0	0	0	0	0	0	0
1600	236	3	222	10	1	0	0	0	0	0	0	0	0	0
1700	242	1	228	13	0	0	0	0	0	0	0	0	0	0
1800	190	1	178	11	0	0	0	0	0	0	0	0	0	0
1900	138	1	131	6	0	0	0	0	0	0	0	0	0	0
2000	108	0	99	9	0	0	0	0	0	0	0	0	0	0
2100	91	0	86	5	0	0	0	0	0	0	0	0	0	0
2200	59	0	58	1	0	0	0	0	0	0	0	0	0	0
2300	36	0	35	1	0	0	0	0	0	0	0	0	0	0
07-19	**2261**	**29**	**2102**	**121**	**2**	**0**	**6**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
06-22	**2613**	**30**	**2433**	**141**	**2**	**0**	**6**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
06-00	**2708**	**30**	**2526**	**143**	**2**	**0**	**6**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
00-00	**2798**	**30**	**2608**	**151**	**2**	**0**	**6**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

Peak step 13:00 (271) **AM Peak step** 11:00 (188) **PM Peak step** 13:00 (271)

In profile: Vehicles = 14215 / 17381 (81.78%)

Traffic Data Service -- San Jose, CA
Class Report

CustomList-15060 -- English (ENU)

Datasets:
Site: **[3WB] CHURCHILL AVE W OF ALMA ST**
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: West (bound)
Name: Default Profile
Scheme: Vehicle classification (Scheme F)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)

Column Legend:
0 [Time] 24-hour time (0000 - 2359)
1 [Total] Number in time step
2 [Cls] Class totals

*** Thursday, February 23, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	11	0	11	0	0	0	0	0	0	0	0	0	0	0
0100	6	0	6	0	0	0	0	0	0	0	0	0	0	0
0200	3	0	3	0	0	0	0	0	0	0	0	0	0	0
0300	6	0	5	1	0	0	0	0	0	0	0	0	0	0
0400	11	0	9	2	0	0	0	0	0	0	0	0	0	0
0500	78	0	64	13	0	1	0	0	0	0	0	0	0	0
0600	163	0	142	19	0	0	1	0	1	0	0	0	0	0
0700	353	6	320	24	2	0	1	0	0	0	0	0	0	0
0800	462	8	400	48	3	0	2	0	1	0	0	0	0	0
0900	374	8	327	34	1	1	2	0	0	1	0	0	0	0
1000	297	7	265	23	0	1	0	0	1	0	0	0	0	0
1100	359	3	310	39	5	1	0	0	1	0	0	0	0	0
1200	297	2	263	28	3	0	1	0	0	0	0	0	0	0
1300	346	4	308	31	0	2	0	0	1	0	0	0	0	0
1400	353	2	306	40	4	1	0	0	0	0	0	0	0	0
1500	351	1	312	36	1	0	0	0	1	0	0	0	0	0
1600	313	0	287	21	4	1	0	0	0	0	0	0	0	0
1700	414	1	391	20	2	0	0	0	0	0	0	0	0	0
1800	351	2	341	8	0	0	0	0	0	0	0	0	0	0
1900	262	1	252	7	1	1	0	0	0	0	0	0	0	0
2000	168	1	163	4	0	0	0	0	0	0	0	0	0	0
2100	136	0	133	3	0	0	0	0	0	0	0	0	0	0
2200	87	0	85	2	0	0	0	0	0	0	0	0	0	0
2300	41	0	40	1	0	0	0	0	0	0	0	0	0	0
07-19	**4270**	**44**	**3830**	**352**	**25**	**7**	**6**	**0**	**5**	**1**	**0**	**0**	**0**	**0**
06-22	**4999**	**46**	**4520**	**385**	**26**	**8**	**7**	**0**	**6**	**1**	**0**	**0**	**0**	**0**
06-00	**5127**	**46**	**4645**	**388**	**26**	**8**	**7**	**0**	**6**	**1**	**0**	**0**	**0**	**0**
00-00	**5242**	**46**	**4743**	**404**	**26**	**9**	**7**	**0**	**6**	**1**	**0**	**0**	**0**	**0**

Peak step 8:00 (462) **AM Peak step** 8:00 (462) **PM Peak step** 17:00 (414)

*** Friday, February 24, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	13	0	13	0	0	0	0	0	0	0	0	0	0	0
0100	16	0	16	0	0	0	0	0	0	0	0	0	0	0
0200	1	0	1	0	0	0	0	0	0	0	0	0	0	0
0300	10	0	9	1	0	0	0	0	0	0	0	0	0	0
0400	19	0	15	1	0	1	2	0	0	0	0	0	0	0
0500	78	0	65	12	0	1	0	0	0	0	0	0	0	0
0600	183	1	166	15	0	1	0	0	0	0	0	0	0	0
0700	294	3	276	13	1	0	0	0	1	0	0	0	0	0
0800	419	2	380	29	6	0	1	0	1	0	0	0	0	0
0900	380	9	324	43	2	2	0	0	0	0	0	0	0	0
1000	332	0	304	25	2	0	1	0	0	0	0	0	0	0
1100	372	1	325	44	1	1	0	0	0	0	0	0	0	0
1200	321	8	284	29	0	0	0	0	0	0	0	0	0	0
1300	299	1	275	20	2	1	0	0	0	0	0	0	0	0
1400	356	1	317	37	0	0	0	0	1	0	0	0	0	0
1500	350	1	317	29	3	0	0	0	0	0	0	0	0	0
1600	345	0	319	21	4	1	0	0	0	0	0	0	0	0
1700	365	0	348	16	1	0	0	0	0	0	0	0	0	0
1800	328	0	314	13	0	0	0	0	1	0	0	0	0	0
1900	301	0	290	10	1	0	0	0	0	0	0	0	0	0
2000	159	0	155	4	0	0	0	0	0	0	0	0	0	0
2100	149	0	144	5	0	0	0	0	0	0	0	0	0	0
2200	108	0	107	1	0	0	0	0	0	0	0	0	0	0
2300	48	0	48	0	0	0	0	0	0	0	0	0	0	0
07-19	**4161**	**26**	**3783**	**319**	**22**	**5**	**2**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
06-22	**4953**	**27**	**4538**	**353**	**23**	**6**	**2**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
06-00	**5109**	**27**	**4693**	**354**	**23**	**6**	**2**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
00-00	**5246**	**27**	**4812**	**368**	**23**	**8**	**4**	**0**	**4**	**0**	**0**	**0**	**0**	**0**

Peak step 8:00 (419) **AM Peak step** 8:00 (419) **PM Peak step** 17:00 (365)

*** Saturday, February 25, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	34	0	33	1	0	0	0	0	0	0	0	0	0	0
0100	17	0	16	1	0	0	0	0	0	0	0	0	0	0
0200	11	0	11	0	0	0	0	0	0	0	0	0	0	0
0300	5	0	5	0	0	0	0	0	0	0	0	0	0	0
0400	15	0	14	1	0	0	0	0	0	0	0	0	0	0
0500	28	0	24	4	0	0	0	0	0	0	0	0	0	0
0600	50	0	46	2	0	1	0	0	1	0	0	0	0	0
0700	113	0	104	9	0	0	0	0	0	0	0	0	0	0
0800	206	0	192	14	0	0	0	0	0	0	0	0	0	0
0900	244	0	230	14	0	0	0	0	0	0	0	0	0	0
1000	288	1	268	18	0	1	0	0	0	0	0	0	0	0
1100	364	3	335	26	0	0	0	0	0	0	0	0	0	0
1200	411	6	388	14	1	0	1	0	1	0	0	0	0	0
1300	360	4	337	18	0	0	1	0	0	0	0	0	0	0
1400	351	2	332	16	1	0	0	0	0	0	0	0	0	0
1500	299	0	284	15	0	0	0	0	0	0	0	0	0	0
1600	252	0	240	12	0	0	0	0	0	0	0	0	0	0
1700	227	1	221	5	0	0	0	0	0	0	0	0	0	0
1800	238	0	226	12	0	0	0	0	0	0	0	0	0	0
1900	202	0	196	6	0	0	0	0	0	0	0	0	0	0
2000	130	2	123	5	0	0	0	0	0	0	0	0	0	0
2100	141	0	138	3	0	0	0	0	0	0	0	0	0	0
2200	86	0	81	4	0	1	0	0	0	0	0	0	0	0
2300	51	0	51	0	0	0	0	0	0	0	0	0	0	0
07-19	**3353**	**17**	**3157**	**173**	**2**	**1**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
06-22	**3876**	**19**	**3660**	**189**	**2**	**2**	**2**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
06-00	**4013**	**19**	**3792**	**193**	**2**	**3**	**2**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
00-00	**4123**	**19**	**3895**	**200**	**2**	**3**	**2**	**0**	**2**	**0**	**0**	**0**	**0**	**0**

Peak step 12:00 (411) **AM Peak step** 11:00 (364) **PM Peak step** 12:00 (411)

*** Sunday, February 26, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	29	0	26	3	0	0	0	0	0	0	0	0	0	0
0100	23	0	23	0	0	0	0	0	0	0	0	0	0	0
0200	10	0	10	0	0	0	0	0	0	0	0	0	0	0
0300	10	0	8	2	0	0	0	0	0	0	0	0	0	0
0400	4	0	2	2	0	0	0	0	0	0	0	0	0	0
0500	12	0	12	0	0	0	0	0	0	0	0	0	0	0
0600	43	0	41	2	0	0	0	0	0	0	0	0	0	0
0700	75	0	67	8	0	0	0	0	0	0	0	0	0	0
0800	113	0	110	3	0	0	0	0	0	0	0	0	0	0
0900	157	2	150	3	1	1	0	0	0	0	0	0	0	0
1000	259	6	240	13	0	0	0	0	0	0	0	0	0	0
1100	291	2	284	5	0	0	0	0	0	0	0	0	0	0
1200	319	3	298	18	0	0	0	0	0	0	0	0	0	0
1300	307	6	288	13	0	0	0	0	0	0	0	0	0	0
1400	313	4	296	13	0	0	0	0	0	0	0	0	0	0
1500	300	2	288	9	1	0	0	0	0	0	0	0	0	0
1600	247	0	239	7	0	1	0	0	0	0	0	0	0	0
1700	214	0	210	4	0	0	0	0	0	0	0	0	0	0
1800	179	0	174	5	0	0	0	0	0	0	0	0	0	0
1900	135	0	130	4	1	0	0	0	0	0	0	0	0	0
2000	118	0	113	5	0	0	0	0	0	0	0	0	0	0
2100	108	0	104	4	0	0	0	0	0	0	0	0	0	0
2200	66	0	63	3	0	0	0	0	0	0	0	0	0	0
2300	34	0	33	1	0	0	0	0	0	0	0	0	0	0
07-19	**2774**	**25**	**2644**	**101**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
06-22	**3178**	**25**	**3032**	**116**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
06-00	**3278**	**25**	**3128**	**120**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
00-00	**3366**	**25**	**3209**	**127**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Peak step 12:00 (319) **AM Peak step** 11:00 (291) **PM Peak step** 12:00 (319)

In profile: Vehicles = 17977 / 20914 (85.96%)

Traffic Data Service -- San Jose, CA
Class Report

CustomList-15059 -- English (ENU)

Datasets:
Site: **[2EB] MEADOW DR W OF ALMA ST**
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: East (bound)
Name: Default Profile
Scheme: Vehicle classification (Scheme F)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)

Column Legend:
0 [Time] 24-hour time (0000 - 2359)
1 [Total] Number in time step
2 [Cls] Class totals

*** Thursday, February 23, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	12	0	12	0	0	0	0	0	0	0	0	0	0	0
0100	7	0	6	1	0	0	0	0	0	0	0	0	0	0
0200	3	0	2	1	0	0	0	0	0	0	0	0	0	0
0300	5	0	5	0	0	0	0	0	0	0	0	0	0	0
0400	8	0	5	3	0	0	0	0	0	0	0	0	0	0
0500	31	0	24	6	0	0	1	0	0	0	0	0	0	0
0600	76	0	69	6	0	1	0	0	0	0	0	0	0	0
0700	244	7	207	29	1	0	0	0	0	0	0	0	0	0
0800	362	3	323	33	0	2	1	0	0	0	0	0	0	0
0900	270	3	240	21	1	2	2	0	1	0	0	0	0	0
1000	252	5	199	44	1	2	0	1	0	0	0	0	0	0
1100	235	5	193	35	2	0	0	0	0	0	0	0	0	0
1200	211	4	172	35	0	0	0	0	0	0	0	0	0	0
1300	282	12	223	46	0	1	0	0	0	0	0	0	0	0
1400	246	7	197	42	0	0	0	0	0	0	0	0	0	0
1500	351	20	280	43	4	1	0	0	2	0	0	1	0	0
1600	310	9	266	32	2	0	0	0	1	0	0	0	0	0
1700	340	10	303	23	2	0	1	0	0	1	0	0	0	0
1800	279	8	248	20	0	1	0	1	1	0	0	0	0	0
1900	250	4	222	24	0	0	0	0	0	0	0	0	0	0
2000	161	3	151	7	0	0	0	0	0	0	0	0	0	0
2100	92	1	84	7	0	0	0	0	0	0	0	0	0	0
2200	80	1	67	12	0	0	0	0	0	0	0	0	0	0
2300	30	1	24	5	0	0	0	0	0	0	0	0	0	0
07-19	**3382**	**93**	**2851**	**403**	**13**	**9**	**4**	**2**	**5**	**1**	**0**	**1**	**0**	**0**
06-22	**3961**	**101**	**3377**	**447**	**13**	**10**	**4**	**2**	**5**	**1**	**0**	**1**	**0**	**0**
06-00	**4071**	**103**	**3468**	**464**	**13**	**10**	**4**	**2**	**5**	**1**	**0**	**1**	**0**	**0**
00-00	**4137**	**103**	**3522**	**475**	**13**	**10**	**5**	**2**	**5**	**1**	**0**	**1**	**0**	**0**

Peak step 8:00 (362) **AM Peak step** 8:00 (362) **PM Peak step** 15:00 (351)

*** Friday, February 24, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	14	0	13	1	0	0	0	0	0	0	0	0	0	0
0100	6	0	5	1	0	0	0	0	0	0	0	0	0	0
0200	3	0	2	1	0	0	0	0	0	0	0	0	0	0
0300	7	0	6	1	0	0	0	0	0	0	0	0	0	0
0400	5	0	3	2	0	0	0	0	0	0	0	0	0	0
0500	33	1	25	7	0	0	0	0	0	0	0	0	0	0
0600	82	0	75	7	0	0	0	0	0	0	0	0	0	0
0700	226	5	188	32	1	0	0	0	0	0	0	0	0	0
0800	347	5	300	34	2	3	3	0	0	0	0	0	0	0
0900	280	1	249	25	2	3	0	0	0	0	0	0	0	0
1000	244	2	194	41	4	2	1	0	0	0	0	0	0	0
1100	233	6	189	37	0	1	0	0	0	0	0	0	0	0
1200	249	8	203	38	0	0	0	0	0	0	0	0	0	0
1300	262	26	197	38	1	0	0	0	0	0	0	0	0	0
1400	281	7	234	37	0	2	1	0	0	0	0	0	0	0
1500	350	20	278	42	3	1	4	0	2	0	0	0	0	0
1600	299	12	247	37	1	0	0	0	2	0	0	0	0	0
1700	312	14	270	25	0	0	1	1	1	0	0	0	0	0
1800	324	9	288	27	0	0	0	0	0	0	0	0	0	0
1900	247	1	219	26	1	0	0	0	0	0	0	0	0	0
2000	179	0	166	13	0	0	0	0	0	0	0	0	0	0
2100	143	2	124	17	0	0	0	0	0	0	0	0	0	0
2200	126	0	110	16	0	0	0	0	0	0	0	0	0	0
2300	51	0	48	3	0	0	0	0	0	0	0	0	0	0
07-19	**3407**	**115**	**2837**	**413**	**14**	**12**	**10**	**1**	**5**	**0**	**0**	**0**	**0**	**0**
06-22	**4058**	**118**	**3421**	**476**	**15**	**12**	**10**	**1**	**5**	**0**	**0**	**0**	**0**	**0**
06-00	**4235**	**118**	**3579**	**495**	**15**	**12**	**10**	**1**	**5**	**0**	**0**	**0**	**0**	**0**
00-00	**4303**	**119**	**3633**	**508**	**15**	**12**	**10**	**1**	**5**	**0**	**0**	**0**	**0**	**0**

Peak step 15:00 (350) **AM Peak step** 8:00 (347) **PM Peak step** 15:00 (350)

*** Saturday, February 25, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	26	0	25	1	0	0	0	0	0	0	0	0	0	0
0100	15	0	14	1	0	0	0	0	0	0	0	0	0	0
0200	6	0	5	1	0	0	0	0	0	0	0	0	0	0
0300	4	0	2	2	0	0	0	0	0	0	0	0	0	0
0400	9	0	7	2	0	0	0	0	0	0	0	0	0	0
0500	16	0	15	1	0	0	0	0	0	0	0	0	0	0
0600	36	0	35	1	0	0	0	0	0	0	0	0	0	0
0700	82	1	70	11	0	0	0	0	0	0	0	0	0	0
0800	141	1	123	17	0	0	0	0	0	0	0	0	0	0
0900	209	2	175	31	0	1	0	0	0	0	0	0	0	0
1000	250	3	212	33	2	0	0	0	0	0	0	0	0	0
1100	273	7	230	34	0	0	1	0	1	0	0	0	0	0
1200	289	9	243	32	2	0	1	0	2	0	0	0	0	0
1300	292	14	248	28	1	0	1	0	0	0	0	0	0	0
1400	320	12	265	41	0	1	0	0	1	0	0	0	0	0
1500	285	8	251	26	0	0	0	0	0	0	0	0	0	0
1600	254	3	220	30	1	0	0	0	0	0	0	0	0	0
1700	245	3	207	34	0	0	1	0	0	0	0	0	0	0
1800	239	2	213	24	0	0	0	0	0	0	0	0	0	0
1900	172	0	156	16	0	0	0	0	0	0	0	0	0	0
2000	130	1	114	15	0	0	0	0	0	0	0	0	0	0
2100	112	1	106	5	0	0	0	0	0	0	0	0	0	0
2200	82	0	71	11	0	0	0	0	0	0	0	0	0	0
2300	49	0	45	4	0	0	0	0	0	0	0	0	0	0
07-19	**2879**	**65**	**2457**	**341**	**6**	**2**	**4**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
06-22	**3329**	**67**	**2868**	**378**	**6**	**2**	**4**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
06-00	**3460**	**67**	**2984**	**393**	**6**	**2**	**4**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
00-00	**3536**	**67**	**3052**	**401**	**6**	**2**	**4**	**0**	**4**	**0**	**0**	**0**	**0**	**0**

Peak step 14:00 (320) **AM Peak step** 11:00 (273) **PM Peak step** 14:00 (320)

*** Sunday, February 26, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	19	0	18	1	0	0	0	0	0	0	0	0	0	0
0100	15	1	13	1	0	0	0	0	0	0	0	0	0	0
0200	5	0	4	1	0	0	0	0	0	0	0	0	0	0
0300	4	0	2	2	0	0	0	0	0	0	0	0	0	0
0400	5	0	4	1	0	0	0	0	0	0	0	0	0	0
0500	6	0	6	0	0	0	0	0	0	0	0	0	0	0
0600	25	0	19	6	0	0	0	0	0	0	0	0	0	0
0700	56	0	50	6	0	0	0	0	0	0	0	0	0	0
0800	159	2	132	24	0	0	1	0	0	0	0	0	0	0
0900	244	1	207	35	0	1	0	0	0	0	0	0	0	0
1000	252	6	211	32	0	1	1	0	1	0	0	0	0	0
1100	231	2	195	33	1	0	0	0	0	0	0	0	0	0
1200	262	10	220	30	0	1	1	0	0	0	0	0	0	0
1300	302	10	258	32	0	1	1	0	0	0	0	0	0	0
1400	285	9	254	21	1	0	0	0	0	0	0	0	0	0
1500	276	7	247	18	2	1	1	0	0	0	0	0	0	0
1600	231	8	207	15	0	1	0	0	0	0	0	0	0	0
1700	234	1	211	22	0	0	0	0	0	0	0	0	0	0
1800	189	2	166	21	0	0	0	0	0	0	0	0	0	0
1900	160	2	138	20	0	0	0	0	0	0	0	0	0	0
2000	99	0	88	11	0	0	0	0	0	0	0	0	0	0
2100	87	0	80	7	0	0	0	0	0	0	0	0	0	0
2200	41	0	38	3	0	0	0	0	0	0	0	0	0	0
2300	28	0	26	2	0	0	0	0	0	0	0	0	0	0
07-19	**2721**	**58**	**2358**	**289**	**4**	**6**	**5**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
06-22	**3092**	**60**	**2683**	**333**	**4**	**6**	**5**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
06-00	**3161**	**60**	**2747**	**338**	**4**	**6**	**5**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
00-00	**3215**	**61**	**2794**	**344**	**4**	**6**	**5**	**0**	**1**	**0**	**0**	**0**	**0**	**0**

Peak step 13:00 (302) **AM Peak step** 10:00 (252) **PM Peak step** 13:00 (302)

In profile: Vehicles = 15191 / 18158 (83.66%)

Traffic Data Service -- San Jose, CA
Class Report

CustomList-15058 -- English (ENU)

Datasets:

Site:	**[2WB] MEADOW DR W OF ALMA ST**
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range:	0 - 100 mph.
Direction:	West (bound)
Name:	Default Profile
Scheme:	Vehicle classification (Scheme F)
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)

Column Legend:

0 [Time]	24-hour time (0000 - 2359)
1 [Total]	Number in time step
2 [Cls]	Class totals

*** Thursday, February 23, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	11	0	10	1	0	0	0	0	0	0	0	0	0	0
0100	12	0	11	1	0	0	0	0	0	0	0	0	0	0
0200	1	0	1	0	0	0	0	0	0	0	0	0	0	0
0300	4	0	4	0	0	0	0	0	0	0	0	0	0	0
0400	13	1	10	2	0	0	0	0	0	0	0	0	0	0
0500	27	1	24	2	0	0	0	0	0	0	0	0	0	0
0600	75	2	64	6	0	0	3	0	0	0	0	0	0	0
0700	245	16	199	25	2	1	0	0	1	0	0	1	0	0
0800	439	23	377	24	2	3	2	1	4	2	0	0	0	1
0900	277	23	216	35	1	0	2	0	0	0	0	0	0	0
1000	219	13	173	28	1	2	0	0	1	1	0	0	0	0
1100	240	12	194	33	1	0	0	0	0	0	0	0	0	0
1200	253	8	204	39	1	1	0	0	0	0	0	0	0	0
1300	243	8	209	25	0	0	1	0	0	0	0	0	0	0
1400	303	8	252	40	1	1	0	0	1	0	0	0	0	0
1500	354	12	299	40	1	1	1	0	0	0	0	0	0	0
1600	352	12	300	38	1	0	0	0	1	0	0	0	0	0
1700	477	8	433	35	0	0	0	0	0	0	0	1	0	0
1800	448	5	401	37	1	0	4	0	0	0	0	0	0	0
1900	274	7	249	16	0	0	1	0	0	0	1	0	0	0
2000	211	6	191	12	0	1	1	0	0	0	0	0	0	0
2100	166	0	152	13	0	0	1	0	0	0	0	0	0	0
2200	73	1	63	8	0	0	1	0	0	0	0	0	0	0
2300	47	3	40	4	0	0	0	0	0	0	0	0	0	0
07-19	**3850**	**148**	**3257**	**399**	**12**	**9**	**10**	**1**	**8**	**3**	**0**	**2**	**0**	**1**
06-22	**4576**	**163**	**3913**	**446**	**12**	**10**	**16**	**1**	**8**	**3**	**1**	**2**	**0**	**1**
06-00	**4696**	**167**	**4016**	**458**	**12**	**10**	**17**	**1**	**8**	**3**	**1**	**2**	**0**	**1**
00-00	**4764**	**169**	**4076**	**464**	**12**	**10**	**17**	**1**	**8**	**3**	**1**	**2**	**0**	**1**

Peak step 17:00 (477) **AM Peak step** 8:00 (439) **PM Peak step** 17:00 (477)

*** Friday, February 24, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	30	1	27	2	0	0	0	0	0	0	0	0	0	0
0100	13	0	12	1	0	0	0	0	0	0	0	0	0	0
0200	7	0	6	1	0	0	0	0	0	0	0	0	0	0
0300	1	0	1	0	0	0	0	0	0	0	0	0	0	0
0400	13	1	11	1	0	0	0	0	0	0	0	0	0	0
0500	37	1	33	3	0	0	0	0	0	0	0	0	0	0
0600	69	2	58	9	0	0	0	0	0	0	0	0	0	0
0700	245	12	197	29	1	0	1	0	0	0	0	0	0	5
0800	453	20	380	36	4	2	2	0	5	1	2	0	0	1
0900	248	11	206	28	1	1	1	0	0	0	0	0	0	0
1000	244	5	198	40	0	1	0	0	0	0	0	0	0	0
1100	265	8	224	28	1	2	1	0	1	0	0	0	0	0
1200	240	4	196	38	0	1	0	0	1	0	0	0	0	0
1300	267	13	231	20	1	1	0	0	0	0	0	1	0	0
1400	322	6	276	36	0	1	1	1	1	0	0	0	0	0
1500	359	8	312	36	0	3	0	0	0	0	0	0	0	0
1600	315	14	283	15	0	0	3	0	0	0	0	0	0	0
1700	458	10	413	30	0	0	0	2	2	0	0	0	0	1
1800	414	6	390	14	1	0	1	0	1	0	0	0	0	1
1900	334	6	313	13	1	0	1	0	0	0	0	0	0	0
2000	195	4	166	24	0	0	0	0	0	0	1	0	0	0
2100	184	1	172	10	0	0	1	0	0	0	0	0	0	0
2200	140	0	130	10	0	0	0	0	0	0	0	0	0	0
2300	66	1	63	2	0	0	0	0	0	0	0	0	0	0
07-19	**3830**	**117**	**3306**	**350**	**9**	**12**	**10**	**3**	**11**	**1**	**2**	**1**	**0**	**8**
06-22	**4612**	**130**	**4015**	**406**	**10**	**12**	**12**	**3**	**11**	**1**	**3**	**1**	**0**	**8**
06-00	**4818**	**131**	**4208**	**418**	**10**	**12**	**12**	**3**	**11**	**1**	**3**	**1**	**0**	**8**
00-00	**4919**	**134**	**4298**	**426**	**10**	**12**	**12**	**3**	**11**	**1**	**3**	**1**	**0**	**8**

Peak step 17:00 (458) **AM Peak step** 8:00 (453) **PM Peak step** 17:00 (458)

*** Saturday, February 25, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	37	0	36	1	0	0	0	0	0	0	0	0	0	0
0100	20	0	20	0	0	0	0	0	0	0	0	0	0	0
0200	13	0	13	0	0	0	0	0	0	0	0	0	0	0
0300	2	0	2	0	0	0	0	0	0	0	0	0	0	0
0400	10	0	9	1	0	0	0	0	0	0	0	0	0	0
0500	17	1	16	0	0	0	0	0	0	0	0	0	0	0
0600	40	1	36	3	0	0	0	0	0	0	0	0	0	0
0700	56	3	50	3	0	0	0	0	0	0	0	0	0	0
0800	114	5	100	8	1	0	0	0	0	0	0	0	0	0
0900	197	6	175	13	1	1	1	0	0	0	0	0	0	0
1000	229	12	193	21	1	0	2	0	0	0	0	0	0	0
1100	287	10	240	33	3	0	1	0	0	0	0	0	0	0
1200	326	8	275	42	1	0	0	0	0	0	0	0	0	0
1300	301	7	262	31	0	0	0	0	1	0	0	0	0	0
1400	249	7	224	16	0	1	1	0	0	0	0	0	0	0
1500	357	13	310	28	3	0	1	0	2	0	0	0	0	0
1600	285	5	260	18	0	0	0	0	2	0	0	0	0	0
1700	315	14	276	23	0	0	0	1	1	0	0	0	0	0
1800	279	3	262	14	0	0	0	0	0	0	0	0	0	0
1900	190	4	170	15	0	0	0	0	1	0	0	0	0	0
2000	162	3	148	11	0	0	0	0	0	0	0	0	0	0
2100	132	2	120	9	0	0	1	0	0	0	0	0	0	0
2200	118	0	113	5	0	0	0	0	0	0	0	0	0	0
2300	59	0	55	4	0	0	0	0	0	0	0	0	0	0
07-19	**2995**	**93**	**2627**	**250**	**10**	**2**	**6**	**1**	**6**	**0**	**0**	**0**	**0**	**0**
06-22	**3519**	**103**	**3101**	**288**	**10**	**2**	**7**	**1**	**7**	**0**	**0**	**0**	**0**	**0**
06-00	**3696**	**103**	**3269**	**297**	**10**	**2**	**7**	**1**	**7**	**0**	**0**	**0**	**0**	**0**
00-00	**3795**	**104**	**3365**	**299**	**10**	**2**	**7**	**1**	**7**	**0**	**0**	**0**	**0**	**0**

Peak step 15:00 (357) **AM Peak step** 11:00 (287) **PM Peak step** 15:00 (357)

*** Sunday, February 26, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	32	1	28	3	0	0	0	0	0	0	0	0	0	0
0100	21	1	18	2	0	0	0	0	0	0	0	0	0	0
0200	19	0	18	1	0	0	0	0	0	0	0	0	0	0
0300	7	0	7	0	0	0	0	0	0	0	0	0	0	0
0400	6	0	6	0	0	0	0	0	0	0	0	0	0	0
0500	12	0	12	0	0	0	0	0	0	0	0	0	0	0
0600	24	0	24	0	0	0	0	0	0	0	0	0	0	0
0700	42	1	35	6	0	0	0	0	0	0	0	0	0	0
0800	94	3	83	5	1	0	1	0	0	0	0	0	0	1
0900	149	6	122	18	0	1	1	0	1	0	0	0	0	0
1000	236	7	206	22	0	1	0	0	0	0	0	0	0	0
1100	257	6	238	10	0	1	1	0	1	0	0	0	0	0
1200	339	11	306	18	3	0	0	0	1	0	0	0	0	0
1300	293	11	253	26	1	1	1	0	0	0	0	0	0	0
1400	288	15	249	23	0	0	0	0	1	0	0	0	0	0
1500	284	12	253	17	2	0	0	0	0	0	0	0	0	0
1600	310	11	270	25	0	1	0	0	2	0	1	0	0	0
1700	292	7	257	26	0	0	1	0	1	0	0	0	0	0
1800	235	4	217	14	0	0	0	0	0	0	0	0	0	0
1900	167	3	146	18	0	0	0	0	0	0	0	0	0	0
2000	116	4	105	7	0	0	0	0	0	0	0	0	0	0
2100	124	1	106	17	0	0	0	0	0	0	0	0	0	0
2200	69	0	66	3	0	0	0	0	0	0	0	0	0	0
2300	41	0	39	2	0	0	0	0	0	0	0	0	0	0
07-19	**2819**	**94**	**2489**	**210**	**7**	**5**	**5**	**0**	**7**	**0**	**1**	**0**	**0**	**1**
06-22	**3250**	**102**	**2870**	**252**	**7**	**5**	**5**	**0**	**7**	**0**	**1**	**0**	**0**	**1**
06-00	**3360**	**102**	**2975**	**257**	**7**	**5**	**5**	**0**	**7**	**0**	**1**	**0**	**0**	**1**
00-00	**3457**	**104**	**3064**	**263**	**7**	**5**	**5**	**0**	**7**	**0**	**1**	**0**	**0**	**1**

Peak step 12:00 (339) **AM Peak step** 11:00 (257) **PM Peak step** 12:00 (339)

In profile: Vehicles = 16935 / 20314 (83.37%)

*** Friday, February 24, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	59	1	55	2	0	0	0	0	0	1	0	0	0	0
0100	31	0	26	4	0	1	0	0	0	0	0	0	0	0
0200	14	0	11	3	0	0	0	0	0	0	0	0	0	0
0300	15	0	11	3	0	0	0	0	0	1	0	0	0	0
0400	13	0	11	1	0	1	0	0	0	0	0	0	0	0
0500	51	0	44	4	0	1	0	0	1	1	0	0	0	0
0600	123	0	100	18	3	2	0	0	0	0	0	0	0	0
0700	328	4	284	36	1	2	1	0	0	0	0	0	0	0
0800	441	3	389	37	1	1	6	0	1	0	0	2	0	1
0900	398	2	357	33	4	0	1	0	1	0	0	0	0	0
1000	391	2	348	35	1	2	1	0	1	1	0	0	0	0
1100	436	5	381	44	1	0	5	0	0	0	0	0	0	0
1200	456	3	387	56	1	4	4	0	0	1	0	0	0	0
1300	506	9	421	61	1	4	9	0	0	1	0	0	0	0
1400	530	2	452	63	1	4	7	0	1	0	0	0	0	0
1500	508	6	449	44	0	1	8	0	0	0	0	0	0	0
1600	540	10	477	42	0	0	10	0	1	0	0	0	0	0
1700	579	13	523	31	1	0	9	0	0	0	1	1	0	0
1800	623	10	570	32	1	0	8	0	1	0	0	1	0	0
1900	531	9	492	24	2	1	3	0	0	0	0	0	0	0
2000	361	1	335	21	2	2	0	0	0	0	0	0	0	0
2100	245	4	229	12	0	0	0	0	0	0	0	0	0	0
2200	210	3	192	14	0	1	0	0	0	0	0	0	0	0
2300	172	1	156	14	1	0	0	0	0	0	0	0	0	0
07-19	**5736**	**69**	**5038**	**514**	**13**	**18**	**69**	**0**	**6**	**3**	**1**	**4**	**0**	**1**
06-22	**6996**	**83**	**6194**	**589**	**20**	**23**	**72**	**0**	**6**	**3**	**1**	**4**	**0**	**1**
06-00	**7378**	**87**	**6542**	**617**	**21**	**24**	**72**	**0**	**6**	**3**	**1**	**4**	**0**	**1**
00-00	**7561**	**88**	**6700**	**634**	**21**	**27**	**72**	**0**	**7**	**6**	**1**	**4**	**0**	**1**

Peak step 18:00 (623) **AM Peak step** 8:00 (441) **PM Peak step** 18:00 (623)

*** Saturday, February 25, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	68	1	61	6	0	0	0	0	0	0	0	0	0	0
0100	56	0	52	3	0	1	0	0	0	0	0	0	0	0
0200	33	1	28	4	0	0	0	0	0	0	0	0	0	0
0300	15	0	12	1	0	0	0	0	0	2	0	0	0	0
0400	20	0	15	4	0	0	0	0	1	0	0	0	0	0
0500	19	0	15	3	1	0	0	0	0	0	0	0	0	0
0600	61	0	45	15	1	0	0	0	0	0	0	0	0	0
0700	133	1	109	22	0	1	0	0	0	0	0	0	0	0
0800	193	1	177	14	0	1	0	0	0	0	0	0	0	0
0900	302	3	276	21	0	0	2	0	0	0	0	0	0	0
1000	344	4	296	37	3	1	1	0	1	0	1	0	0	0
1100	436	5	389	28	5	1	8	0	0	0	0	0	0	0
1200	447	7	399	33	2	0	5	0	1	0	0	0	0	0
1300	491	5	429	52	0	0	5	0	0	0	0	0	0	0
1400	462	2	411	43	1	0	5	0	0	0	0	0	0	0
1500	521	11	474	32	0	1	3	0	0	0	0	0	0	0
1600	476	3	437	34	0	0	2	0	0	0	0	0	0	0
1700	540	12	489	35	0	0	4	0	0	0	0	0	0	0
1800	483	4	441	34	1	0	3	0	0	0	0	0	0	0
1900	403	2	368	32	0	0	1	0	0	0	0	0	0	0
2000	258	2	243	12	0	1	0	0	0	0	0	0	0	0
2100	238	0	214	23	1	0	0	0	0	0	0	0	0	0
2200	164	1	150	12	1	0	0	0	0	0	0	0	0	0
2300	125	1	117	7	0	0	0	0	0	0	0	0	0	0
07-19	**4828**	**58**	**4327**	**385**	**12**	**5**	**38**	**0**	**2**	**0**	**1**	**0**	**0**	**0**
06-22	**5788**	**62**	**5197**	**467**	**14**	**6**	**39**	**0**	**2**	**0**	**1**	**0**	**0**	**0**
06-00	**6077**	**64**	**5464**	**486**	**15**	**6**	**39**	**0**	**2**	**0**	**1**	**0**	**0**	**0**
00-00	**6288**	**66**	**5647**	**507**	**16**	**7**	**39**	**0**	**3**	**2**	**1**	**0**	**0**	**0**

Peak step 17:00 (540) **AM Peak step** 11:00 (436) **PM Peak step** 17:00 (540)

*** Sunday, February 26, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	67	0	63	4	0	0	0	0	0	0	0	0	0	0
0100	49	2	40	7	0	0	0	0	0	0	0	0	0	0
0200	24	0	24	0	0	0	0	0	0	0	0	0	0	0
0300	15	0	13	1	0	0	0	0	0	1	0	0	0	0
0400	14	0	10	3	0	1	0	0	0	0	0	0	0	0
0500	14	0	11	2	1	0	0	0	0	0	0	0	0	0
0600	36	0	31	5	0	0	0	0	0	0	0	0	0	0
0700	85	0	79	6	0	0	0	0	0	0	0	0	0	0
0800	180	0	167	12	0	0	1	0	0	0	0	0	0	0
0900	282	1	256	24	0	0	0	0	0	1	0	0	0	0
1000	305	5	278	16	1	0	4	0	1	0	0	0	0	0
1100	382	4	338	35	0	0	4	0	1	0	0	0	0	0
1200	411	4	370	29	0	0	8	0	0	0	0	0	0	0
1300	454	11	397	42	1	0	2	0	1	0	0	0	0	0
1400	416	6	378	24	5	0	3	0	0	0	0	0	0	0
1500	430	8	396	21	0	0	5	0	0	0	0	0	0	0
1600	440	5	401	32	0	0	1	0	0	0	0	1	0	0
1700	428	9	383	35	0	0	1	0	0	0	0	0	0	0
1800	389	3	351	34	0	1	0	0	0	0	0	0	0	0
1900	348	1	319	24	0	0	4	0	0	0	0	0	0	0
2000	233	2	216	15	0	0	0	0	0	0	0	0	0	0
2100	173	1	159	13	0	0	0	0	0	0	0	0	0	0
2200	102	1	91	10	0	0	0	0	0	0	0	0	0	0
2300	79	0	71	6	1	0	0	0	1	0	0	0	0	0
07-19	**4202**	**56**	**3794**	**310**	**7**	**1**	**29**	**0**	**3**	**1**	**0**	**1**	**0**	**0**
06-22	**4992**	**60**	**4519**	**367**	**7**	**1**	**33**	**0**	**3**	**1**	**0**	**1**	**0**	**0**
06-00	**5173**	**61**	**4681**	**383**	**8**	**1**	**33**	**0**	**4**	**1**	**0**	**1**	**0**	**0**
00-00	**5356**	**63**	**4842**	**400**	**9**	**2**	**33**	**0**	**4**	**2**	**0**	**1**	**0**	**0**

Peak step 13:00 (454) **AM Peak step** 11:00 (382) **PM Peak step** 13:00 (454)

In profile: Vehicles = 26432 / 68170 (38.77%)

Traffic Data Service -- San Jose, CA
Class Report

CustomList-15067 -- English (ENU)

Datasets:
Site: **[4] PALO ALTO AVE W OF ALMA ST**
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: West (bound)
Name: Default Profile
Scheme: Vehicle classification (Scheme F)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)

Column Legend:
0 [Time] 24-hour time (0000 - 2359)
1 [Total] Number in time step
2 [Cls] Class totals

*** Thursday, February 23, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	43	0	36	7	0	0	0	0	0	0	0	0	0	0
0100	19	0	16	2	0	0	0	0	0	1	0	0	0	0
0200	7	0	5	2	0	0	0	0	0	0	0	0	0	0
0300	7	0	5	2	0	0	0	0	0	0	0	0	0	0
0400	29	0	23	5	0	1	0	0	0	0	0	0	0	0
0500	85	2	62	21	0	0	0	0	0	0	0	0	0	0
0600	170	4	134	32	0	0	0	0	0	0	0	0	0	0
0700	425	8	338	70	2	4	2	1	0	0	0	0	0	0
0800	560	15	485	54	3	2	0	0	1	0	0	0	0	0
0900	507	8	429	68	1	1	0	0	0	0	0	0	0	0
1000	476	6	396	67	2	1	0	0	2	1	1	0	0	0
1100	568	7	457	98	1	4	0	0	1	0	0	0	0	0
1200	577	8	489	78	1	1	0	0	0	0	0	0	0	0
1300	556	6	484	63	1	1	0	0	0	1	0	0	0	0
1400	558	6	488	63	0	1	0	0	0	0	0	0	0	0
1500	673	3	591	79	0	0	0	0	0	0	0	0	0	0
1600	736	10	663	60	1	0	1	0	0	0	0	1	0	0
1700	804	5	745	50	3	0	0	0	1	0	0	0	0	0
1800	690	3	636	51	0	0	0	0	0	0	0	0	0	0
1900	497	3	463	29	0	1	1	0	0	0	0	0	0	0
2000	363	2	335	26	0	0	0	0	0	0	0	0	0	0
2100	299	0	282	17	0	0	0	0	0	0	0	0	0	0
2200	204	0	194	10	0	0	0	0	0	0	0	0	0	0
2300	109	1	98	10	0	0	0	0	0	0	0	0	0	0
07-19	**7130**	**85**	**6201**	**801**	**15**	**15**	**3**	**1**	**5**	**2**	**1**	**1**	**0**	**0**
06-22	**8459**	**94**	**7415**	**905**	**15**	**16**	**4**	**1**	**5**	**2**	**1**	**1**	**0**	**0**
06-00	**8772**	**95**	**7707**	**925**	**15**	**16**	**4**	**1**	**5**	**2**	**1**	**1**	**0**	**0**
00-00	**8962**	**97**	**7854**	**964**	**15**	**17**	**4**	**1**	**5**	**3**	**1**	**1**	**0**	**0**

Peak step 17:00 (804) **AM Peak step** 11:00 (568) **PM Peak step** 17:00 (804)

*** Friday, February 24, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	57	0	53	4	0	0	0	0	0	0	0	0	0	0
0100	31	0	25	5	0	0	0	0	0	1	0	0	0	0
0200	18	0	15	2	1	0	0	0	0	0	0	0	0	0
0300	11	0	9	2	0	0	0	0	0	0	0	0	0	0
0400	26	0	20	4	0	1	0	0	1	0	0	0	0	0
0500	71	0	55	14	0	1	1	0	0	0	0	0	0	0
0600	210	1	173	33	2	0	0	0	0	1	0	0	0	0
0700	368	5	297	60	1	3	0	0	2	0	0	0	0	0
0800	513	10	447	47	3	4	2	0	0	0	0	0	0	0
0900	494	9	422	57	3	3	0	0	0	0	0	0	0	0
1000	513	9	440	59	1	2	1	0	1	0	0	0	0	0
1100	534	6	467	55	1	3	0	0	0	2	0	0	0	0
1200	549	6	493	47	0	0	1	0	0	1	0	1	0	0
1300	590	3	533	51	0	2	0	0	0	1	0	0	0	0
1400	644	9	579	56	0	0	0	0	0	0	0	0	0	0
1500	720	12	643	63	1	0	0	0	0	1	0	0	0	0
1600	698	6	628	64	0	0	0	0	0	0	0	0	0	0
1700	773	7	730	35	1	0	0	0	0	0	0	0	0	0
1800	628	4	595	29	0	0	0	0	0	0	0	0	0	0
1900	507	3	473	30	1	0	0	0	0	0	0	0	0	0
2000	385	2	366	17	0	0	0	0	0	0	0	0	0	0
2100	337	3	317	17	0	0	0	0	0	0	0	0	0	0
2200	261	1	249	11	0	0	0	0	0	0	0	0	0	0
2300	163	2	146	15	0	0	0	0	0	0	0	0	0	0
07-19	**7024**	**86**	**6274**	**623**	**11**	**17**	**4**	**0**	**3**	**5**	**0**	**1**	**0**	**0**
06-22	**8463**	**95**	**7603**	**720**	**14**	**17**	**4**	**0**	**3**	**6**	**0**	**1**	**0**	**0**
06-00	**8887**	**98**	**7998**	**746**	**14**	**17**	**4**	**0**	**3**	**6**	**0**	**1**	**0**	**0**
00-00	**9101**	**98**	**8175**	**777**	**15**	**19**	**5**	**0**	**4**	**7**	**0**	**1**	**0**	**0**

Peak step 17:00 (773) **AM Peak step** 11:00 (534) **PM Peak step** 17:00 (773)

*** Saturday, February 25, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	91	1	81	8	0	1	0	0	0	0	0	0	0	0
0100	66	0	63	3	0	0	0	0	0	0	0	0	0	0
0200	35	0	34	1	0	0	0	0	0	0	0	0	0	0
0300	12	1	10	0	0	0	0	0	0	1	0	0	0	0
0400	28	0	23	4	1	0	0	0	0	0	0	0	0	0
0500	39	0	32	6	0	1	0	0	0	0	0	0	0	0
0600	71	1	58	11	0	1	0	0	0	0	0	0	0	0
0700	139	1	122	16	0	0	0	0	0	0	0	0	0	0
0800	223	5	186	29	1	2	0	0	0	0	0	0	0	0
0900	364	7	310	45	0	1	1	0	0	0	0	0	0	0
1000	464	9	416	37	1	0	0	0	0	0	0	0	0	1
1100	533	4	496	29	2	0	2	0	0	0	0	0	0	0
1200	555	8	505	38	1	2	0	0	0	0	0	1	0	0
1300	616	7	560	43	2	1	0	0	2	1	0	0	0	0
1400	629	12	582	32	1	1	1	0	0	0	0	0	0	0
1500	606	5	558	42	0	0	0	0	1	0	0	0	0	0
1600	532	3	497	31	1	0	0	0	0	0	0	0	0	0
1700	485	2	453	30	0	0	0	0	0	0	0	0	0	0
1800	486	3	441	42	0	0	0	0	0	0	0	0	0	0
1900	372	0	344	28	0	0	0	0	0	0	0	0	0	0
2000	279	2	260	17	0	0	0	0	0	0	0	0	0	0
2100	321	0	304	16	0	1	0	0	0	0	0	0	0	0
2200	204	1	191	12	0	0	0	0	0	0	0	0	0	0
2300	175	0	161	12	0	1	0	0	0	0	1	0	0	0
07-19	**5632**	**66**	**5126**	**414**	**9**	**7**	**4**	**0**	**3**	**1**	**0**	**1**	**0**	**1**
06-22	**6675**	**69**	**6092**	**486**	**9**	**9**	**4**	**0**	**3**	**1**	**0**	**1**	**0**	**1**
06-00	**7054**	**70**	**6444**	**510**	**9**	**10**	**4**	**0**	**3**	**1**	**1**	**1**	**0**	**1**
00-00	**7325**	**72**	**6687**	**532**	**10**	**12**	**4**	**0**	**3**	**2**	**1**	**1**	**0**	**1**

Peak step 14:00 (629) **AM Peak step** 11:00 (533) **PM Peak step** 14:00 (629)

*** Sunday, February 26, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	92	1	83	8	0	0	0	0	0	0	0	0	0	0
0100	62	1	57	4	0	0	0	0	0	0	0	0	0	0
0200	35	1	33	1	0	0	0	0	0	0	0	0	0	0
0300	11	0	10	1	0	0	0	0	0	0	0	0	0	0
0400	14	1	11	1	0	0	1	0	0	0	0	0	0	0
0500	20	0	19	1	0	0	0	0	0	0	0	0	0	0
0600	56	0	52	2	0	2	0	0	0	0	0	0	0	0
0700	119	2	107	10	0	0	0	0	0	0	0	0	0	0
0800	225	0	206	19	0	0	0	0	0	0	0	0	0	0
0900	344	2	313	27	1	1	0	0	0	0	0	0	0	0
1000	414	1	384	28	0	0	0	0	1	0	0	0	0	0
1100	494	6	460	26	0	0	0	0	2	0	0	0	0	0
1200	530	9	485	34	0	0	0	0	2	0	0	0	0	0
1300	516	5	489	21	0	1	0	0	0	0	0	0	0	0
1400	526	8	490	26	0	0	1	0	1	0	0	0	0	0
1500	521	8	488	25	0	0	0	0	0	0	0	0	0	0
1600	516	5	471	39	1	0	0	0	0	0	0	0	0	0
1700	455	4	418	33	0	0	0	0	0	0	0	0	0	0
1800	384	5	351	28	0	0	0	0	0	0	0	0	0	0
1900	326	3	297	26	0	0	0	0	0	0	0	0	0	0
2000	217	0	200	17	0	0	0	0	0	0	0	0	0	0
2100	183	1	171	10	1	0	0	0	0	0	0	0	0	0
2200	122	0	113	9	0	0	0	0	0	0	0	0	0	0
2300	63	0	57	6	0	0	0	0	0	0	0	0	0	0
07-19	**5044**	**55**	**4662**	**316**	**2**	**2**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
06-22	**5826**	**59**	**5382**	**371**	**3**	**4**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
06-00	**6011**	**59**	**5552**	**386**	**3**	**4**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
00-00	**6245**	**63**	**5765**	**402**	**3**	**4**	**2**	**0**	**6**	**0**	**0**	**0**	**0**	**0**

Peak step 12:00 (530) **AM Peak step** 11:00 (494) **PM Peak step** 12:00 (530)

In profile: Vehicles = 31633 / 68170 (46.40%)

Traffic Data Service -- San Jose, CA
Class Report

CustomList-15067 -- English (ENU)

Datasets:
Site: **[4] PALO ALTO AVE W OF ALMA ST**
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: West (bound)
Name: Default Profile
Scheme: Vehicle classification (Scheme F)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)

Column Legend:
0 [Time] 24-hour time (0000 - 2359)
1 [Total] Number in time step
2 [Cls] Class totals

*** Thursday, February 23, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	43	0	36	7	0	0	0	0	0	0	0	0	0	0
0100	19	0	16	2	0	0	0	0	0	1	0	0	0	0
0200	7	0	5	2	0	0	0	0	0	0	0	0	0	0
0300	7	0	5	2	0	0	0	0	0	0	0	0	0	0
0400	29	0	23	5	0	1	0	0	0	0	0	0	0	0
0500	85	2	62	21	0	0	0	0	0	0	0	0	0	0
0600	170	4	134	32	0	0	0	0	0	0	0	0	0	0
0700	425	8	338	70	2	4	2	1	0	0	0	0	0	0
0800	560	15	485	54	3	2	0	0	1	0	0	0	0	0
0900	507	8	429	68	1	1	0	0	0	0	0	0	0	0
1000	476	6	396	67	2	1	0	0	2	1	1	0	0	0
1100	568	7	457	98	1	4	0	0	1	0	0	0	0	0
1200	577	8	489	78	1	1	0	0	0	0	0	0	0	0
1300	556	6	484	63	1	1	0	0	0	1	0	0	0	0
1400	558	6	488	63	0	1	0	0	0	0	0	0	0	0
1500	673	3	591	79	0	0	0	0	0	0	0	0	0	0
1600	736	10	663	60	1	0	1	0	0	0	0	1	0	0
1700	804	5	745	50	3	0	0	0	1	0	0	0	0	0
1800	690	3	636	51	0	0	0	0	0	0	0	0	0	0
1900	497	3	463	29	0	1	1	0	0	0	0	0	0	0
2000	363	2	335	26	0	0	0	0	0	0	0	0	0	0
2100	299	0	282	17	0	0	0	0	0	0	0	0	0	0
2200	204	0	194	10	0	0	0	0	0	0	0	0	0	0
2300	109	1	98	10	0	0	0	0	0	0	0	0	0	0
07-19	**7130**	**85**	**6201**	**801**	**15**	**15**	**3**	**1**	**5**	**2**	**1**	**1**	**0**	**0**
06-22	**8459**	**94**	**7415**	**905**	**15**	**16**	**4**	**1**	**5**	**2**	**1**	**1**	**0**	**0**
06-00	**8772**	**95**	**7707**	**925**	**15**	**16**	**4**	**1**	**5**	**2**	**1**	**1**	**0**	**0**
00-00	**8962**	**97**	**7854**	**964**	**15**	**17**	**4**	**1**	**5**	**3**	**1**	**1**	**0**	**0**

Peak step 17:00 (804) **AM Peak step** 11:00 (568) **PM Peak step** 17:00 (804)

*** Friday, February 24, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	57	0	53	4	0	0	0	0	0	0	0	0	0	0
0100	31	0	25	5	0	0	0	0	0	1	0	0	0	0
0200	18	0	15	2	1	0	0	0	0	0	0	0	0	0
0300	11	0	9	2	0	0	0	0	0	0	0	0	0	0
0400	26	0	20	4	0	1	0	0	1	0	0	0	0	0
0500	71	0	55	14	0	1	1	0	0	0	0	0	0	0
0600	210	1	173	33	2	0	0	0	0	1	0	0	0	0
0700	368	5	297	60	1	3	0	0	2	0	0	0	0	0
0800	513	10	447	47	3	4	2	0	0	0	0	0	0	0
0900	494	9	422	57	3	3	0	0	0	0	0	0	0	0
1000	513	9	440	59	1	2	1	0	1	0	0	0	0	0
1100	534	6	467	55	1	3	0	0	0	2	0	0	0	0
1200	549	6	493	47	0	0	1	0	0	1	0	1	0	0
1300	590	3	533	51	0	2	0	0	0	1	0	0	0	0
1400	644	9	579	56	0	0	0	0	0	0	0	0	0	0
1500	720	12	643	63	1	0	0	0	0	1	0	0	0	0
1600	698	6	628	64	0	0	0	0	0	0	0	0	0	0
1700	773	7	730	35	1	0	0	0	0	0	0	0	0	0
1800	628	4	595	29	0	0	0	0	0	0	0	0	0	0
1900	507	3	473	30	1	0	0	0	0	0	0	0	0	0
2000	385	2	366	17	0	0	0	0	0	0	0	0	0	0
2100	337	3	317	17	0	0	0	0	0	0	0	0	0	0
2200	261	1	249	11	0	0	0	0	0	0	0	0	0	0
2300	163	2	146	15	0	0	0	0	0	0	0	0	0	0
07-19	**7024**	**86**	**6274**	**623**	**11**	**17**	**4**	**0**	**3**	**5**	**0**	**1**	**0**	**0**
06-22	**8463**	**95**	**7603**	**720**	**14**	**17**	**4**	**0**	**3**	**6**	**0**	**1**	**0**	**0**
06-00	**8887**	**98**	**7998**	**746**	**14**	**17**	**4**	**0**	**3**	**6**	**0**	**1**	**0**	**0**
00-00	**9101**	**98**	**8175**	**777**	**15**	**19**	**5**	**0**	**4**	**7**	**0**	**1**	**0**	**0**

Peak step 17:00 (773) **AM Peak step** 11:00 (534) **PM Peak step** 17:00 (773)

*** Saturday, February 25, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	91	1	81	8	0	1	0	0	0	0	0	0	0	0
0100	66	0	63	3	0	0	0	0	0	0	0	0	0	0
0200	35	0	34	1	0	0	0	0	0	0	0	0	0	0
0300	12	1	10	0	0	0	0	0	0	1	0	0	0	0
0400	28	0	23	4	1	0	0	0	0	0	0	0	0	0
0500	39	0	32	6	0	1	0	0	0	0	0	0	0	0
0600	71	1	58	11	0	1	0	0	0	0	0	0	0	0
0700	139	1	122	16	0	0	0	0	0	0	0	0	0	0
0800	223	5	186	29	1	2	0	0	0	0	0	0	0	0
0900	364	7	310	45	0	1	1	0	0	0	0	0	0	0
1000	464	9	416	37	1	0	0	0	0	0	0	0	0	1
1100	533	4	496	29	2	0	2	0	0	0	0	0	0	0
1200	555	8	505	38	1	2	0	0	0	0	0	1	0	0
1300	616	7	560	43	2	1	0	0	2	1	0	0	0	0
1400	629	12	582	32	1	1	1	0	0	0	0	0	0	0
1500	606	5	558	42	0	0	0	0	1	0	0	0	0	0
1600	532	3	497	31	1	0	0	0	0	0	0	0	0	0
1700	485	2	453	30	0	0	0	0	0	0	0	0	0	0
1800	486	3	441	42	0	0	0	0	0	0	0	0	0	0
1900	372	0	344	28	0	0	0	0	0	0	0	0	0	0
2000	279	2	260	17	0	0	0	0	0	0	0	0	0	0
2100	321	0	304	16	0	1	0	0	0	0	0	0	0	0
2200	204	1	191	12	0	0	0	0	0	0	0	0	0	0
2300	175	0	161	12	0	1	0	0	0	0	1	0	0	0
07-19	**5632**	**66**	**5126**	**414**	**9**	**7**	**4**	**0**	**3**	**1**	**0**	**1**	**0**	**1**
06-22	**6675**	**69**	**6092**	**486**	**9**	**9**	**4**	**0**	**3**	**1**	**0**	**1**	**0**	**1**
06-00	**7054**	**70**	**6444**	**510**	**9**	**10**	**4**	**0**	**3**	**1**	**1**	**1**	**0**	**1**
00-00	**7325**	**72**	**6687**	**532**	**10**	**12**	**4**	**0**	**3**	**2**	**1**	**1**	**0**	**1**

Peak step 14:00 (629) **AM Peak step** 11:00 (533) **PM Peak step** 14:00 (629)

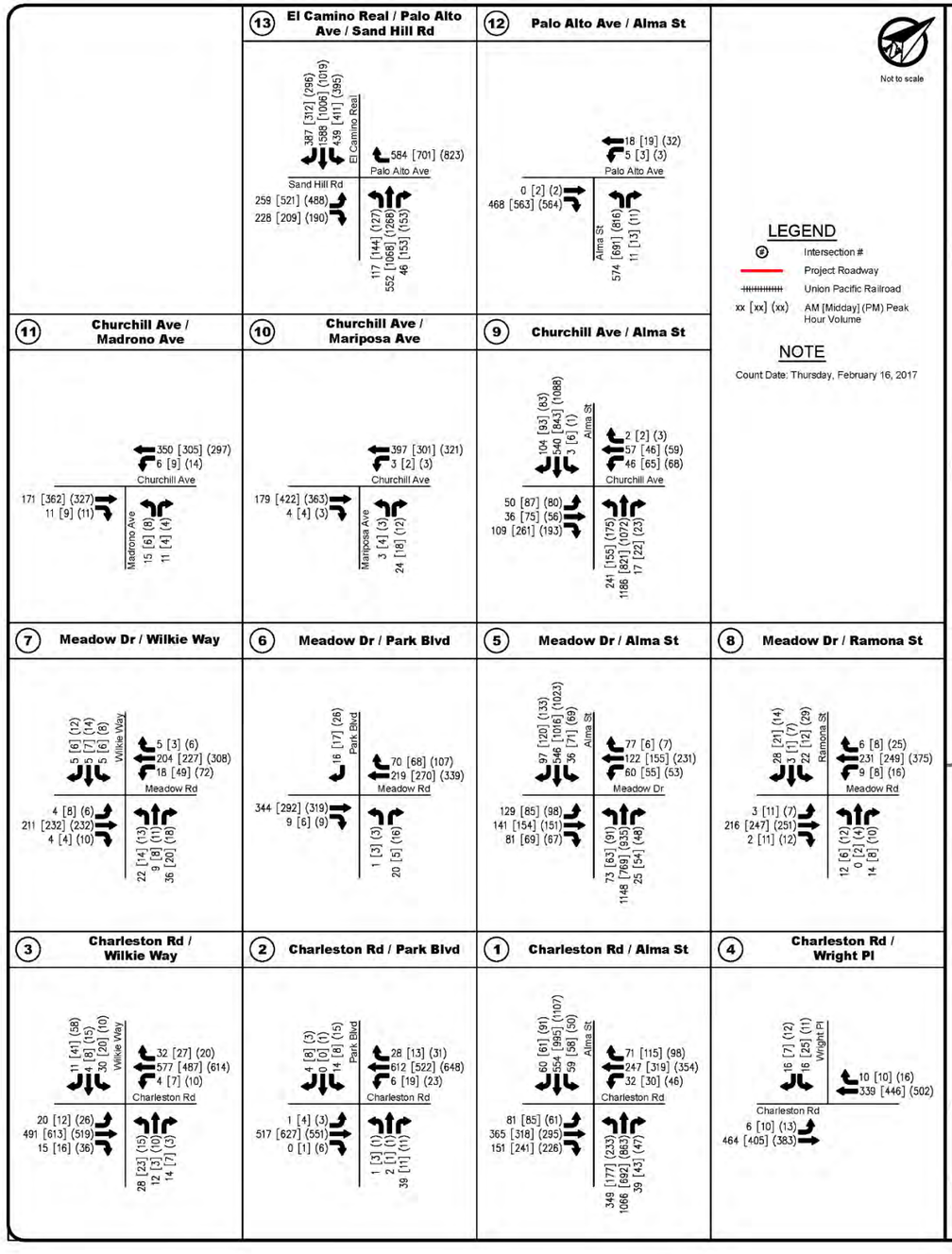
*** Sunday, February 26, 2017**

Time	Total	Cls 1	Cls 2	Cls 3	Cls 4	Cls 5	Cls 6	Cls 7	Cls 8	Cls 9	Cls 10	Cls 11	Cls 12	Cls 13
0000	92	1	83	8	0	0	0	0	0	0	0	0	0	0
0100	62	1	57	4	0	0	0	0	0	0	0	0	0	0
0200	35	1	33	1	0	0	0	0	0	0	0	0	0	0
0300	11	0	10	1	0	0	0	0	0	0	0	0	0	0
0400	14	1	11	1	0	0	1	0	0	0	0	0	0	0
0500	20	0	19	1	0	0	0	0	0	0	0	0	0	0
0600	56	0	52	2	0	2	0	0	0	0	0	0	0	0
0700	119	2	107	10	0	0	0	0	0	0	0	0	0	0
0800	225	0	206	19	0	0	0	0	0	0	0	0	0	0
0900	344	2	313	27	1	1	0	0	0	0	0	0	0	0
1000	414	1	384	28	0	0	0	0	1	0	0	0	0	0
1100	494	6	460	26	0	0	0	0	2	0	0	0	0	0
1200	530	9	485	34	0	0	0	0	2	0	0	0	0	0
1300	516	5	489	21	0	1	0	0	0	0	0	0	0	0
1400	526	8	490	26	0	0	1	0	1	0	0	0	0	0
1500	521	8	488	25	0	0	0	0	0	0	0	0	0	0
1600	516	5	471	39	1	0	0	0	0	0	0	0	0	0
1700	455	4	418	33	0	0	0	0	0	0	0	0	0	0
1800	384	5	351	28	0	0	0	0	0	0	0	0	0	0
1900	326	3	297	26	0	0	0	0	0	0	0	0	0	0
2000	217	0	200	17	0	0	0	0	0	0	0	0	0	0
2100	183	1	171	10	1	0	0	0	0	0	0	0	0	0
2200	122	0	113	9	0	0	0	0	0	0	0	0	0	0
2300	63	0	57	6	0	0	0	0	0	0	0	0	0	0
07-19	**5044**	**55**	**4662**	**316**	**2**	**2**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
06-22	**5826**	**59**	**5382**	**371**	**3**	**4**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
06-00	**6011**	**59**	**5552**	**386**	**3**	**4**	**1**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
00-00	**6245**	**63**	**5765**	**402**	**3**	**4**	**2**	**0**	**6**	**0**	**0**	**0**	**0**	**0**

Peak step 12:00 (530) **AM Peak step** 11:00 (494) **PM Peak step** 12:00 (530)

In profile: Vehicles = 31633 / 68170 (46.40%)

Appendix D - Existing Traffic Turning Volumes at Key Intersections



C:\Users\cla341\37\Desktop\Palo Alto\PaloAltoRPM_Task4_ExistingConditionsReport_v4.docx

MOTT MACDONALD

CITY OF PALO ALTO

Travel Demand Model Validation Report

City of Palo Alto: Rail Program Management

October 30, 2017

City of Palo Alto

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Travel Demand Model Validation Report

City of Palo Alto: Rail Program Management

October 30, 2017

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
V2	3/3/17	R Davies	M DiFrancia		
V3	3/10/17	R Davies	M DiFrancia		
V4	6/30/17	R Davies	M DiFrancia		
V5	10/30/17	A Nie	R Davies		

Document reference:

Information class: Standard

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1. Introduction

The City of Palo Alto Travel Demand model is an essential source of information and part of the "tool kit" the Consultant will use for the technical analyses of the Task 4: Rail Corridor Circulation Study, as part of the Consultant's Rail Program Management Services. Task 4 itemizes a number of subtasks that will be carried out as follows:

- Data Review
- Existing Documents
- Existing Traffic Counts
- Travel Demand Models
- Development Proposals
- Utilities and Right of Way
- Field Observations
- Collision Data
- Grade Crossing Hazards and Gate Downtime
- Evaluation of Alternatives

This report focuses on the Travel Demand Model. The Travel Demand Model is a regional model that has been used by the City of Palo Alto (referred to as the "City") to provide transportation information on the Comprehensive Plan and other major changes that will impact transportation. The Travel Demand Model was developed based on the VTA regional travel demand model using the Cube Voyager program. How the model will be used is described together with the background setting for the analyses.

A description of the model is included together with identifying its limitations and the appropriate way of integrating the use of the model into the analyses that form a major component of the overall evaluation studies. The Consultant has reviewed the output of the model at its base year (2014) with newly obtained and other recent traffic volume counts. This provides a measure of how the model can be used. Finally, the proposed analytical methods the consultant intends to use are discussed.

2. Background and Use of the Travel Demand Model

The Rail Corridor Circulation Study is set up to assess what the effect will be of the alternative grade separation road/rail designs on the street based traffic. This will include all motorized vehicles, bicycles, and pedestrians. This report addresses motorized vehicles only; other modes are covered elsewhere.

Analyses of the Travel Demand Model reflect automobiles, taxis, road transit (bus and shuttles), and trucks. The model simulates road traffic patterns and volumes in the road network. It is responsive to connectivity in the road network and delay-generated-congestion on the road network. It will simulate the rerouting of traffic to reflect all drivers (apart from fixed rate road transit services), minimizing their journey times.

For this exercise, only the road traffic assignment model is used. There are other choice models within the overall modeling framework (mainly location and mode choice), but they are not considered to be impacted sufficiently by the alternative forms of grade crossings to be reflected in the analyses.

The Travel Demand Model is very large (almost 3,000 zones) and is primarily intended to be used to assess the impact of major changes in land use and transportation infrastructure and services. For example, a major capacity increase of a freeway or changes in population or employment in the City and surrounding area. However, the model is quite suitable for assessing driver's responses to major changes in road connectivity and delays generated by congestion. It is also the best tool available for forecasting future growth in travel demand.

The Consultant will use the Travel Demand Model for two important elements of the analysis. First, it will be used to assess the rerouting of drivers to respond to connectivity changes by either grade separations or road closures replacing current at grade crossing, for example. This will allow the impact of rerouting to be analyzed with the alternatives being tested. The second use will be to assess the most likely growth of travel demand and its impact in the future years at the key points in the road network. This growth will be applied to observed traffic volumes and movements to project to a future year estimation of traffic conditions.

At the key intersection and grade crossings, a more detailed approach will be applied. New data has been obtained from recent traffic counts and this data, along with the use of forecast growth parameters, will be used as input to a more detailed modeling of the intersections. This is described further in in the following sections of the report.

3. Model Review

Although the model geographically covers the whole Bay Area (nine counties), its focused area is the City of Palo Alto, where it has more detailed information about the roadway network and land use. The City model has 2,980 traffic analysis zones (TAZs). The zones are denser in the City area than in other areas. The base year of the model is 2014, and the planning horizon year is 2030. Figure 1 below shows the TAZs for the City of Palo Alto.

Figure 1: Traffic Analysis Zones

3.1 Travel Demand Models

Two models were received from Hexagon Transportation Consultants, who currently maintains the City model:

- 2014 base year model
- 2030 Alt 1 model. This is one of the many future year models of the City. The City has a number of future year models, each representing a different planning scenario. The 2030 Alt 1 model is considered the most appropriate for this study, as it represents the currently approved City Comprehensive Plan.

The City model has a number of traffic forecasting periods: AM peak 4-Hour, PM peak 4-Hour, Mid-Day, and Night. In this study, only the peak hour traffic forecasts will be used, as those represent the most critical conditions. The City model, however, does not produce peak hour traffic directly. The peak hour forecasts have to be derived through factoring the AM 4-Hour and PM 4-Hour traffic forecasts. The same process will be followed for forecasting peak hour traffic in this study, as would be done for other infrastructure projects in the City.

3.2 Limitations of the Model

The City model is not an intersection based model in the sense that turning movement delay is not explicitly modeled and is not sensitive to volume changes. The model is not intended to address this level of detail. From the traffic operation point of view, this is a limitation of the model because in urban streets, traffic delay is typically incurred at intersections instead of the link level. This model uses speed/flow relationships with implicit (average) delays for intersections.

3.3 Roadway Network in the Study Area

The City model is not built on a GIS network. It therefore lacks many roadway network details in the study area. This is illustrated in Figure 2, where the thick blue lines represent the model network while the gray lines represent the GIS network. It can be seen from the figure that there are many streets that are not included in the model. The missing of those local streets, and the fact that not all local streets are represented, may affect how traffic is assigned or routed in the model. This is completely normal for a strategic model covering the size of area that it does. Therefore, the model forecasts need to be examined on how they can be used for traffic operations analysis.

Figure 2: Model Network vs. GIS Network

Source: Mott MacDonald and ArcGIS, 2017

3.4 Study Intersections

This project has four (4) key study intersections / railway and highway crossings. In the following section, the actual layout of these intersections is compared with what has been assumed in the model. Aerial photos are used to show the actual layouts of these intersections. From north to south the intersections are:

1. Palo Alto Ave with El Camino Real
2. Churchill Ave with Alma Street
3. Meadow Drive with Alma Street
4. Charleston Rd with Alma Street

Alma street is a four (4) lane arterial throughout the City and a main north-south route alongside and immediately to the east of the Caltrain tracks. The intersecting streets have an east-west orientation and are four (4) lanes in width.

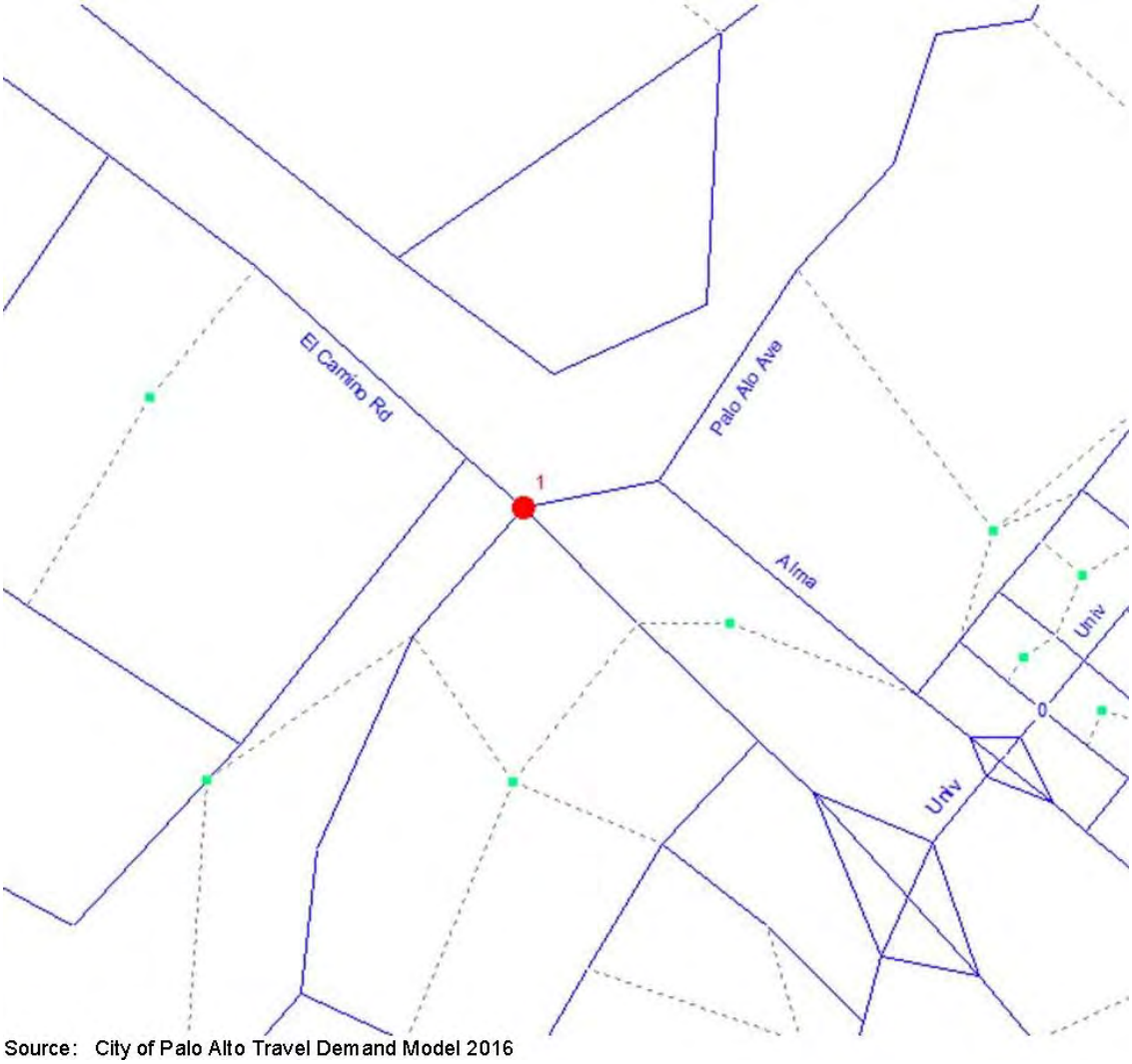
Intersection 1: Palo Alto Ave / El Camino Real

The intersection is identified by Node 5255. The actual layout is presented in Figure 3 and the model layout in Figure 4.

Figure 3: Palo Alto Avenue/ El Camino Real

Source: Google Earth 2016

Figure 4: Palo Alto Avenue/El Camino Real in the City Model



Source: City of Palo Alto Travel Demand Model 2016

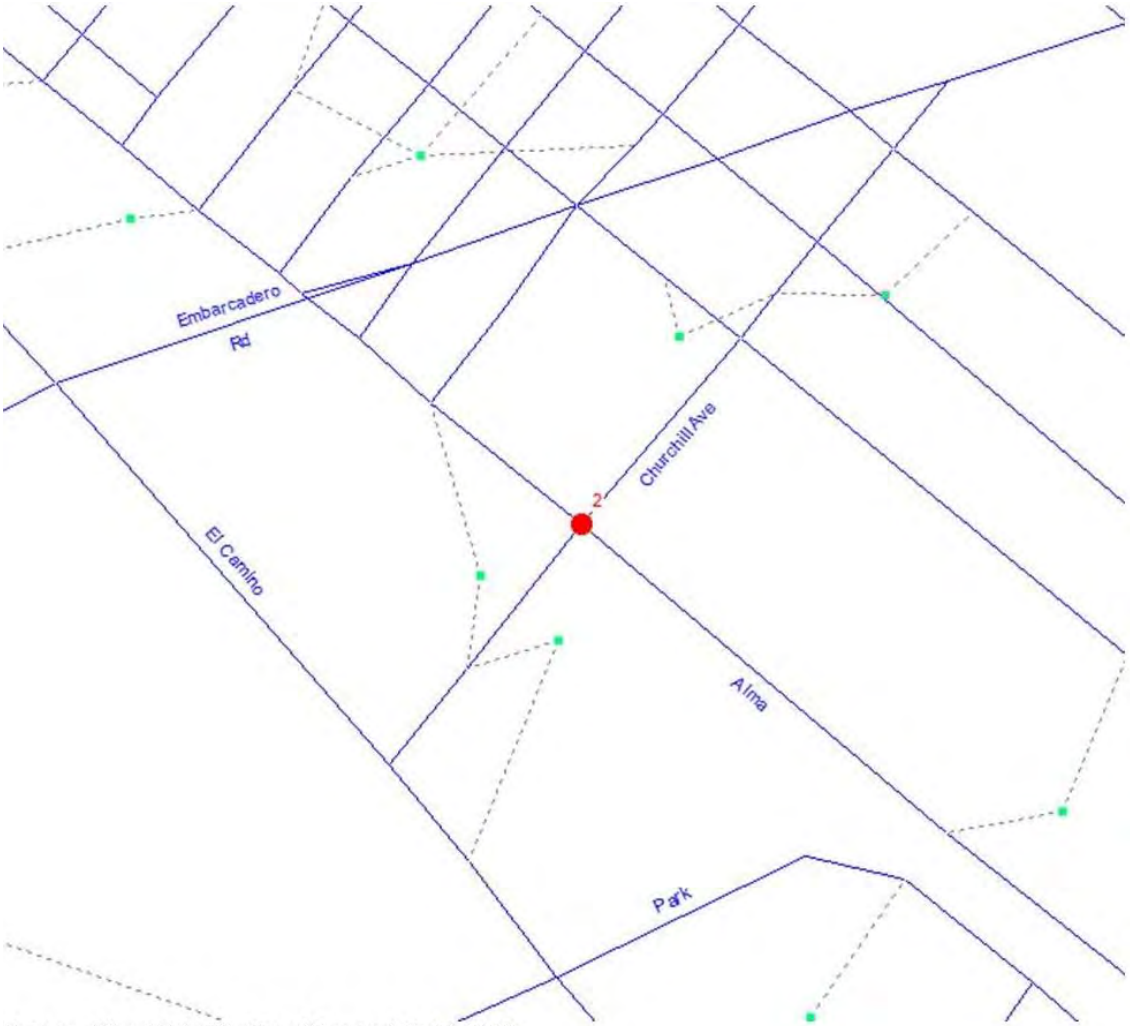
Intersection 2: Churchill Ave / Alma Street

The intersection is identified by Node 5507 in the City model. The actual layout is presented in Figure 5 and the model layout in Figure 6.

Figure 5: Churchill Ave and Alma Street

Source: Google 2016

Figure 6: Churchill Avenue/Alma Street in the City Model



Source: City of Palo Alto Travel Demand Model, 2016

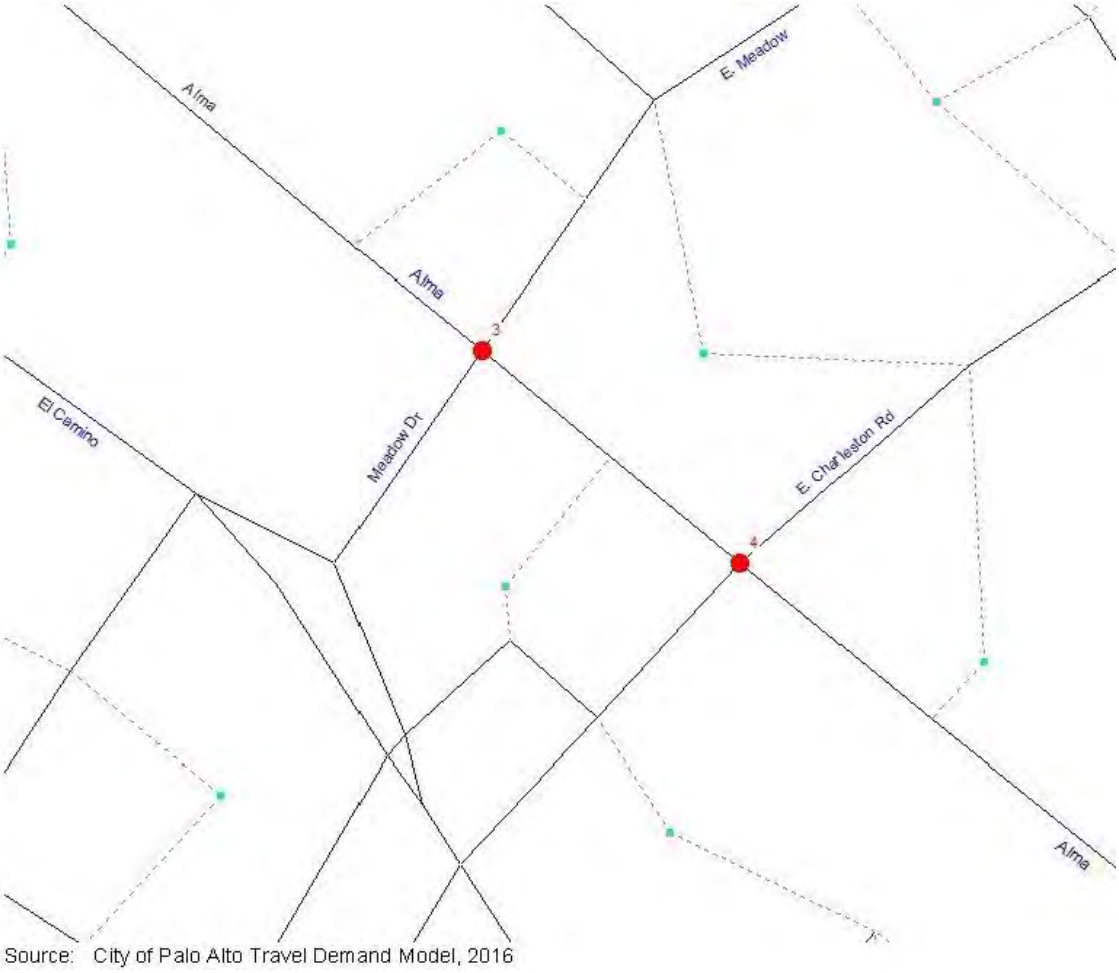
Intersection 3: Meadow Drive / Alma Street

This intersection is identified by Node 4643 in the City model. The actual layout is presented in Figure 7 and the model layout in Figure 8.

Figure 7: Meadow Drive and Alma Street

Source: Google Earth, 2016

Figure 8: Model Layout of Charleston Road and Meadow Drive Along Alma Street



Source: City of Palo Alto Travel Demand Model, 2016

Figure 9: Charleston Road/ Alma Street

Source: Google Earth, 2016

Intersection 4: Meadow Drive / Alma Street

This intersection is identified by Node 9350 in the City model. The actual intersection layout is presented in Figure 9, and the model layout is presented in Figure 8.

3.5 Model Results Validation

The purpose of the model validation is to better understand the capacity of the model in forecasting traffic at the corridor level in the study area, as well as the proper use of the model forecast for traffic operations analysis. The validation is not intended to be a “critique” of the model but rather to develop how it can be used in the process. The comparison of the modeled with counted flows is highly unlikely to be the same:

- The model peak hour flows are converted from four (4) peak-hour traffic assignment results, whereas the counted flows are true peak hour flows.
- Models of this size are not intended to be used at individual street or intersection level.
- The model does not represent all of the streets in the City.
- Traffic counts can also vary from day to day.
- The model is 2014, and the counts are 2015/16.

The model is validated in two ways. The first is to compare the 2014 traffic forecasts with the 2015/2016 traffic counts. The second way is to compare the 2014 traffic forecast with the 2030 traffic forecasts and check the reasonableness of the volume change, i.e., whether the volume changes are reasonably explained by the network and land use changes.

3.6 2014 Model Results vs. Traffic Counts

The comparison of the base year traffic forecasts with traffic counts is summarized in Table 1. The "Counts" column represents the 2015/2016/2017 observed traffic counts, and the "model" column represents the traffic forecasts from the 2014 base year model (note: the El Camino Real / Palo Alto Ave intersection traffic counts are from 2017, while those of other intersections are from 2015/2016). The comparison is conducted for one hour in both the AM and PM peak periods at the four key study intersections.

Table 1: Base Year Model Forecast Validation

Int.	Approach direction	AM Peak					PM Peak				
		Counts	Model	Diff	Diff%	GEH*	Counts	Model	Diff	Diff%	GEH
1.El Camino Real / Palo Alto Ave	SB	2414	2537	123	5%	2.5	1710	2121	411	24%	9.4
	NB	715	964	249	35%	8.6	1548	2291	743	48%	17.0
	EB	487	239	-248	-51%	13.0	687	297	-381	-56%	17.3
	WB	584	434	-150	-26%	6.6	823	720	-103	-13%	3.7
2.Alma St. / Churchill Ave	SB	696	658	-38	-5%	1.5	1161	1215	54	5%	1.6
	NB	1529	650	-879	-57%	26.6	1463	864	-599	-41%	17.6
	EB	203	47	-156	-77%	14.0	438	46	-392	-89%	25.2
	WB	94	98	4	4%	0.4	160	46	-114	-71%	11.2
3.Alma St. / Meadow Dr	SB	812	723	-89	-11%	3.2	1346	1038	-308	-23%	8.9
	NB	1348	1184	-164	-12%	4.6	1361	1386	25	2%	0.7
	EB	434	611	177	41%	7.7	368	759	391	106%	16.5
	WB	368	188	-180	-49%	10.8	441	116	-325	-74%	19.5
4.Alma St. / Charleston Rd	SB	746	1290	544	73%	17.1	1259	1696	437	35%	11.4
	NB	1470	1379	-91	-6%	2.4	1455	1480	25	2%	0.7
	EB	666	243	-423	-64%	19.8	668	274	-394	-59%	18.2
	WB	399	250	-149	-37%	8.3	522	228	-294	-56%	15.2

Source: observed traffic counts and 2014 base year traffic forecast model

* GEH stands for Geoffrey Edward Havers, who developed a statistical method of measuring the "goodness of fit" between two independent data sets. It is a modified Chi Squared test and outputs a statistical value for the comparison. It has been adopted by the UK Department of Transportation, many U.S. State DOTs, and the travel demand modeling industry in general.

A number of observations can be made from the comparison:

- The volume discrepancy between the model forecasts and the traffic counts demonstrates that the model should not be used directly to estimate individual traffic flows. The general standard is that when the GEH value is greater than 5.0, the data sets are not compatible, which was to be expected.
- The model forecasts on Alma Street are generally lower than the observed traffic counts.

Based on the above, it was decided that future year traffic forecasts from the model should not be used directly for traffic operational analyses at a detailed level and would be used to estimate the growth in traffic demand. The models would also be used to identify changes in travel patterns.

3.7 2030 Model Results vs. 2014 Model Results

The comparison between the 2030 future year forecasts and the base year forecasts is presented in Table 2.

Table 2: 2030 Alt. 1 Model Forecast Validation

Int.	Approach direction	AM Peak				PM Peak			
		2014	2030	Diff	Diff%	2014	2030	Diff	Diff%
1. El Camino Real / Palo Alto Ave	SB	2537	3203	666	26%	2121	2794	673	32%
	NB	964	1113	149	15%	2291	2706	415	18%
	EB	239	199	-40	-17%	297	265	-32	-11%
	WB	434	609	175	40%	720	902	182	25%
2.Alma St. / Churchill Ave	SB	658	829	171	26%	1215	1576	361	30%
	NB	650	970	320	49%	864	1084	220	25%
	EB	47	75	28	60%	46	62	16	35%
	WB	98	102	4	4%	46	53	7	15%
3.Alma St. / Meadow Dr	SB	723	949	226	31%	1038	1481	443	43%
	NB	1184	1552	368	31%	1386	1741	355	26%
	EB	611	691	80	13%	759	782	23	3%
	WB	188	158	-30	-16%	116	114	-2	-2%
4.Alma St. / Charleston Rd	SB	1290	1531	241	19%	1696	2080	384	23%
	NB	1379	1741	362	26%	1480	1643	163	11%
	EB	243	313	70	29%	274	470	196	72%
	WB	250	378	128	51%	228	648	420	184%

Source: observed traffic counts, and 2014/ 2030 year traffic forecast models

The comparison shows that:

- The 2030 future year traffic forecasts are systematically higher than the base year forecasts along Alma Street. The volume growth incremental rate is roughly 2% annually. This is an expected result.
- The cross-street traffic largely increases over time. But at a few locations, the future year forecasts are lower than the base year forecasts by a small margin. There are some, reassignments in the model that account for this.

The volume change seems to be consistent along Alma Street and the growth rate seems to be reasonable. The growth shown is quite suitable to be added to traffic forecasts to derive a set of improved 2030 traffic forecasts.

4. Future Year Modeling Methodology

4.1 Travel Models

The City Travel Demand Models will be used to derive the growth in traffic volumes for all the traffic operations analyses (TOA). This will be commenced by examining two different time travel models:

- 2014 base year model. The model approximately represents the existing year condition.
- 2030 Alt 1 model. This model represents one of the City's most likely future year conditions. For this project, this model reflects the no-build condition.

Based on these two models, other models will be constructed to evaluate the future year "project" conditions. The use of "project" in this instance means any planning or design measures that are related to this study and to be explored in this study. A number of varying project conditions will require evaluation. The approach is to add the forecast growth from the models to the observed traffic volumes:

- Refined traffic forecast = counts + (future year model forecast – base year model forecast).

4.2 Improvement Plans in the Traffic Forecasting Model

Assuming the potential project alternatives in this study are limited to local roadway improvements such as grade-separation, roadway signing and restriping, or even traffic signal treatment, these improvements are unlikely to change the overall traffic demand or traffic distribution pattern at the regional level. These local improvements typically affect only route choice: if a specific route becomes more attractive, it is going to draw more traffic from adjacent parallel streets. This is essentially a traffic assignment issue.

It is also assumed that the above roadway improvements change traffic delay at the turning movement level rather than the link level. For example, grade-separation effectively reduces signal delays and thereby reduces intersection turning movement delay.

The following steps will be followed to incorporate each roadway improvement into the model:

- Revise the model network to reflect the geometric changes
- Estimate traffic delays due to the increase from four (4) trains each in the peak hour, each direction, at current at-grade intersections, to ten trains each direction.
- Estimate the traffic delay as a result of these geometric changes, using traffic operation models (Synchro).
- These will then be used to estimate turn penalties in the model at the intersections under review.

More details on the methodology and the results of these tests will be contained in later reports.

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Report No. 1 of the Rail Corridor Circulation Studies: SCENARIOS 1 to 6 - DRAFT

October 27, 2017

1. Introduction

1.1 On 28 June 2017, a staff report was presented to the City Council Rail Committee entitled "Draft Rail Program Circulation Study Scenarios." In this Staff Report, six (6) different scenarios were recommended for study that were intended to support the identification and evaluation of grade separation alternatives. This document reports on the outcomes of those studies and also includes a description of the background; the objectives; and the methodologies employed to obtain the results.

1.2 The intent of the Rail Corridor Circulation Study was to estimate the effect on traffic circulation under up to eight (8) different scenarios that have been modeled using the regional/Citywide travel demand model. This has been used to assess the diversionary (traffic rerouting) impacts of the possible changes to the rail corridor road network in the City that future grade crossing layouts may cause. A more detailed examination of the intersections at, and close to, the current at-grade crossings has also been carried out using traffic operational models. These "Year 2030" scenarios include several variations of grade crossings and grade separations at each railroad corridor crossing location. The first two scenarios ("Year 2030 No Build Scenario One" and "Year 2030 No Build Scenario Two") do not include any new grade crossings, new grade separations or modifications to existing crossings, as they refer to the "No Build" scenarios. The remaining six (6) scenarios (Year 2030 Scenarios 1 through 6) include varying collections of new multi-modal grade-separated crossings, new bicycle-and-pedestrian-only grade-separated crossings, new grade separations, modified grade crossings, and closed grade crossings. The analysis of scenarios is intended to inform the selection of grade separations alternatives for more in-depth study and evaluation. These scenarios are for testing only and are not intended to establish any policy directions or suppose a preferred alternative.

1.3 The impacts of any future modifications to the current at-grade and grade-separated crossings will affect accessibility across the Caltrain tracks. To construct a grade separation where currently there is an existing at-grade

crossing, clearly reduces the interference or obstruction caused by that crossing and therefore improves East/West access/capacity at that location. That may or may not attract additional vehicular traffic to that crossing. Similarly, closing (i.e., eliminating) an existing at-grade crossing will cause traffic to divert to other routes. The intent of this study is to assess probable changes to motor vehicle and bicycle traffic circulation/demands under changes in accessibility/capacity caused by railroad crossing related infrastructure improvement scenarios. To the extent that it is possible with the demand models, an order-of-magnitude quantification of those changes is described.

1.4 Even if no changes or modifications are made to the existing rail crossings, increases in traffic demands driven by land-use and population growth would occur between existing and future (2030) conditions. Vehicular traffic is forecast to grow at a little over 1% per year. The Caltrain service modifications, made possible by the electrification, are likely to double the number of trains in the peak periods compared to now, when they are implemented. There is also the potential for having high-speed rail services on this line, in addition to Caltrain. The combination of the increased frequency of gate closures at the crossings and increased traffic flows will undoubtedly increase road congestion from what it is now.

1.5 Two types of Year 2030 “No Build” scenarios were first defined. A Year 2030 “No Build 1” scenario was first developed that includes growth in traffic between current and Year 2030 conditions while assuming no change to existing rail service frequencies, and no change in existing roadway circulation conditions. Included in the Circulation Study tests, is another Year 2030 “No Build 2” scenario where both the increased train frequencies and traffic growth (between existing and year 2030) are simulated within the demand models, while assuming no future construction occurs. The “No Build 2” with both train frequencies and traffic volume scenario forms the ‘baseline’ from which comparisons against the scenario tests are made.

1.6 The current average number of gate closures caused by passing trains is 6-7 per hour over the peak periods. The highest number in any one hour recorded is 10. The assumptions within the demand modeling is that this will rise to an average of 20 by 2030 if both Caltrain Modernization and high-speed-rail services are implemented. Caltrain current signal system headways allow for a maximum of an express train every five (5) minutes and a local train every six (6) minutes. This would mean 24 express trains per hour for both directions if evenly spaced at five-minute intervals and 20 local trains per hour if evenly spaced at six-minute intervals. Neither of these conditions would be likely to occur in “real life”. Firstly, the service will most likely be a mixture of both local and express trains and secondly, running at uniform minimum headways through a peak hour is highly unlikely to be achievable in practice. Therefore, by assuming a maximum of 20 gate closures per hour over the peak periods, the model is addressing the likely worst-case scenario in terms of traffic disruption.

It is also likely that with such intense service frequencies, that occasionally, a single-gate closure could accommodate two (2) trains passing in opposite

directions, meaning that the number of gate closures was actually less than the total two-way train frequency.

1.7 Finally, conclusions are drawn from the series of 'sensitivity' tests carried out for alternative scenarios. It is important to note what is forecast to happen if nothing is done to improve the crossings and not only whether diversions will occur under various scenarios of infrastructure changes, but whether their impact is likely to be significant or not. The study area is shown in Figure 1.1.

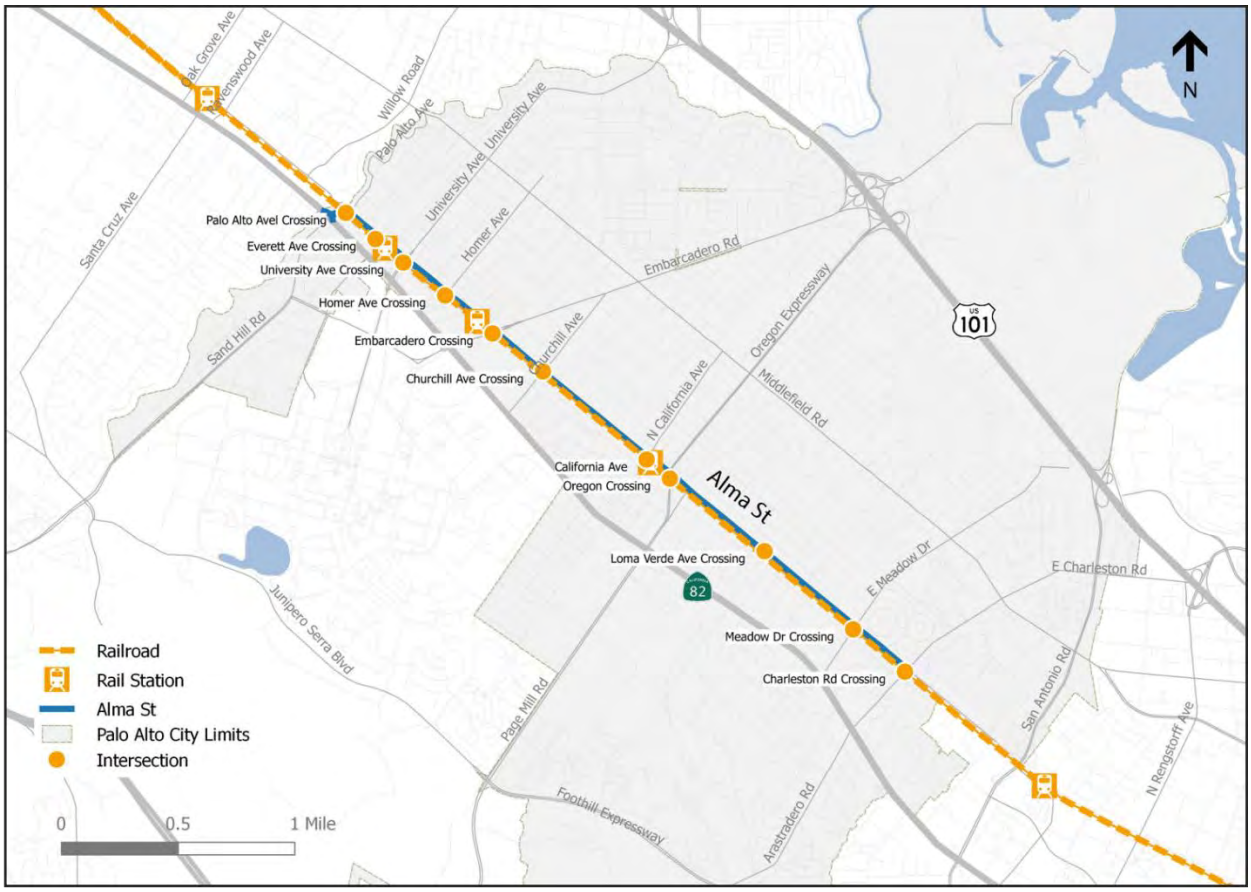

Figure 1.1 The Study Area

and the operational models

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2. Study Methods

2.1 A two-step analysis process was used to complete the circulation study. A large-scale regional/citywide traffic demand model is first used to estimate both the growth in traffic demand within the road network and the diversion impacts that any proposed changes to the road infrastructure will cause. The demand model is fully described in the "Travel Model Validation Report." Since the regional model cannot simulate traffic flows reliably at an individual roadway link or intersection level, a more refined post-processing of forecasts and operational analysis at an individual intersection level is completed in the second step. This is described below in Section 2.5 to 2.7.

2.2 The Travel Demand Model runs on a "Cube Voyager" software platform. This is a universally accepted platform throughout the planning industry. The model itself comes from the MTC and Santa Clara VTA regional models and is compatible with all models used for infrastructure planning on the Peninsula and the Bay Area. The models are forecast to the future year of 2030 and outputs estimates of traffic volume conditions for the hourly average of a four-hour peak period in both the morning and afternoon for an average week day. Both inputs to and outputs from the Travel Demand Models and the operational models are mounted on the City's website.

2.3 The Travel Demand Model is a four-stage model in which trip generation, trip distribution (locations), mode choice (motor vehicle, transit or rail) and assignment (either highway, transit or rail networks) are estimated. The model is calibrated on observations at a base-year against land-use and population data. For future year forecasts to 2030, the main input to the models are the future year assumptions on the 2030 land uses; populations; employment and car ownership. This is the same model that has been used for developing the transportation elements of the Comprehensive Plan. The model is owned by and is accessible through the City of Palo Alto.

2.4 The train frequencies that cause gate closures during the peak periods vary considerably at the crossing locations from three (3) per hour to ten (10) per hour. The highest frequencies tend to be 8:00-9:00 am and 6:00-7:00 pm. The other variable involved is the crossing traffic volume. It is a combination of these two variables that produces congestion. Crossing traffic volume peaks at different times at different location and at different times to the train frequency peaks. For example, at the Palo Alto crossing, westbound traffic peaks between 11:00 am and 12:00 pm. At Churchill Rd and E/W Meadow Dr, the afternoon peak hour for eastbound traffic is 3:00 pm to 4:00 pm. So, a single peak-hour demand model would not capture all the peak conditions and would not be fully representative for analysis. By adopting the City's Demand Model that covers a four-hour peak period for both the AM and PM, the study has encapsulated the dynamic variables that make up traffic congestion.

The qualification being that the highest peaks at individual locations could generate more congestion for a short time than the model would predict.

A further issue is that of a phenomenon called “peak spreading.” As traffic congestion grows, drivers tend to change their time of travel to avoid the worst conditions. It is traffic saturated conditions that cause “peak spreading” to happen, where the physical capacity of the system is reached. When looking at the possibility of a 20% growth of traffic by the year 2030, it is likely that the highest peak traffic volumes could not be accommodated by some parts of the road network capacity. The result would be an expansion of the peak conditions to a wider time period. By using a four-hour average peak period, this growth can be realistically simulated by the demand model.

The analyses of the operational conditions, however, does use current peak hour volumes, with growth added by the demand model to analyze those conditions in the future forecast year of 2030. This means that the operational analyses will have captured the most congested conditions.

2.5 The individual intersection-level forecasts were developed using Year 2017 intersection turning-volume level ground counts as the basis. Each of the critical intersections that include the rail crossings were surveyed early in 2017, with new weekday peak-hour traffic counts obtained at thirteen (13) study intersections. This included the actual rail crossing intersections as well as the closely located and influential adjacent intersections.

2.6 The traffic count data and forecasts were used as input to a traffic operational modeling procedure to analyze the performance of the intersection. The software platform is Synchro® (Version 8). This is a popular traffic operational analysis software platform that is universally used and accepted throughout North America.

2.7 The Synchro® analysis was initially used for the 2017 (actual) conditions and reported in the Existing Conditions Report. For the future forecast year of 2030, the 2017 count data was modified/refined to reflect regional-model forecasted growth in traffic demand through year 2030 from year 2017. The impact, as a result of traffic growth, was analyzed with the Synchro® software. The Demand Model was used to estimate that growth. The result is that at individual intersections, the peak one-hour (as opposed to the four-hour average of the peak period) demands are more accurately represented.

2.8 To address the important issue of Bicycle accessibility, a separate analysis procedure was used. This consisted of developing an accessibility map, based on travel time contours (an isochronic analysis), using a GIS-based mapping procedure. This plots the travel distance that can be achieved with 5, 10, 15 and 20-minute cycling times. The process, therefore, easily identifies the ability of bicyclists to make east/west movements across the Caltrain tracks and indicates where there is good and poor accessibility. The average bicycle speed was taken as 12 mph, which is what the City typically uses to time traffic signals along bikeways.

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3. Scenario Specifications

3.1 Eight (8) separate circulation scenarios were tested with both the morning (AM) and afternoon (PM) peak period models at a future forecast year of 2030. These are presented in Tables 1 and 2. Table 1 describes the six (6) scenarios that are analyzed and Table 2 is a tabular representation of the scenarios.

3.2 For each at-grade crossing, there are a variety of treatments available.

- ✧ Remain as it is today with all-modes having access. (No change)
- ✧ Closure for all modes. (Motor vehicles)
- ✧ Closure for vehicles, pedestrians, bicycles, but retaining Pedestrian and Bicycle access, either remaining at-grade or grade separated.
- ✧ Grade separation for all modes.
- ✧ Widen existing grade-separated crossings.

There are other measures that can also be implemented such as remaining as an at-grade crossing for all modes but imposing a quiet zone. This is not an option that can be analyzed within the modeling procedures in the circulation studies, but is a qualitative assessment in terms of impacts. For the demand model tests, there is no sensitivity to the type of grade separation that may be employed, only that the current obstruction caused by the presence of the rail crossing is removed.

3.3 An analysis of the details of traffic operations for specific designs will be the subject of further work when the alternatives are being considered.

3.4 The following are the crossing locations and their current (or future committed) conditions:

- ✧ Palo Alto Avenue (AKA Alma Street) – existing at-grade, all modes
- ✧ Everett Avenue/Lytton Avenue – planned grade-separated bicycle/pedestrian
- ✧ University Avenue – existing grade-separated, all modes
- ✧ Homer Avenue – existing grade-separated bicycle/pedestrian
- ✧ Embarcadero Road – existing grade-separated, all modes
- ✧ Churchill Avenue – Existing at-grade, all modes
- ✧ California Avenue – existing grade-separated bicycle/pedestrian
- ✧ Oregon Expressway – existing grade-separated with no pedestrian access
- ✧ Loma Verde Avenue/Matadero Creek – planned grade-separated bicycle/pedestrian
- ✧ East/West Meadow Drive – existing at-grade, all modes
- ✧ East/West Charleston Road – existing at-grade, all modes
- ✧ San Antonio Road – existing grade-separated, all modes

This represents the “No Build” infrastructure condition.

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Table 1, below, presents a general description of each of the sample scenarios that were tested. All were analyzed for the future forecast year of 2030.

Also, to be noted is that where the circulation study assumes grade separations, it does not differentiate between the type of separation (below grade, above grade, etc.). This is due to the focused nature of the analyses and means that additional circulation analysis will likely be needed for grade separation alternatives that emerge through the community process if, for example, the type of separation results in local street closures in the vicinity. It was also assumed that all grade separations included full connections (both turning and through movements) with Alma Street, as it exists today.

Table 1 - Description of Test Scenarios

Scenario	General Description of Changes
No Build – Scenario 1	No changes to the crossings; existing rail service levels.
No Build – Scenario 2	No changes to the crossings; additional Caltrain plus High-Speed Rail Service for the peak period the forecast frequencies. (6 Caltrain and 4 HSR trains per hour in each direction in the peak periods.)
Sample Scenario 1 (Low Build)	Closed at-grade crossings at Palo Alto Ave (AKA Alma St), Churchill Ave, and E/W Meadow Dr; widened grade-separated crossing at Embarcadero Rd; new grade-separated crossing at E/W Charleston Rd.
Sample Scenario 2 (Low-Medium Build)	Closed at-grade crossings at Palo Alto Ave (AKA Alma St) and E/W Meadow Dr; new grade-separated bicycle/pedestrian crossing at Everett Ave/Lytton Ave and Loma Verde Ave/Matadero Creek; new quiet zone at-grade crossing at Churchill Ave; new grade-separated crossing at E/W Charleston Rd
Sample Scenario 3 (Medium Build)	Widened grade-separated crossing at Embarcadero Rd; new grade-separated bicycle/pedestrian crossing at Churchill Ave and E/W Meadow Dr; new grade-separated crossing at E/W Charleston Rd
Sample Scenario 4 (Full Build Phase 1)	New grade-separated bicycle/pedestrian crossing at Loma Verde Ave/Matadero Creek; new grade-separated crossing at E/W Charleston Rd
Sample Scenario 5 (Full Build Option A)	New at-grade quiet zone crossing at Palo Alto Ave (Alma St); new grade-separated bicycle/pedestrian crossings at Churchill Ave and Loma Verde Ave/Matadero Creek; new grade-separated crossing at E/W Meadow Dr and E/W Charleston Rd
Sample Scenario 6 (Full Build Option B)	New grade-separated crossings at Palo Alto Ave (AKA Alma St), Churchill Ave, E/W Meadow Dr, and E/W Charleston Rd; new grade-separated bicycle/pedestrian crossings at Everett Ave/Lytton Ave and Loma Verde Ave/Matadero Creek; widened grade-separated crossing at Embarcadero Rd

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Table 2 - Rail Corridor Circulation Study: Traffic Measures

Crossing	Existing (No Build)	Sample Scenario					
		1 Low Build	2 Low-Medium Build	3 Medium Build	4 Full Build Phase 1	5 Full Build Option A	6 Full Build Option B
Palo Alto Ave (AKA Alma St)	A	X	X	A	A	Q	S
University Ave	S	S	S	S	S	S	S
Embarcadero Rd	S	W	S	W	S	S	W
Churchill Ave	A	X	Q	A	A	A	A
Oregon Expwy	S	S	S	S	S	S	S
E/W Meadow Dr	A	X	X	A	A	S	S
E/W Charleston Rd	A	S	S	S	S	S	S

Key EXISTING NEW

Bicycle and Pedestrian measures for these scenarios are contained in Table 6.

A = At Grade Q = Quiet Zone W = Widened Grade Separated
X = Closed to all Traffic S = Grade Separated

4. Scenario Test Results 1: Traffic Diversions

4.1 For the six (6) test scenarios, the travel demand model was used to assess the diversion effects. The model was used to estimate how travel patterns will change when accessibility changes. This shows where increases and decreases occur in traffic volumes when a scenario is compared to the "No Build" scenarios. These are shown graphically in Figures 4.1 to 4.12. The "No Build Scenario 1" will include all infrastructure and rail service as it exists today (2017) with the forecasted 2030 traffic demand. The "No Build Scenario 2" includes all infrastructure as it exists today, but with the forecasted 2030 traffic demand and the increase in the frequency of rail crossing gate closures resulting from proposed Caltrain and High-Speed Rail service.

4.2 In 2030, the train frequency in the peak periods of the average weekday is forecast to increase to around three times today's service levels (i.e., from an average of 6-7 trains per hour to 20 trains per hour). This assumes both Caltrain and high-speed rail future forecast services will be operating. It could be speculated that even if high-speed rail is not in service by then, the demand for Caltrain services could push the train frequency to that level. That could be near to a practical saturation level for Caltrain services to operate if no further modifications (such as more passing tracks) are constructed.

In simple capacity terms, this translates to approximately a 20% reduction in vehicular capacities across the Caltrain at-grade crossings from today. For both

the No-Build Scenario 1 and Scenario 2, a 15% increase in total vehicular traffic volumes crossing the rail lines within the City is forecast through Year 2030 over existing conditions.

4.3 The difference between No Build Scenario 1 and No Build Scenario 2 is that there would be a vehicular traffic rerouting effect for the individual crossings due to the increase in grade-crossing congestion caused by effectively tripling the potential for gate closures. Essentially crossing traffic reduces on Palo Alto Ave; E/W Meadow Dr and Charleston Rd and increases on Oregon Expressway and San Antonio Rd. There is little effect on Churchill Ave; University Ave and Embarcadero Rd. So, there is a redistribution of routing to the grade-separated crossings in the south of the City.

4.4 In the rest of the comparisons, the "No Build Scenario 2" option is assumed to be the baseline, so in Figures 4.1 to 4.12, the "traffic differences" diagrams are shown for each scenario against the "No Build Scenario 2", with the red overlay showing which roads will have increased traffic flows and the green overlay showing where traffic flows will be reduced. For each scenario, a summary of this is included with a description of the effect on the volumes using the various rail crossings within the City.

4.5 SAMPLE SCENARIO 1

Sample Scenario 1 has three (3) of the at-grade crossings closed and Charleston Rd. grade separated. Embarcadero Rd is widened. The total 2030 traffic crossing reduces to 2017 levels, so the growth is effectively rerouted out of the City. University Ave and Embarcadero Rd experience small increases but Charleston Rd experiences very high increases in traffic flows, over 50% above the No Build Scenario 2 flows, shown in Figures 4.1 and 4.2.

4.6 SAMPLE SCENARIO 2

Scenario 2 has Palo Alto Ave and Meadow Dr closed; Churchill Ave remaining at grade and Charleston Rd grade separated. The total crossing traffic flows reduce by around 10% from the No Build Scenario 2 conditions, so around 5% above today's conditions. There is some small amount of increases to traffic on the grade-separated crossings, with the exception of Charleston Rd which experiences over 50% increase in traffic flow.

In the westbound direction, Oregon Expressway is likely to exceed LOS D. In the eastbound direction, Embarcadero Rd is likely to be congested, well above LOS D. University Ave is not likely to exceed LOS D. Shown in Figures 4.3 and 4.4.

4.7 SAMPLE SCENARIO 3

Scenario 3 has the existing grade separation at Embarcadero Rd being widened and with Charleston Rd grade separated. There are slight increases for Palo Alto Ave and Embarcadero Rd but over a 50% increase from the No Build Scenario 2 for Charleston Rd.

The widening of Embarcadero Rd reduces potential congestion and assists in balancing the traffic volumes between the grade-separated crossing. The widening, therefore, is a justifiable measure and serves the purpose for which it is intended. Both Palo Alto Ave and Embarcadero Rd are likely not to exceed LOS D. Shown in Figures 4.5 and 4.6.

4.8 SAMPLE SCENARIO 4

The only change from No Build Scenario 2 to Sample Scenario 4 is that a grade separation for Charleston Road is included. There is little change except for Charleston Rd itself, which attracts over an additional 50% of traffic flow. Shown in Figures 4.7 and 4.8.

4.9 SAMPLE SCENARIO 5

Scenario 5 has an at-grade quiet zone at Palo Alto Ave and grade separations at Charleston Rd and Meadow Dr. Churchill Ave remains at-grade. Both Meadow Dr and Charleston Rd experience a high level of additional traffic flow. This is likely to have the effect of having similar traffic operating conditions as today, on the existing grade separations. So, the traffic growth is taken up by the new grade-separated crossings. Shown in Figures 4.9 and 4.10.

4.10 SAMPLE SCENARIO 6

This scenario offers the greatest level of total capacity increase for the crossings within the City of all the scenarios tested. It has all the specifications of sample scenario 5 with the addition of widening at Embarcadero Rd and Palo Alto Ave grade separated. Churchill Ave stays the same as today. Each of the former at-grade crossings that are assumed to be grade separated attract substantial additional traffic flows – much of which is diverted from the existing grade-separated crossings in the City. The existing grade-separated crossings operate with similar levels of traffic flow to today and substantially better than in No Build Scenario 2. Shown in Figures 4.11 and 4.12.

4.11 DISCUSSION ON TRAFFIC DIVERSION OUTCOMES

Although six (6) scenarios is only a fraction of the vast number of possible combinations and permutations for different layouts of the crossings in the City, it seems the tests completed provide a reasonable picture of likely outcomes of different scenarios. These range from Sample Scenario 1, the most restrictive, which is specified to close down all the at-grade crossings except Charleston Rd, to Sample Scenario 6, that includes grade separating every crossing that is currently at-grade, except for Churchill Ave.

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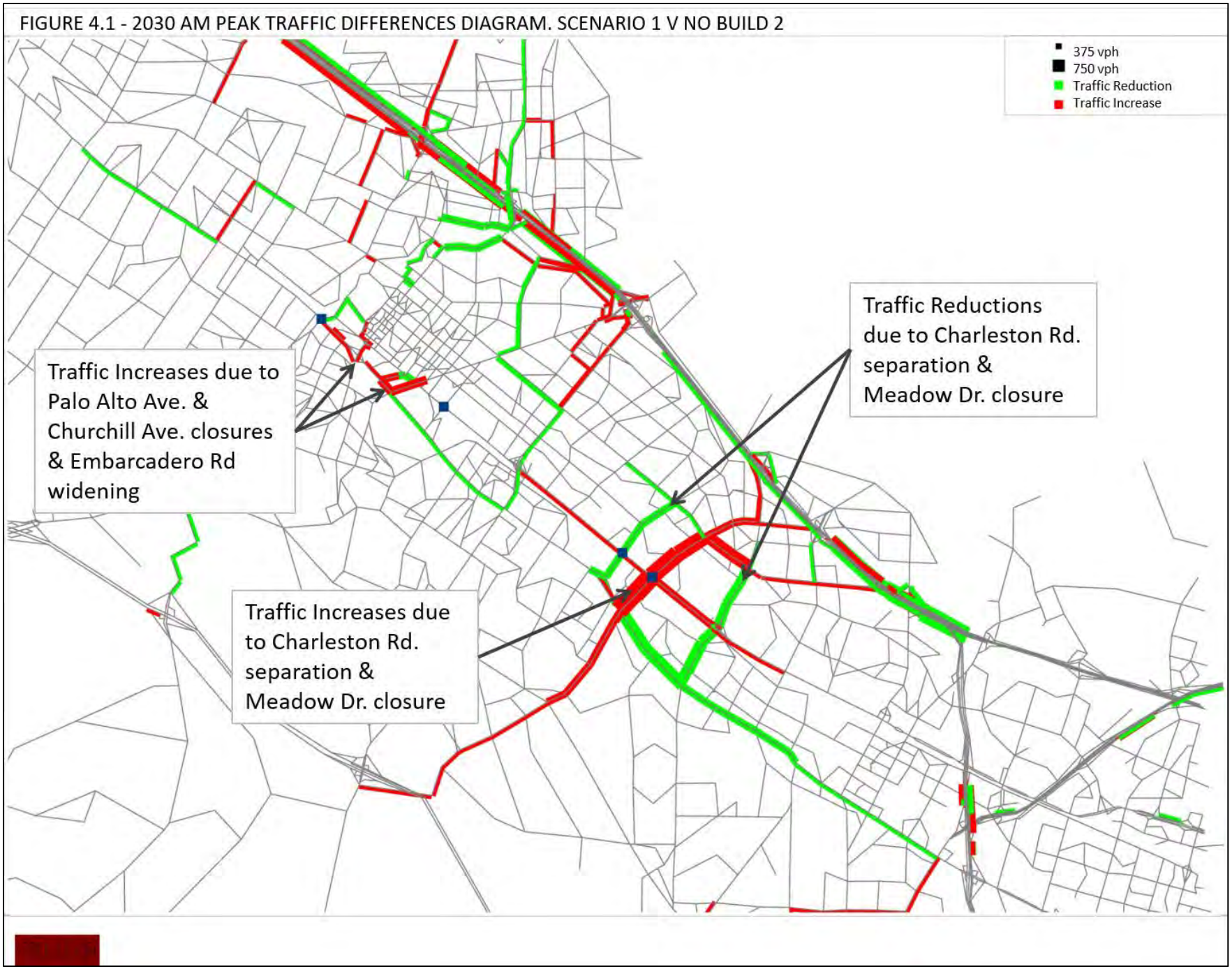
FIGURE 4.1 - 2030 AM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 1 V NO BUILD 2



MOTT MACDONALD

FIGURE 4.2 - 2030 PM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 1 V NO BUILD 2

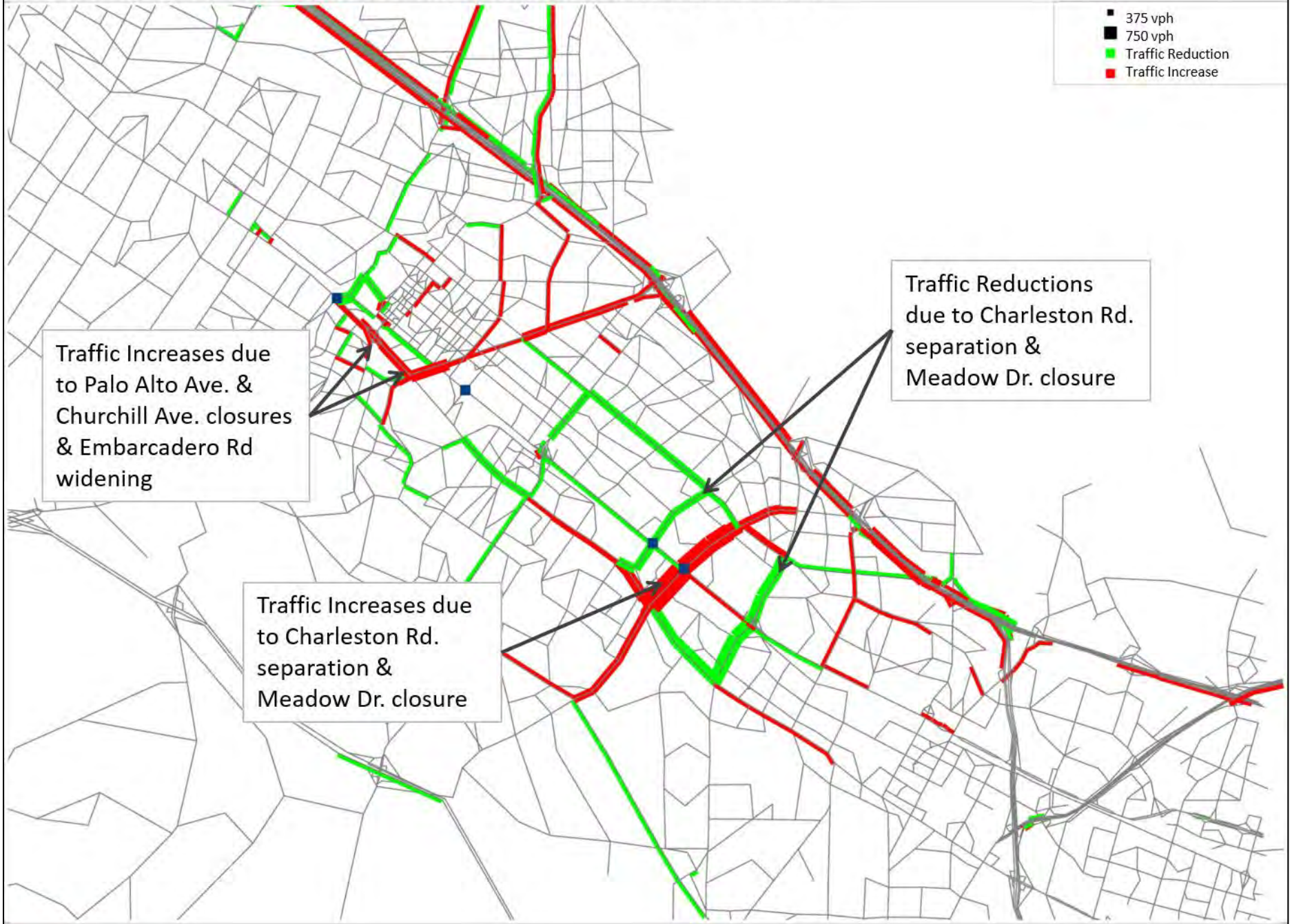


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FIGURE 4.3 - 2030 AM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 2 V NO BUILD 2

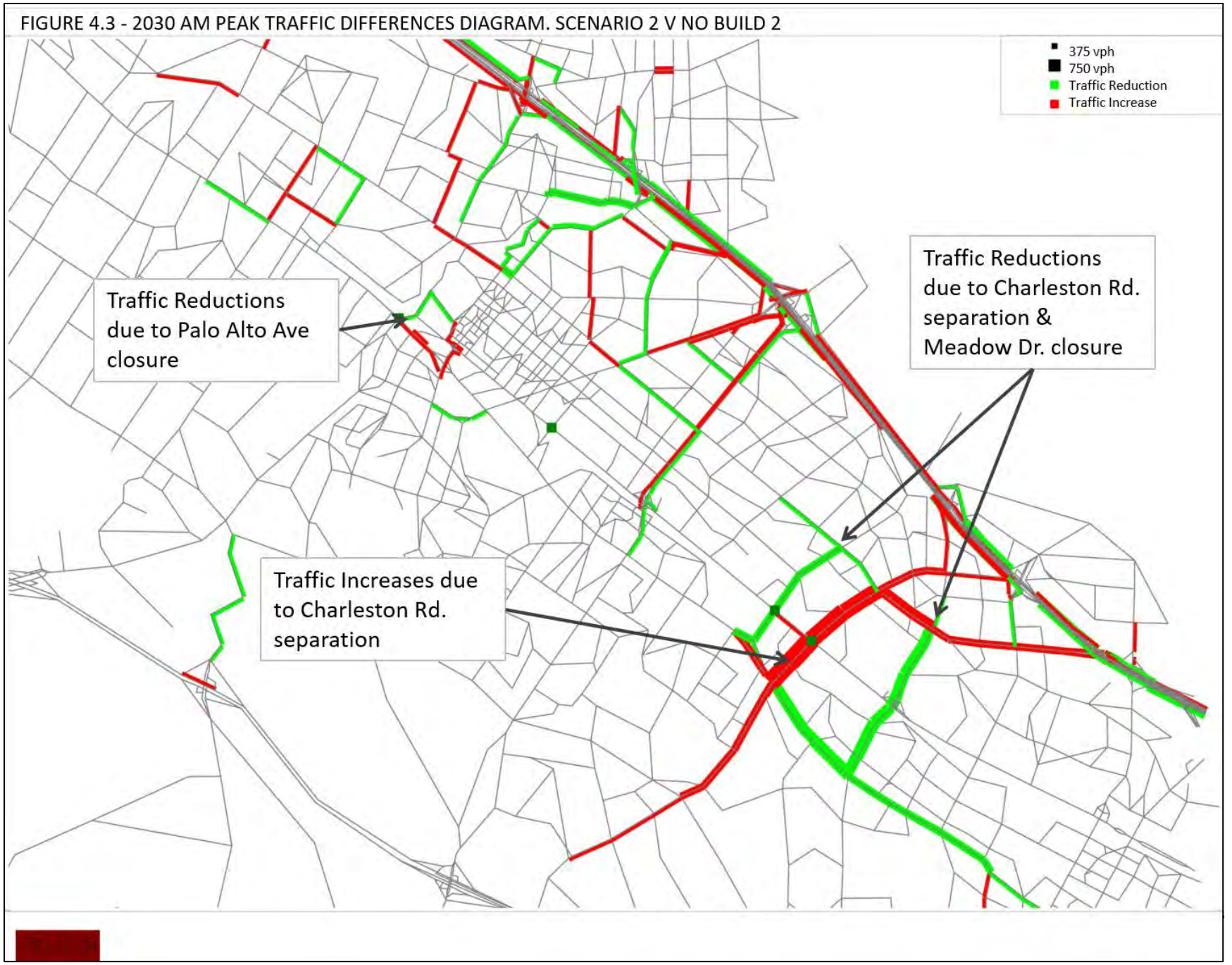

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FIGURE 4.4 - 2030 PM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 2 V NO BUILD 2

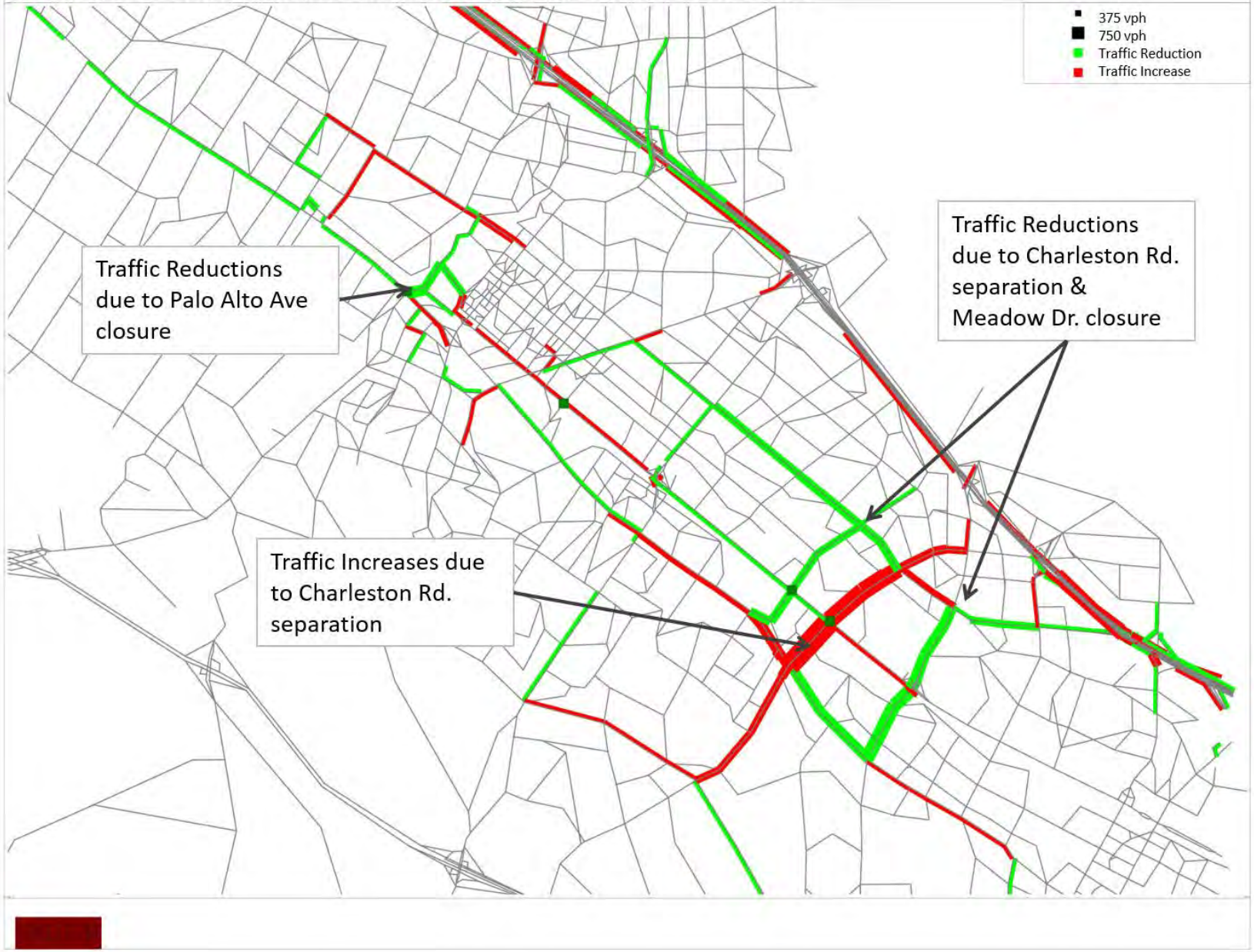

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FIGURE 4.5 - 2030 AM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 3 V NO BUILD 2

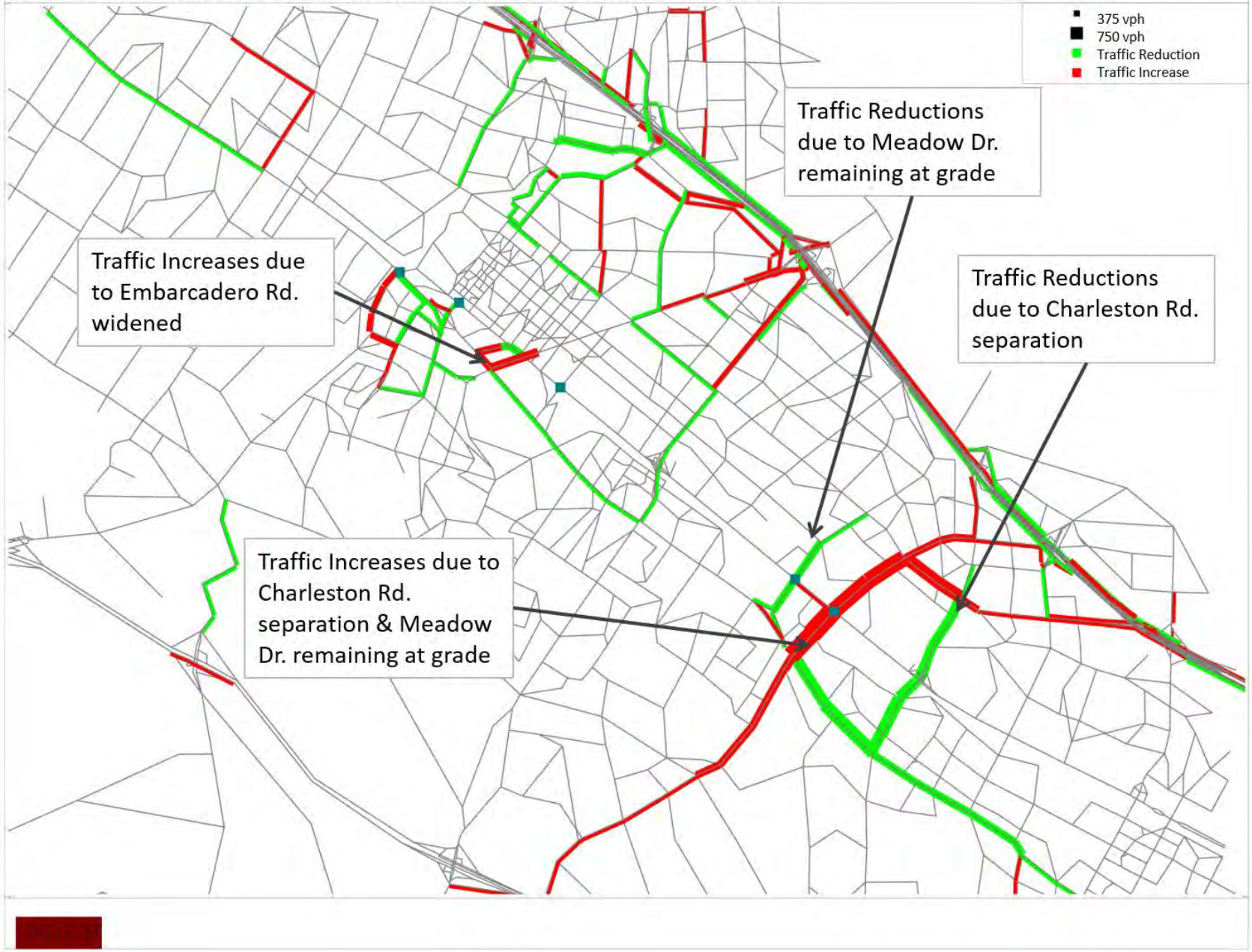

FIGURE 4.6 - 2030 PM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 3 V NO BUILD 2

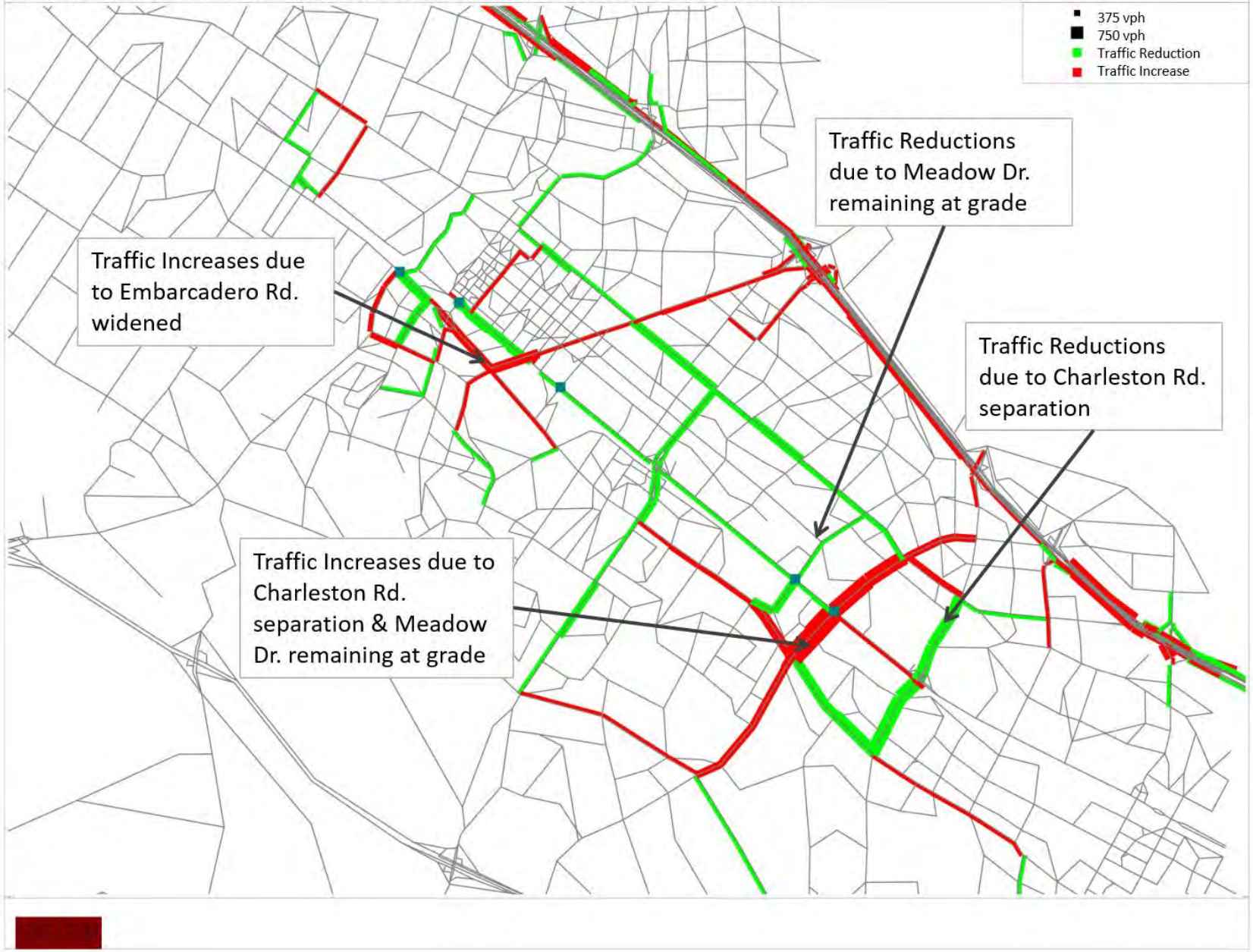

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FIGURE 4.7 - 2030 AM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 4 V NO BUILD 2

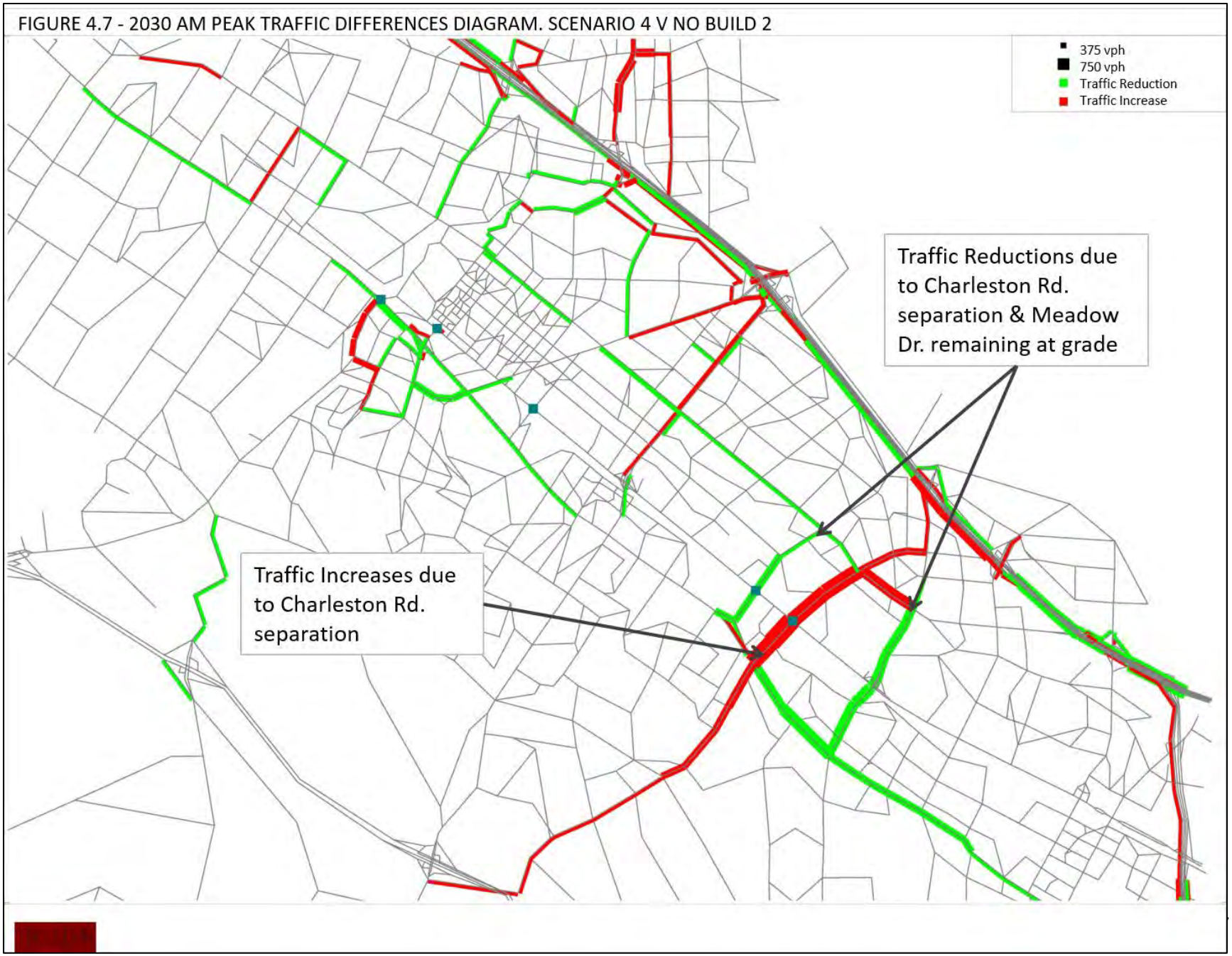

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FIGURE 4.8 - 2030 PM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 4 V NO BUILD 2

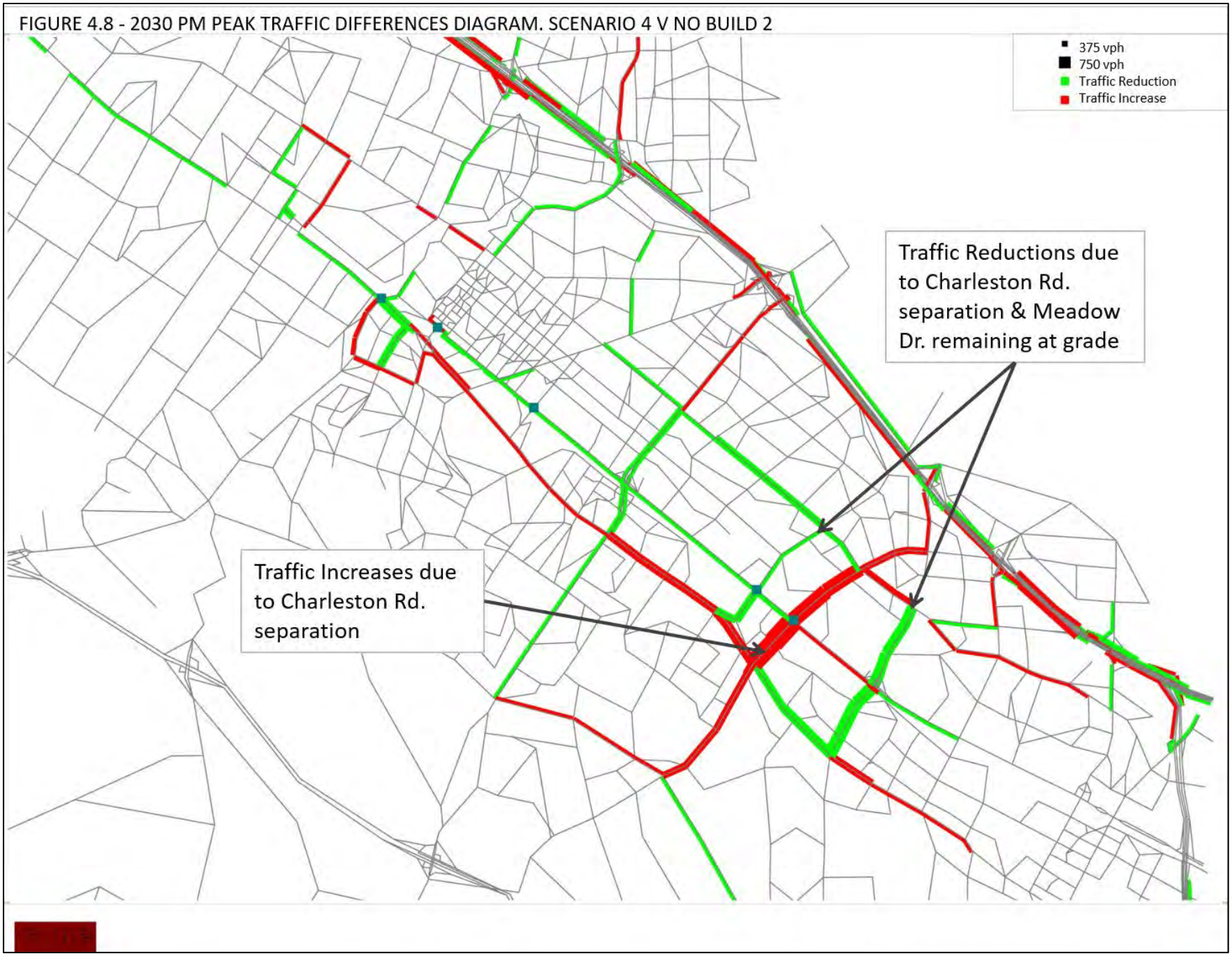

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FIGURE 4.9 - 2030 AM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 5 V NO BUILD 2

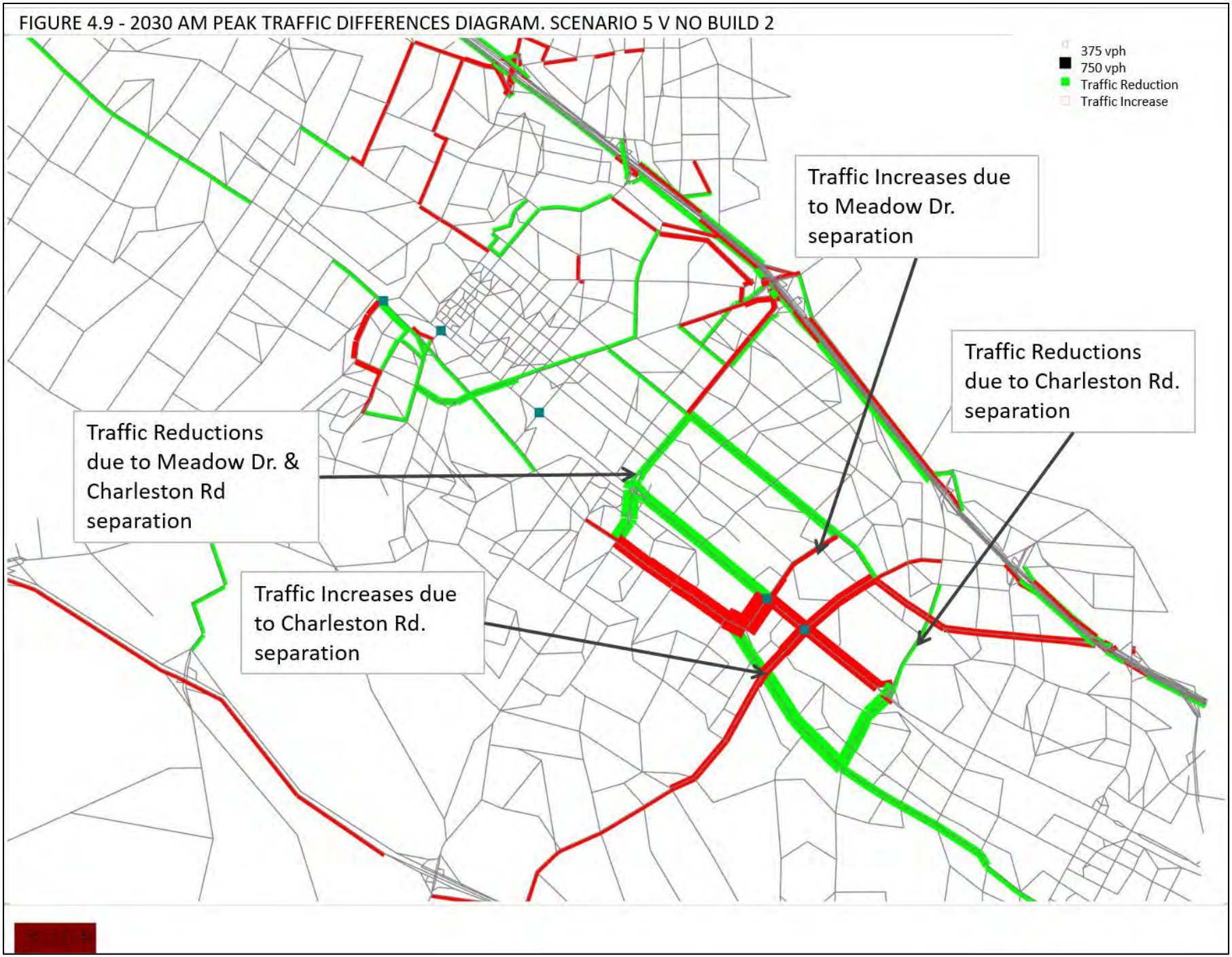

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FIGURE 4.10 - 2030 PM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 5 V NO BUILD 2

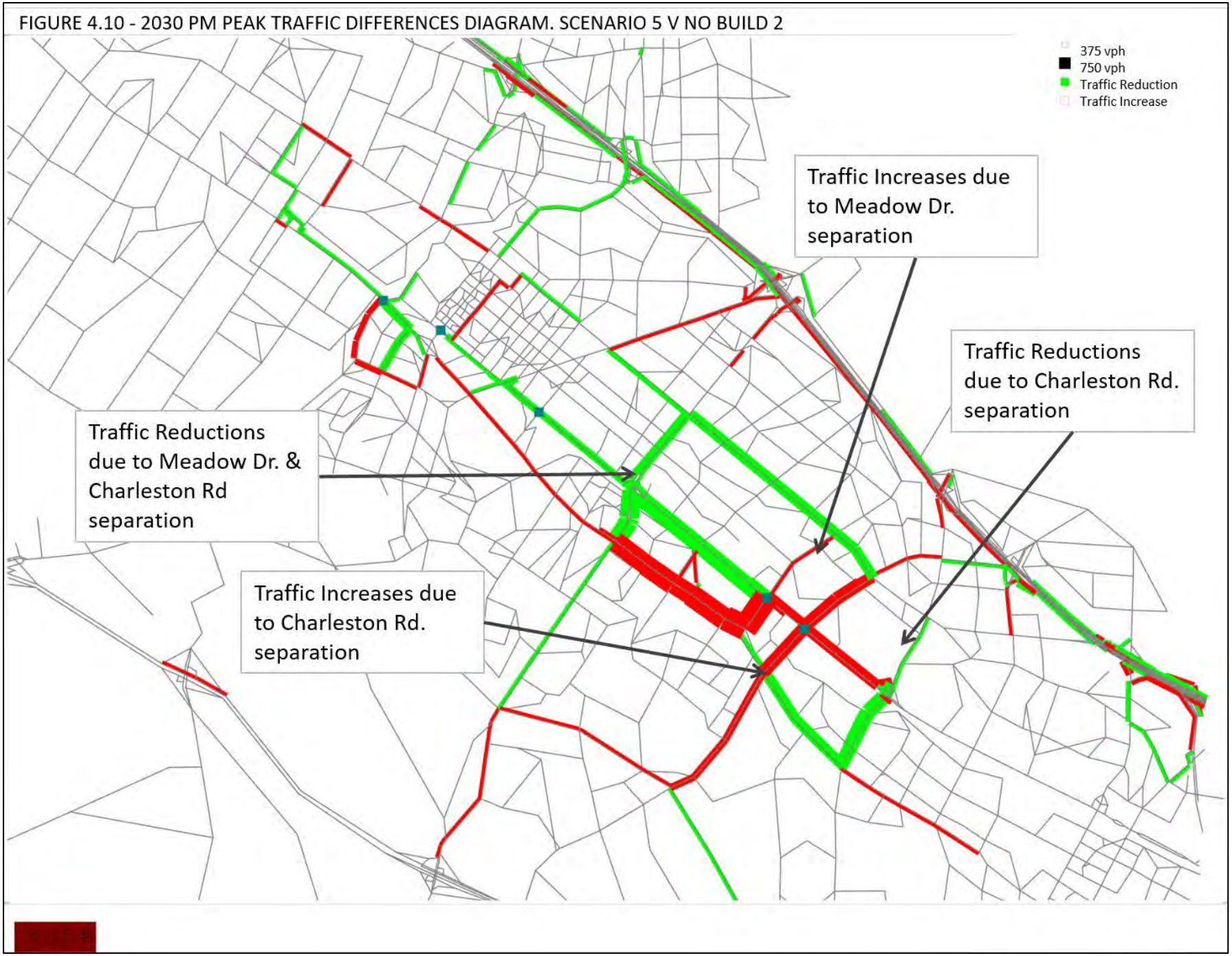

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FIGURE 4.11 - 2030 AM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 6 V NO BUILD 2

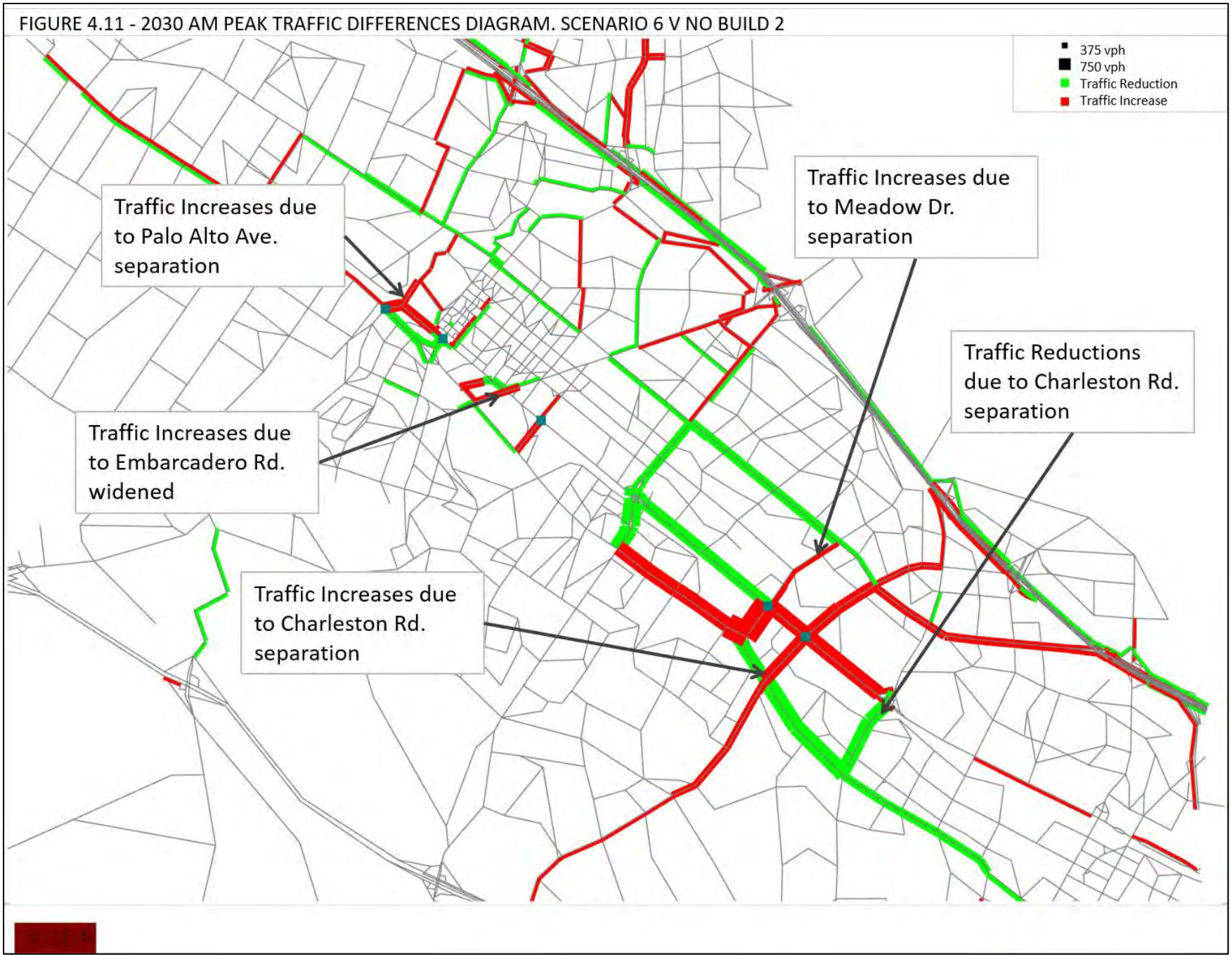
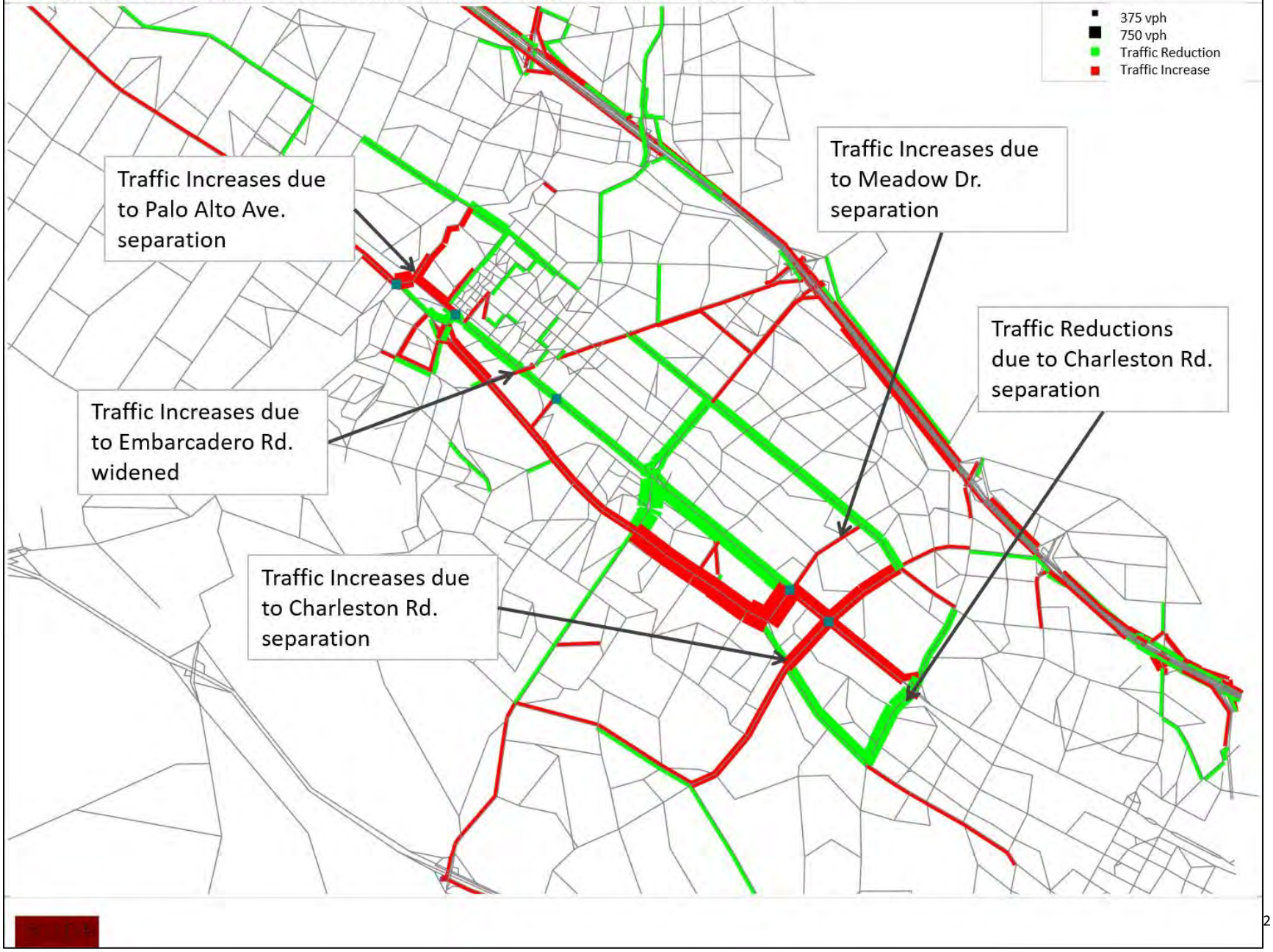


FIGURE 4.12 - 2030 PM PEAK TRAFFIC DIFFERENCES DIAGRAM. SCENARIO 6 V NO BUILD 2



In general, the outcomes of the tests are intuitive with those crossings that remain at grade shedding traffic to either the existing grade-separated crossings or any that will be newly constructed as grade separated. The exception is Churchill Ave which seems relatively insensitive to changes in the layout and functions of the crossings. This may be because Churchill is used for very local trips that are unlikely to reroute without significant inconvenience.

4.12 If the grade separations were to be constructed, then some rerouting would occur from the existing grade separations. Charleston Rd is particularly likely to experience this if it is grade separated; specifically attracting traffic that currently uses the San Antonio Road grade-separated crossing. Charleston Rd and Arastradero Rd corridor is one of the few connecting routes for I-280 and US 101

Sample Scenario 1 is likely to divert the 15% growth in traffic demand from today to 2030, out of the City and divert existing traffic from the routes that are closed to those that are grade separated. This is shown in Figures 4.13 and 4.14.

It should be noted that in Figures 4.13 to 4.16 the increases are compared to current conditions, not to the “No Build Scenario 2.” This gives a perspective to the likely increases compared to today.

4.13 Sample Scenario 6 displays about the highest crossing capacity of the six (6) sample scenarios for vehicular traffic. Churchill Ave is not assumed grade separated, but seems fairly insensitive to change and may not make any significant difference. Sample Scenario 6 is technically equivalent to having the Caltrain track below or above ground for the whole length through the City, from a traffic modeling perspective.

This Scenario attracts some 5% more total crossing traffic than No Build Scenario 2. All routes that are currently at-grade and become grade separated in Scenario 6 will attract significant additional volumes of traffic, as can be seen in Figures 4.15 and 4.16. Much of this traffic reroutes from existing grade crossings, particularly San Antonio Road.

4.14 In Table 3 – a summary assessment of the likely effects of the different proposals for the at-grade treatments are shown, as demonstrated by the model.

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Table 3 - Response of the at-grade intersections to change

Condition / Location	Remain at-grade	Closed	Grade-separated
Palo Alto Ave / Alma St	Little effect	Sheds small amount of traffic to Ravenswood Ave and University Ave	Significantly increases traffic flows. (~30%)
Churchill Ave	Little effect	Considerable diversion to Embarcadero Rd, which if widened could operate satisfactorily.	It is suspected that there would be little effect on other grade crossings, if other separations implemented. Could attract small amounts of traffic.
E/W Meadow Drive	As traffic grows, will shed to Oregon Expressway and Charleston Rd (if grade separated)	Some diversion to Charleston Road; significant if Charleston is grade-separated	Significantly increases traffic flows (~50%)
Charleston Rd	As traffic grows, will shed to San Antonio Road	Not tested but likely to either shed significant traffic to San Antonio Road or reduce traffic overall	Significant increases to traffic flows (50+%). Some diverts from San Antonio Rd.

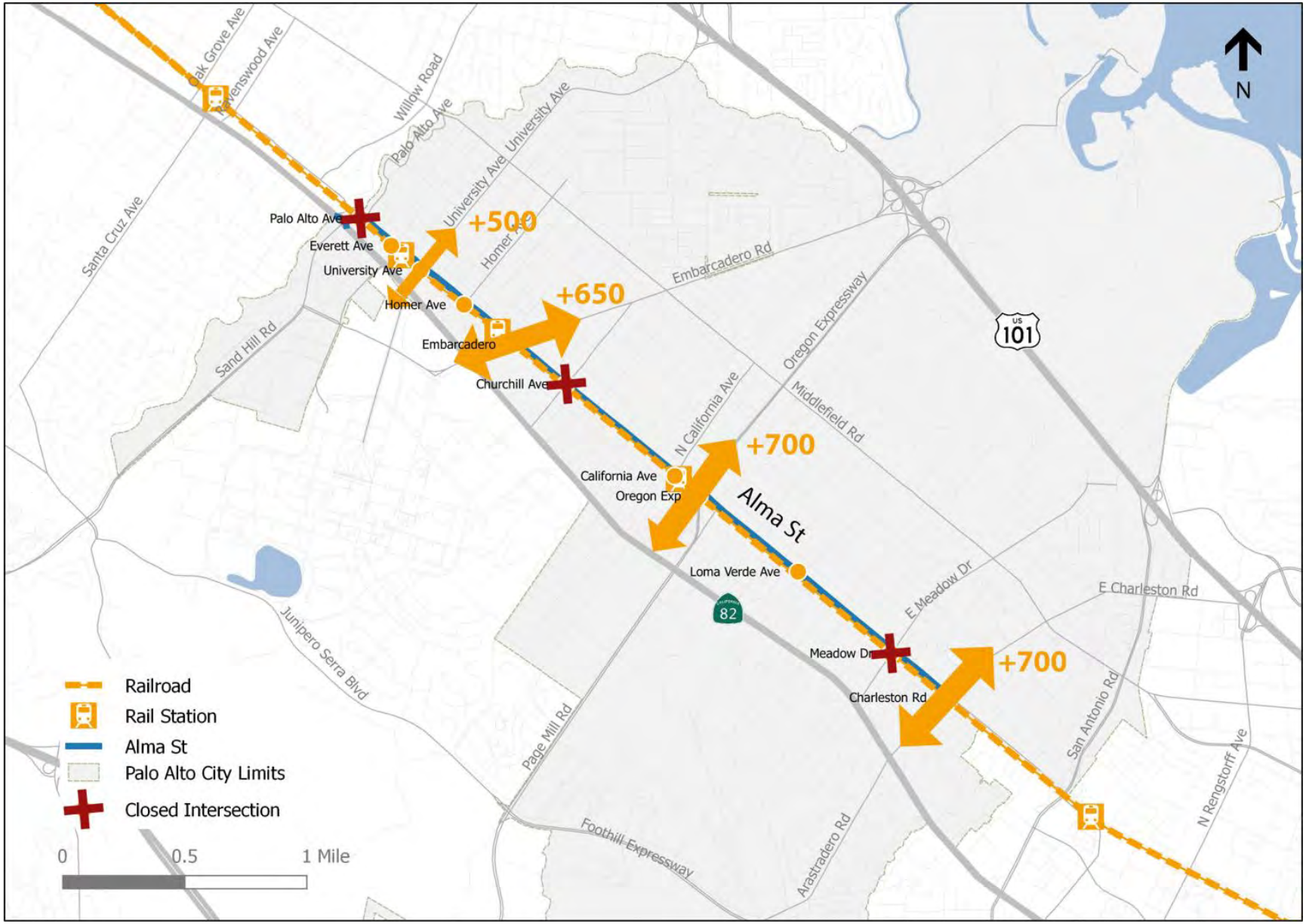


Figure 4.13 Flow Increases From 2017 to 2030 (AM Peak) VPH: All At-Grade Closed Except Charleston Rd. – Sample Scenario 1

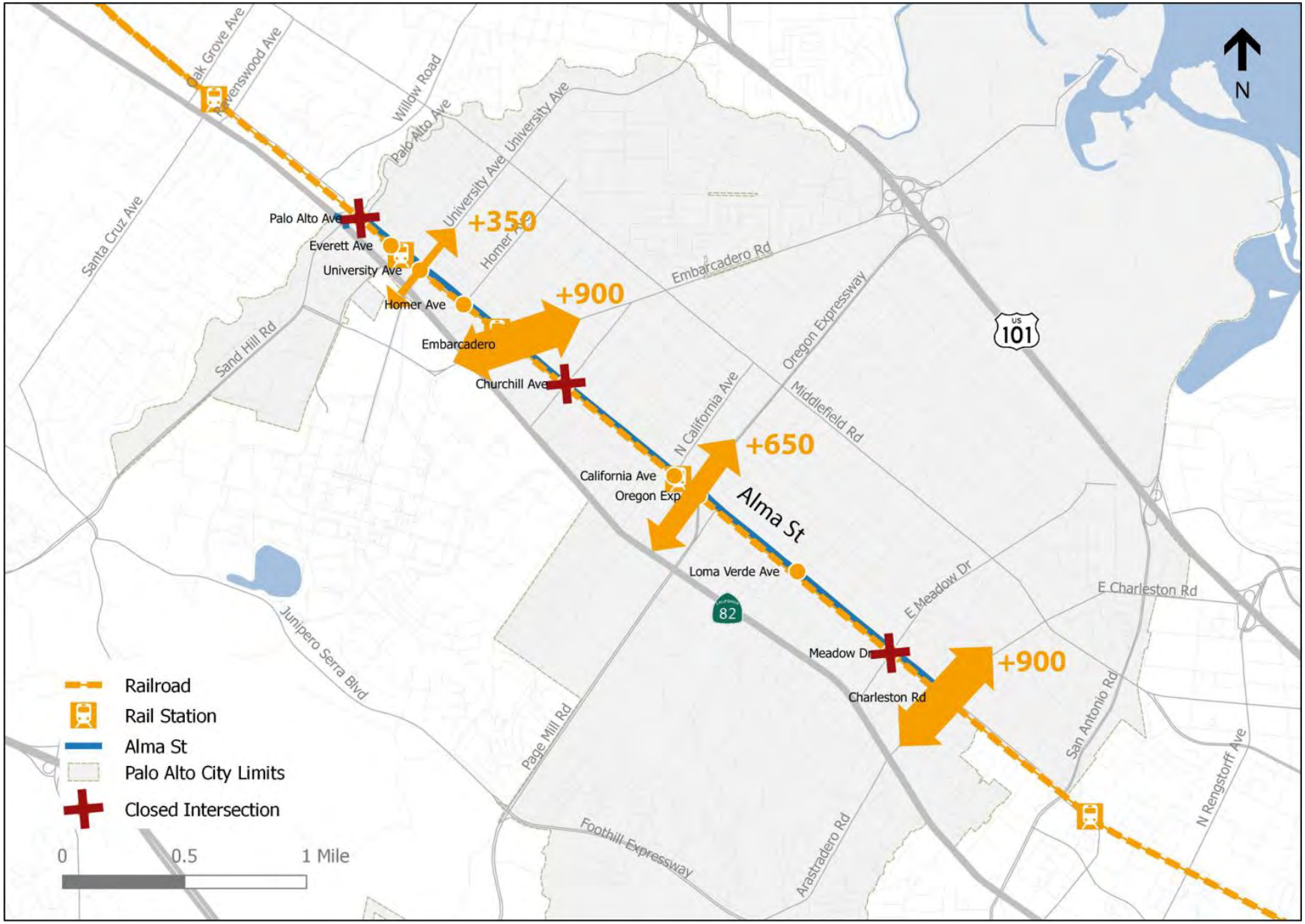


Figure 4.14 Flow Increases From 2017 to 2030 (PM Peak) VPH: All At-Grade Closed Except Charleston Rd. – Sample Scenario 1

Figure 4.15 Flow Increases From 2017 to 2030 (AM Peak) VPH: Full Grade Separation Except Churchill Ave. – Sample Scenario 6

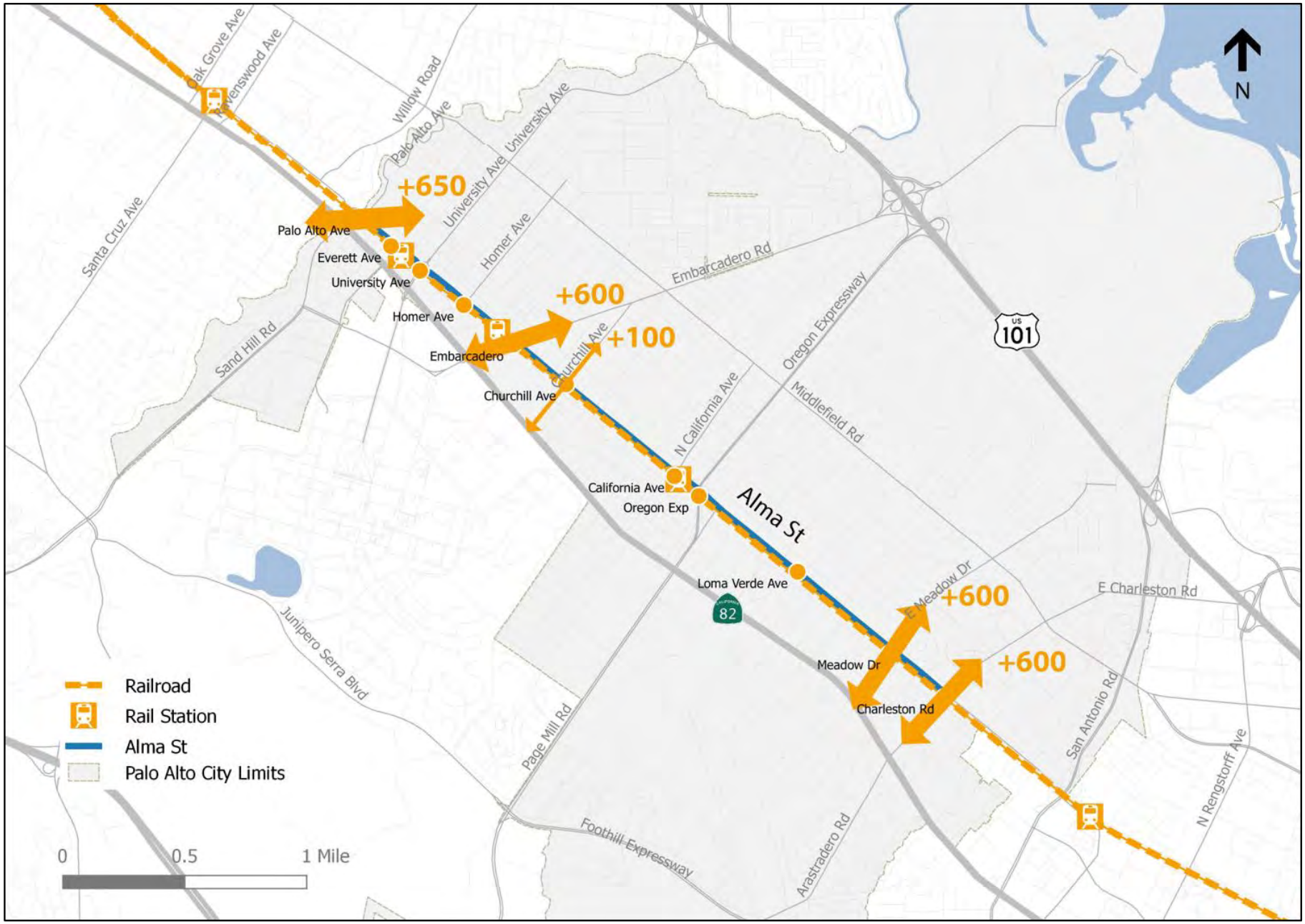


Figure 4.16 Flow Increases From 2017 to 2030 (PM Peak) VPH: Full Grade Separation Except Churchill Ave. – Sample Scenario 6

5. Scenario Test Results 2: Intersection Analyses

5.1 GENERAL

This section of the report describes the results of a more detailed examination of the operational performance of the intersections. The computer program Synchro® (version 8) was used for the analysis. For each intersection, the traffic flows surveyed in 2017 were used as input with the addition of forecast traffic growth from 2017 to 2030. The growth was estimated using the travel demand model.

The forecast traffic flows are described below. This is followed by an analysis of the conditions, in terms of traffic delay and queues, that are likely to occur if the Caltrain services are increased to, firstly, Caltrain modernization specification and secondly, to both the Caltrain Modification and high-speed rail specification for train service frequencies. This section then describes the more detailed analyses that have been carried out for the performance of the intersections under Sample Scenarios 1 to 6. Finally, a discussion is included in the results.

5.2 TRAFFIC FLOWS

The intersections analyzed are shown in Figure 5.1. and listed below.

5.3 The following are the intersections that have been examined:

- ✧ Palo Alto Avenue/Alma St (unsignalized intersection)
- ✧ El Camino Real/Palo Alto Ave/Sand Hill Rd
- ✧ Churchill Ave/Alma St
- ✧ Churchill Ave/Mariposa Ave (unsignalized intersection)
- ✧ Churchill Ave/Madrona Ave (unsignalized intersection)
- ✧ Meadow Dr/Ramona St (unsignalized intersection)
- ✧ Meadow Dr/Alma St
- ✧ Meadow Dr/Park Blvd (unsignalized intersection)
- ✧ Meadow Dr/Wilkie Way
- ✧ Charleston Rd/Wright Pl (unsignalized intersection)
- ✧ Charleston Rd/Alma St
- ✧ Charleston Rd/Park Blvd (unsignalized intersection)
- ✧ Charleston Rd/Wilkie Way

These intersections were all subject to count surveys in 2017 – as reported and analyzed in the “Existing Conditions Report.”

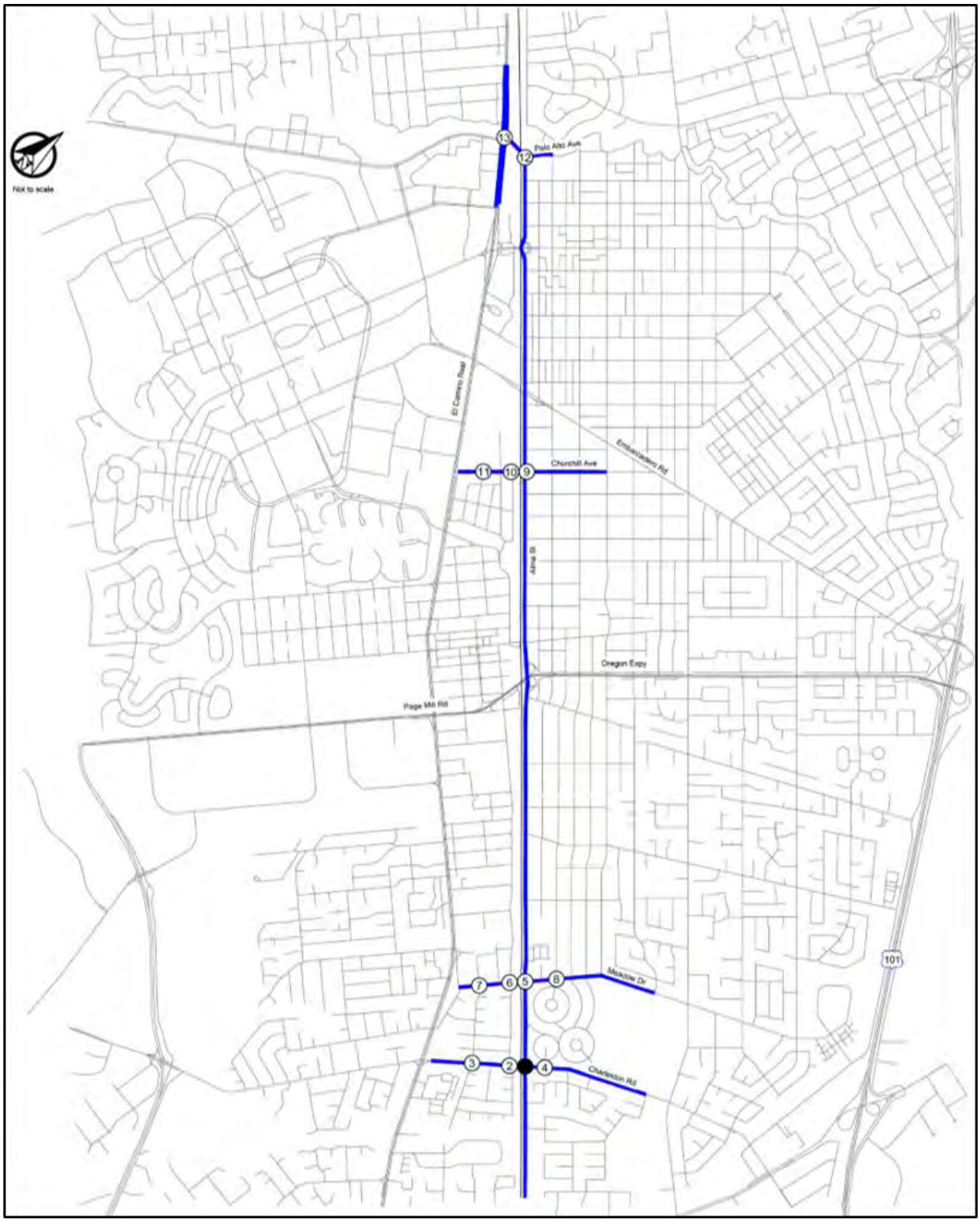


Figure 5.1 Intersections Analyzed on At-Grade Crossing Routes

5.4 TRAFFIC CONDITIONS FOR "NO BUILD" SCENARIOS

Tests were carried out for a number of possible conditions for the future:

2017 - current conditions

2020 - Caltrain Modernization train frequency increases

2030 - Caltrain Modernization and high-speed-rail train frequency increases (No Build Scenario 2)

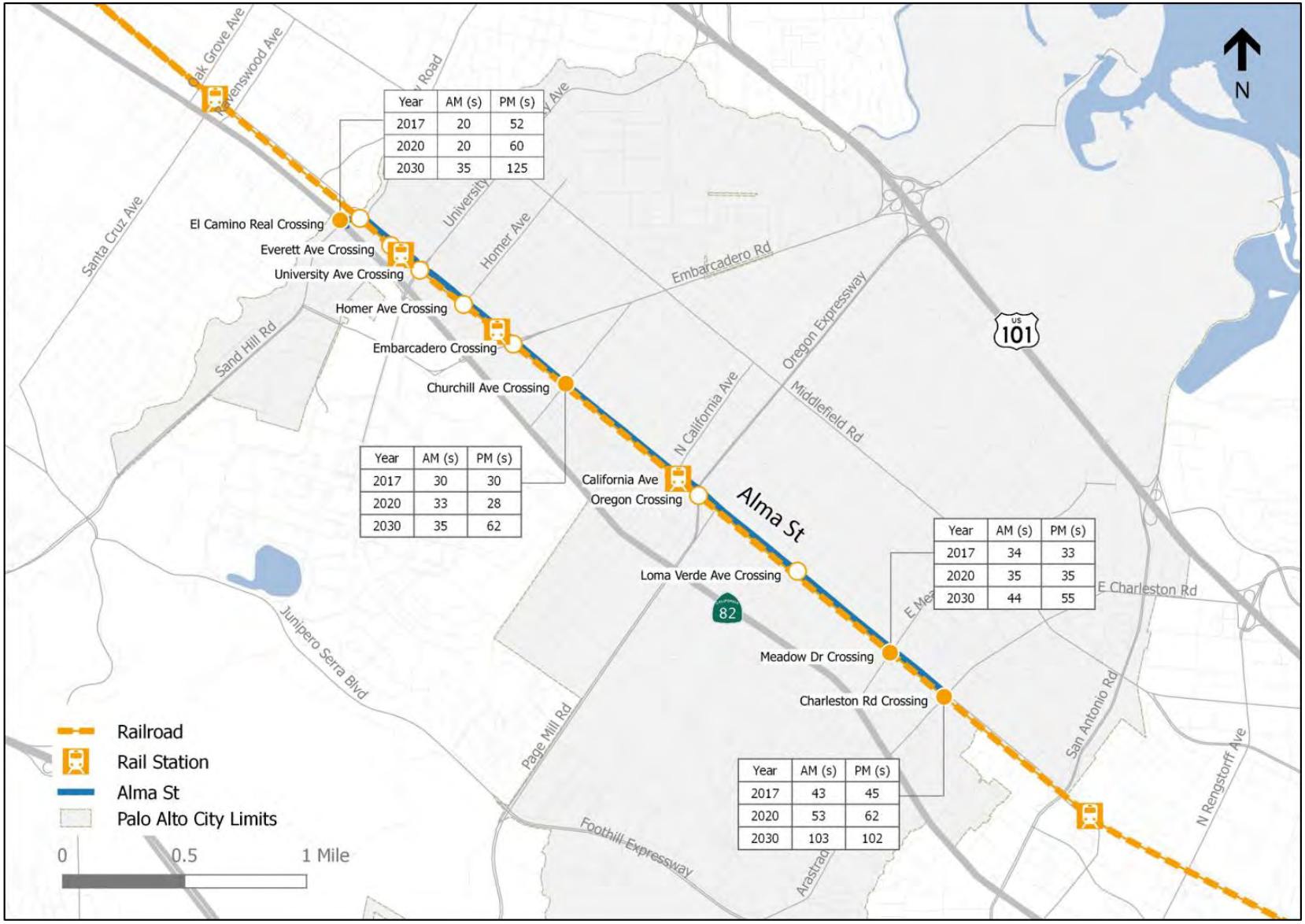
In Figure 5.2, the average vehicle delays are shown under the three (3) analysis years described above. As can be seen, particularly in the PM peak, delays are forecast to at least double in many cases from 2017 to 2030.

5.5 Figures 5.3 and 5.4 show the likely queue formation for the future year of 2030 in the PM peak for a "No Build Scenario 2" condition. The PM peak, generally, has higher volume of flows than the AM peak. Queues become a more serious issue when they cause gridlock by backing up through intersections that are up-stream (in traffic flow terms) of the intersection under examination. As can be seen, this occurs at a number of the intersections under review and particularly on El Camino Real, which is a major route through the City.

5.6 Table 4 below shows the typical level-of-service (LOS) for the key traffic flows that cross the rail track for the three (3) analysis years at each of the at-grade crossings (as set out above in 5.4).

Table 4 – Level-of-Service of Key Rail Crossing Movements

Crossing	2017	2020	2030
Palo Alto Ave	E/F	F	F
Churchill Ave	E	F	F
Meadow Dr	D/E	D/E	E/F
Charleston Rd	E/F	F	F



Year	AM (s)	PM (s)
2017	20	52
2020	20	60
2030	35	125

Year	AM (s)	PM (s)
2017	30	30
2020	33	28
2030	35	62

Year	AM (s)	PM (s)
2017	34	33
2020	35	35
2030	44	55

Year	AM (s)	PM (s)
2017	43	45
2020	53	62
2030	103	102

Figure 5.2 Vehicle Delays for “No Build” Condition With Programed Train Frequency Increases

Figure 5.3 2030 PM Peak Period Estimated “No Build” Queues at Palo Alto Ave. & Churchill Ave.

Figure 5.4 2030 PM Peak Period Estimated “No Build” Queues at Meadow Dr. & Charleston Rd.

5.7 TRAFFIC CONDITIONS UNDER SAMPLE SCENARIOS 1-6 AT 2030

Table 5 shows a summary of the motor vehicle level-of-service (LOS) for traffic operations at the intersections analyzed on the Caltrain track crossing routes, that are currently at grade as set out in paragraph 5.3 and shown in Figure 5.1. The LOS is for the times when the rail gates are not closed. For the LOS for times when the gates are closed, Table 4 should be referred to. It should be remembered that the forecast flows into the intersections vary considerably between different scenarios and therefore the LOS will also vary. For example, when an existing at-grade crossing is assumed to be grade separated in a scenario, it is likely to attract more traffic, which then can deteriorate the intersection LOS's on that route. This also means that some routes that remain at-grade will operate at a better LOS during times when the rail crossing gate is open, than when they are assumed to be grade separated. This is usually because traffic is deterred from using a route with an at-grade crossing because of the likelihood of gate closures. When a route that was previously at-grade is proposed for grade-separation, the demand model shows it will attract additional traffic and that additional traffic may cause a deterioration in the operating LOS at the intersections on that route. When future alternative (more detailed) designs for grade operations are carried out, these conditions may well be improved.

Table 5 – Level-of-Service of Traffic Operations at the Intersections on the Rail Track Crossing Routes

Sample Scenarios

Scenario & Time Period / Crossing Route	"No Build" Scenario 2		1		2		3		4		5		6	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Palo Alto Ave	C	C	A	A	A	A	C	C	C	C	C	C	C	F
Churchill Ave	C	D	A	A	C	C	C	D	C	C	C	C	C	D
Meadow Dr	C	C	C	C	C	C	C	C	C	C	E	F	E	D
Charleston Rd	D	E	F	F	F	F	F	F	F	F	F	F	F	F

5.8 DISCUSSION ON TRAFFIC OPERATION ANALYSES

Under the "No Build Scenario 2" condition which assumes maximum increase in train services from Caltrain and high-speed-rail, all of the at-grade crossings are likely to operate at LOS-F for traffic signal phases during which a rail track gate closure is included. With the forecast frequencies of closures, this will occur on an increasing number of occasions during the peak periods (one every three [3] minutes on average). Conversely, if an at-grade crossing remains at-grade,

traffic will likely divert to other routes and this may improve the operating LOS for periods when no gate closures occur.

5.9 For routes where currently at-grade crossings are converted to grade separations, additional traffic is likely to be attracted which may deteriorate the LOS for all intersections on that route. This can be seen in Table 5; however, where the all mode closures of the rail crossings at Palo Alto Ave; Churchill Ave and Meadow Dr (Scenario 1) are implemented, it may improve the LOS of the surrounding intersections.

If closures were to be implemented and traffic diverted to existing grade crossings, then the LOS on Embarcadero Rd and Oregon Expressway are likely to operate higher than LOS D. Without widening, Embarcadero Rd in an eastbound direction would likely be highly congested and above LOS D.

5.10 A further consideration is that the actual timings of the gate-crossing cannot be predicted precisely. There is a randomness associated with arrival time of the train within a given time period. This is exacerbated by the fact that the services are two-way operations, each direction having their own frequency characteristics. This may mean that on occasions, the traffic queuing from one signal phase that included a gate closure may not sufficiently recover to a normal non-gate closure condition, before another gate-closure phase occurs for the traffic signal. Conversely, opposite direction trains may utilize one gate closure, resulting in more open gate time within a given window.

5.11 In summary, for those crossing routes that remain at-grade, it is likely that the intersections will operate at LOS F for the times when there is a gate closure. Due to traffic being attracted away from these routes, because of the likelihood of drivers experiencing a gate closure, the traffic volumes on those routes are likely to reduce. This would mean the LOS would improve when no gate closures occurred. However, for the forecast train frequencies in 2030 under the full impact of Caltrain Modernization and high-speed-rail specifications, the likelihood of a traffic signal phase including a gate closure becomes very much higher than today.

For those routes that do have future grade separated Caltrain track crossings, where none exist today, increased traffic flows are likely to occur and thus the LOS at the intersections on that route may deteriorate.

6. Bicycle & Pedestrian Accessibility

6.1 As part of the scenario testing, a variety of different proposals for new bicycle and pedestrian crossings for the Caltrain track were prepared. These are shown in Table 6 below.

As part of any future grade-separated crossings, both bicycle and pedestrian facilities will be fully accommodated within the overall infrastructure designs.

These will be equivalent in access and safety terms to the latest standards and to any of the other newly constructed Bicycle/Pedestrian-only grade separations.

Table 6 - Rail Corridor Circulation Study: Bicycle and Pedestrian Measures for the Sample Scenarios 1-6

Crossing	Existing (No Build)	Sample Scenario					
		1 Low Build	2 Low-Medium Build	3 Medium Build	4 Full Build Phase 1	5 Full Build Option A	6 Full Build Option B
Everett Ave/Lytton Ave	-	-	B/P	-	-	-	B/P
Homer Ave	B/P	B/P	B/P	B/P	B/P	B/P	B/P
Churchill Ave [1]		-	-	B/P	-	B/P	-
California Ave	B/P	B/P	B/P	B/P	B/P	B/P	B/P
Loma Verde Ave/ Matadero Creek	-	-	B/P	-	B/P	B/P	B/P
E/W Meadow Dr. [1]		-	-	B/P	-	-	-

Key EXISTING

NEW

B/P = Grade-Separated Bicycle/Pedestrian Only

[1] = In close proximity

6.2 The sample scenarios with crossing closures for all modes (1 and 2) if implemented without the provision of pedestrian and bicycle-crossing facilities close by, would seriously deteriorate mobility for those modes of travel. For the No Build Scenario 2 and as it is today, there is a significant gap between Oregon Expressway and Meadow Dr. With Sample Scenario 1, this gap is extended by the closure of Meadow Dr. Added to this, new gaps would appear between Oregon Expressway and Churchill Ave and north of Palo Alto Ave. Sample Scenario 2 is a considerable improvement on Sample Scenario 1 with the addition of new Bicycle/Pedestrian-crossing facilities at Everett Ave/Lytton Ave and at Loma Verde Ave/Matadero Creek. Sample Scenario 2 though, still reduces mobility north of Palo Alto Ave by closing it, and also, marginally between the new Loma Verde Ave/Matadero Ave crossing and Charleston Rd, by closing Meadow Dr.

6.3 Sample Scenario 6 provides the maximum accessibility for Bicyclists and Pedestrians of all the scenarios tested. As all at-grade crossings are assumed grade separated, except Churchill Ave, and all proposed new grade-separated crossings for bicycle and pedestrian are assumed constructed, the overall level of accessibility is very high. This is shown in Figure 6.3. The only remaining at-grade crossing that does not have improved Bicycle and Pedestrian crossing facilities would be Churchill Avenue

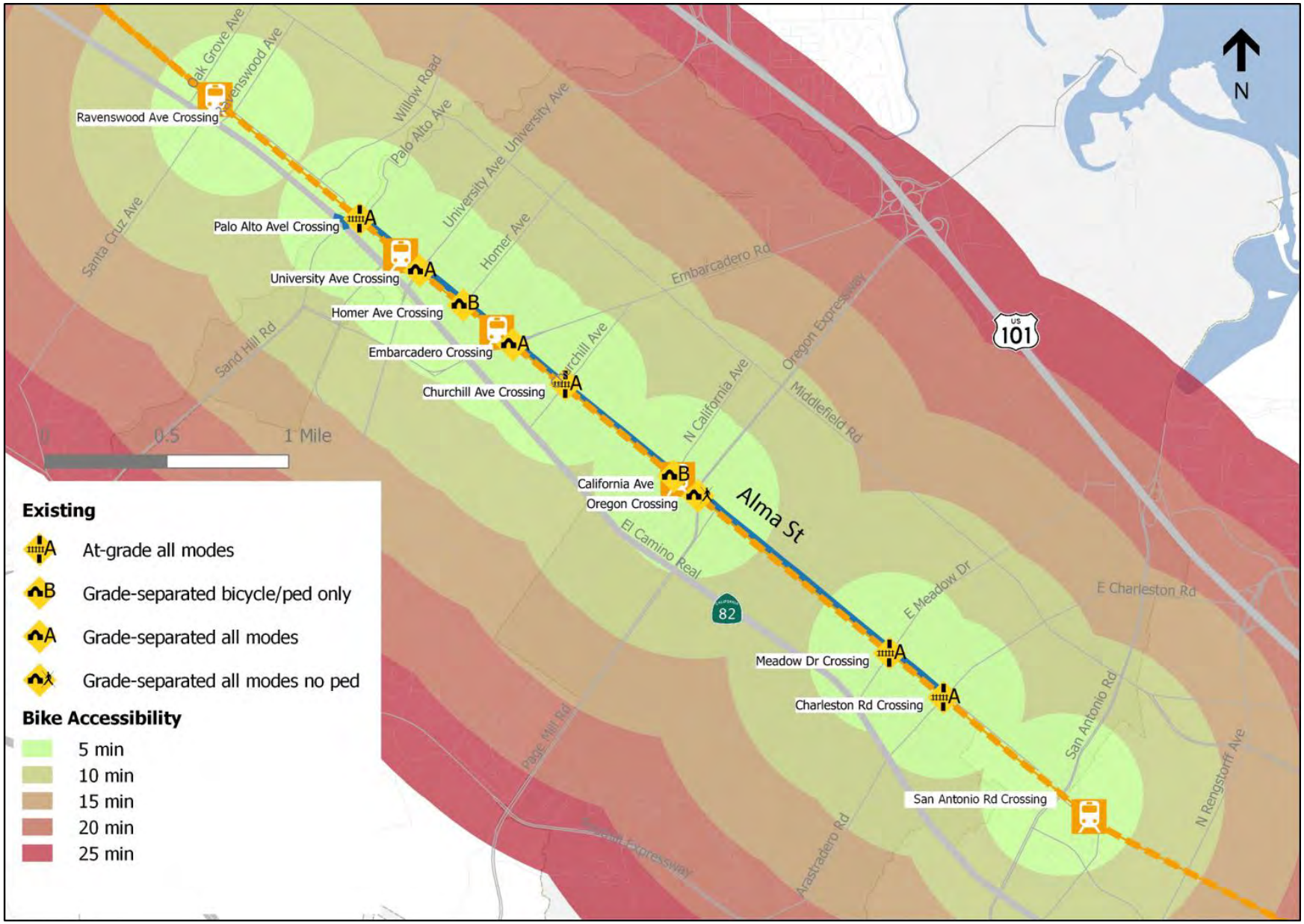


Figure 6.1 Bicycle Accessibility Map: Existing Conditions

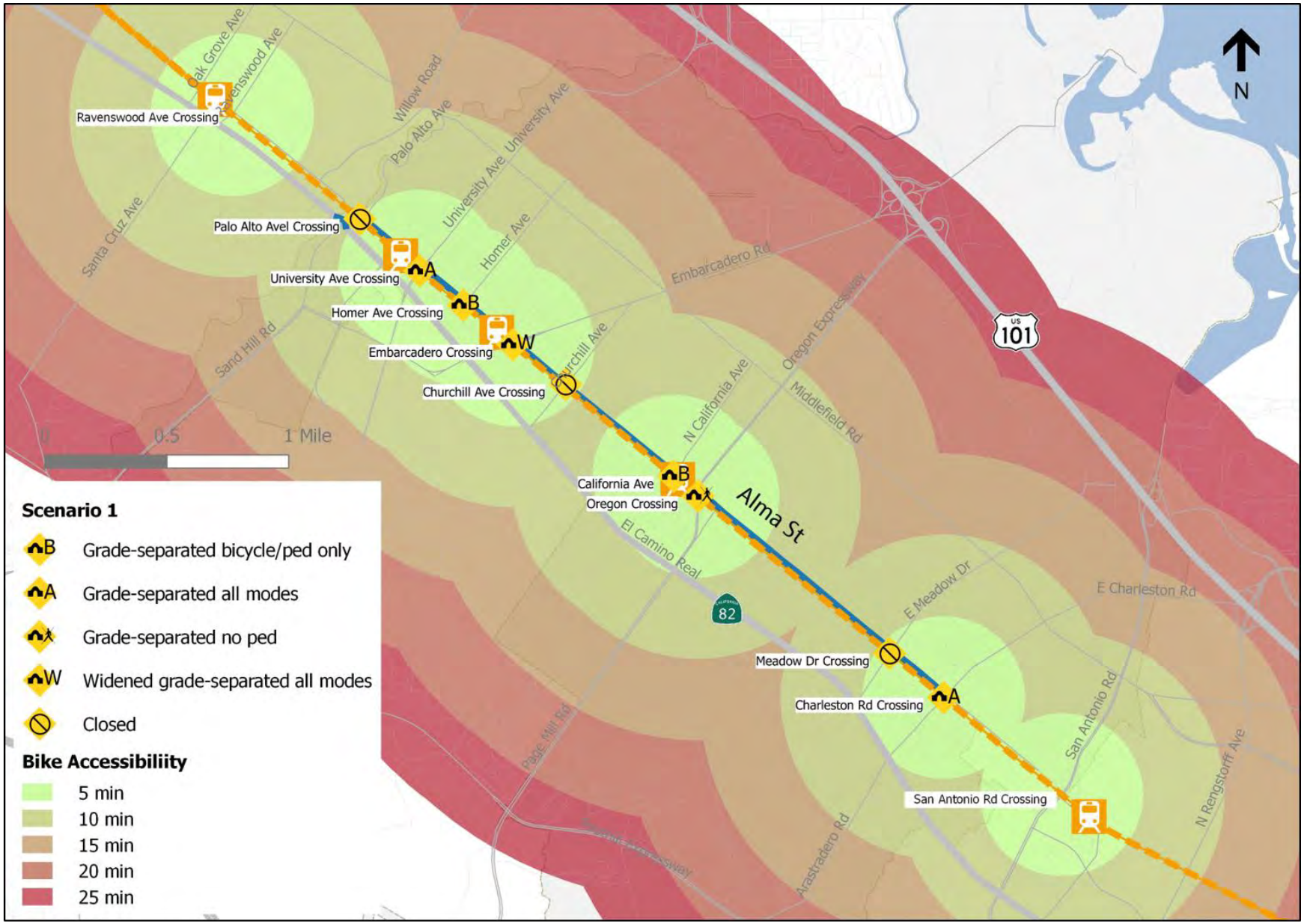


Figure 6.2 Bicycle Accessibility Map: Sample Scenario 1

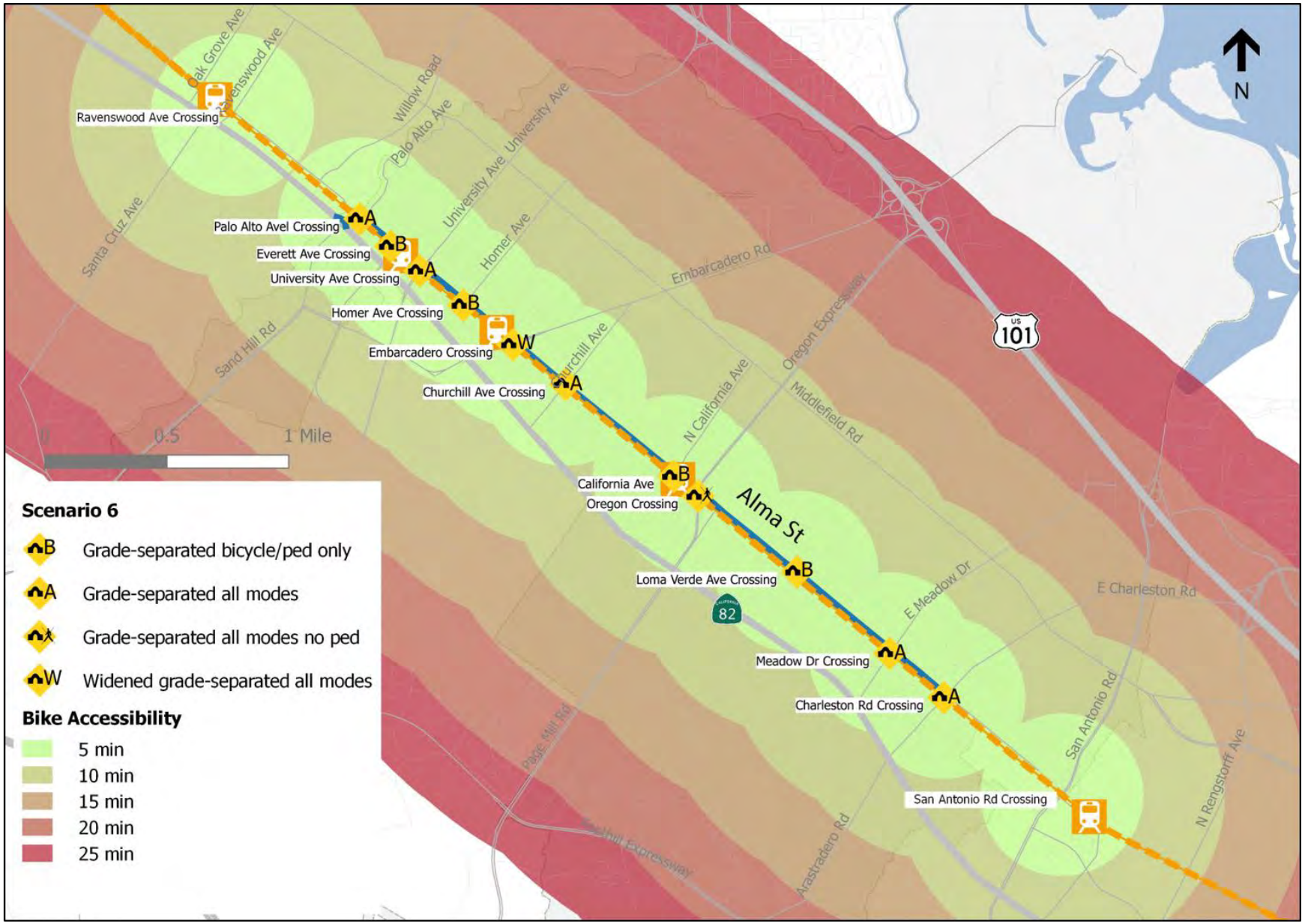


Figure 6.3 Bicycle Accessibility Map: Sample Scenario 6

7. Road Safety

7.1 The Existing Conditions Report, the accident data showed the following in Table 7.

Table 7: Study Area Intersection Roadway Accident Data 2011-2015

Item \ Location	Alma St & Palo Alto Ave	Alma St & Churchill Ave	Alma St & Meadow Dr	Alma St & Charleston Rd
Total Collisions	6	30	25	27
Injury Collisions	1	10	11	10
Fatal Collisions	0	0	0	1

Source: SWITRS data provided by City of Palo Alto, 2017

Churchill Ave, Meadow Dr and Charleston Rd all have around the same level of total collisions and injury-related collisions, with one (1) fatality at Charleston Rd. Any new construction to the latest standards, particularly a grade separation or closure, is likely to reduce the potential for accidents.

8. Summary and Conclusions

8.1 The Traffic Circulation Study tests were carried out with the City's Travel Demand Model for examining the impacts of traffic growth and any traffic diversionary effects from the different layouts and combinations of grade separations. Although the number of permutations and combinations of different forms of treatment to the Caltrain crossings are potentially very high, the six (6) representative tests carried out have provided a reasonable picture of what is likely to happen under the most foreseeable/practical scenarios.

8.2 Six (6) sample scenarios were tested that ranged from a very restricted accessibility specification to one with a very high level of accessibility across the Caltrain tracks.

8.3 Total growth in traffic across the Caltrain track crossing from now (2017) to 2030 is forecast to be around 15% under "No Build" condition.

8.4 Under a "No Build Scenario 2" condition (i.e., with the expected maximum of 20 trains per hour during peak periods), the increased delays at the at-grade crossings would cause traffic to divert to the currently grade-separated crossings; particularly Oregon Expressway and San Antonio Rd. The conditions on both of these routes is likely to be worse than LOS D.

8.5 For a situation with the higher level of restricted access (Sample Scenario 1), the test assumed closure of the Palo Alto Ave; Churchill Ave and Meadow Dr at-grade crossings. Charleston Rd was assumed grade separated. For this scenario, the overall 2030 traffic volumes across the Caltrain track within the City would reduce to levels that exist today and the 'growth' would be diverted out of the City.

8.6 Sample Scenarios 1 and 2 would seriously reduce bicycle and pedestrian accessibility across the Caltrain track and, therefore, active transportation

mobility in general, unless newly constructed crossings were provided in the same or close-by locations.

8.7 For the scenarios with a number of grade separations replacing currently at-grade crossings, the total 2030 traffic across the Caltrain tracks could grow by more than 20% from today. This means some traffic is diverted in from outside the City compared to a "No Build" conditions.

8.8 In all cases, currently at-grade crossings, if they were to be grade separated, would attract traffic from the existing grade-separated crossings. Charleston Rd and Meadow Dr are likely to attract over 50% increases relative to the No Build Scenario 2 with Palo Alto Ave over 30%. Much of the additional traffic would be diverted from the currently grade-separated crossings. This is likely to improve the LOS on all the existing grade-separated crossings.

8.9 The model shows that the traffic that diverts to be the longer distance traffic, whereby decisions by drivers on changes in routing are made outside the City.

8.10 The more detailed examination of the individual intersection traffic operations shows that under the forecast "No Build Scenario 2" conditions, the intersection at the rail crossings would be operating at Level-of-Service F on an overall basis and could incur at least twice the delay experienced today.

8.11 For Caltrain crossing routes within the City that are assumed to remain at-grade, the traffic flow volumes are forecast to experience little change from 2017, and any additional traffic due to growth diverts to those crossings where there are grade separations. Such grade separations may be the existing ones or newly constructed ones. Thus, the traffic operational conditions for the routes that remain at-grade remain similar to today when a gate-closure does not interfere with the signal phasing. However, for the signal phases where a gate closure does impose on the phasing conditions, the motor vehicle level-of-service drops to F. In 2030 with full Caltrain modernization and high-speed rail train pre-emptions, this would occur a substantial number of times during the peak periods.

8.12 For the Caltrain crossing routes within the City that are assumed to be upgraded from at-grade to grade separated, the traffic volumes are likely to increase substantially. This could cause the level-of-service of the individual intersections on the crossing routes, close to the track, to deteriorate.

8.13 Any complete all-mode closures on the crossing routes will cause substantial reduction in mobility to bicyclists and pedestrians unless either an existing grade-separated crossing is close by or a new one is constructed.

8.14 In the period from 2011 to 2015, a total of 88 accident collisions were recorded, of which 32 involved injury and one (1) a fatality. New construction, either grade separations or closures, are likely to reduce this substantially.

Attachment A-9

Evaluation of Microsimulation Software Analysis Packages for Intersections near Railroad Grade Crossings

2015 ITE Western District Annual Meeting

Tuesday, July 21, 2015

Ian Barnes, PE

Fehr & Peers – Walnut Creek, CA

i.barnes@fehrandpeers.com

FEHR & PEERS

Improving Communities Since 1985

Las Vegas 2015 WESTERN DISTRICT MEETING ite

Session Overview

- Background
- Grade crossing challenges
- Software evaluation
- Results comparison
- Conclusions

Background

Why did we perform this evaluation?

"…a true creator is necessity, which is the mother of our invention"

- Plato, *The Republic*

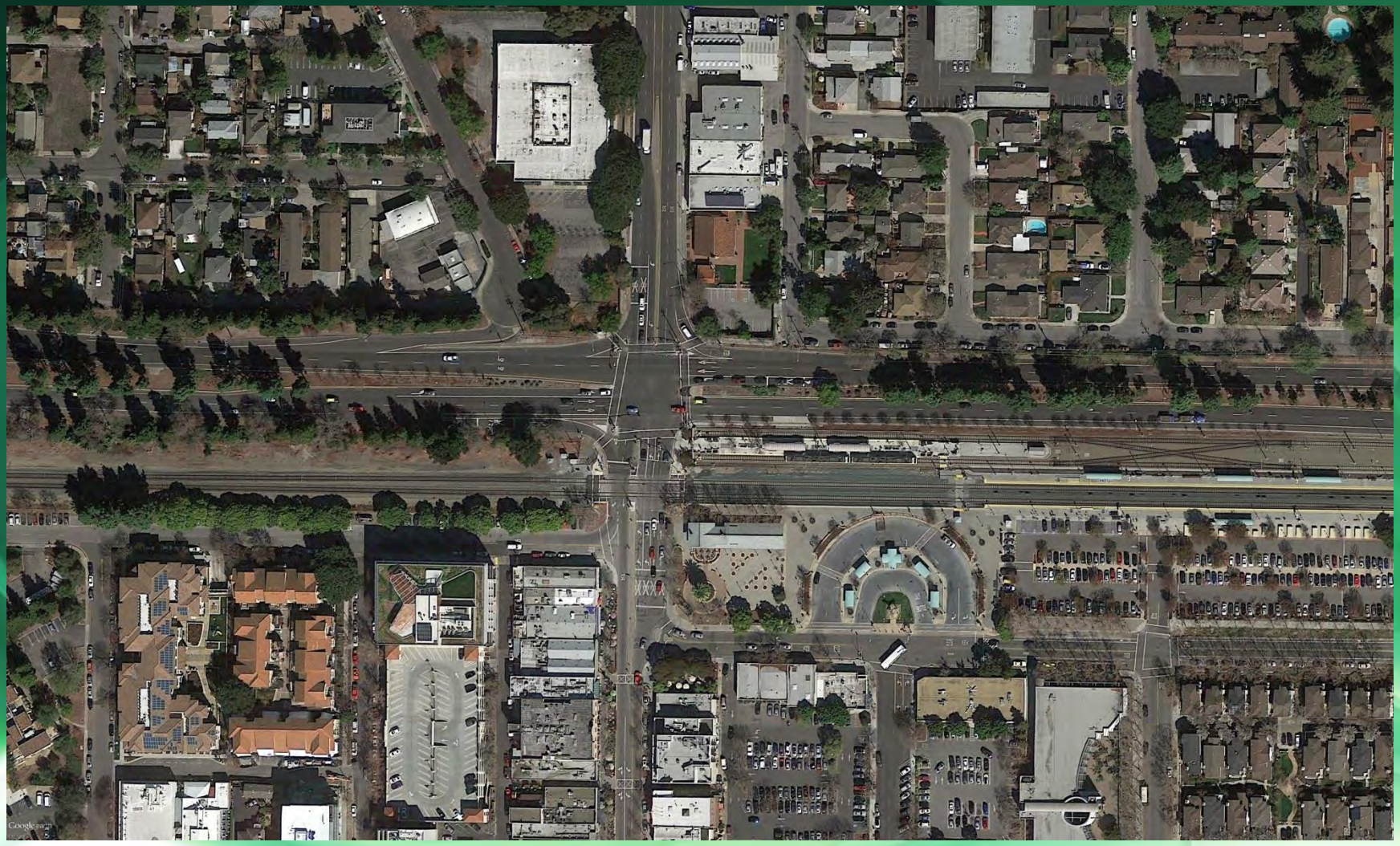
Background – Key Project

- Caltrain Peninsula Corridor Electrification
- Electrifying system from San Francisco to South San Jose (51 miles)
- More trains: 10 per hour to 12 per hour
- Gate down times projected to change

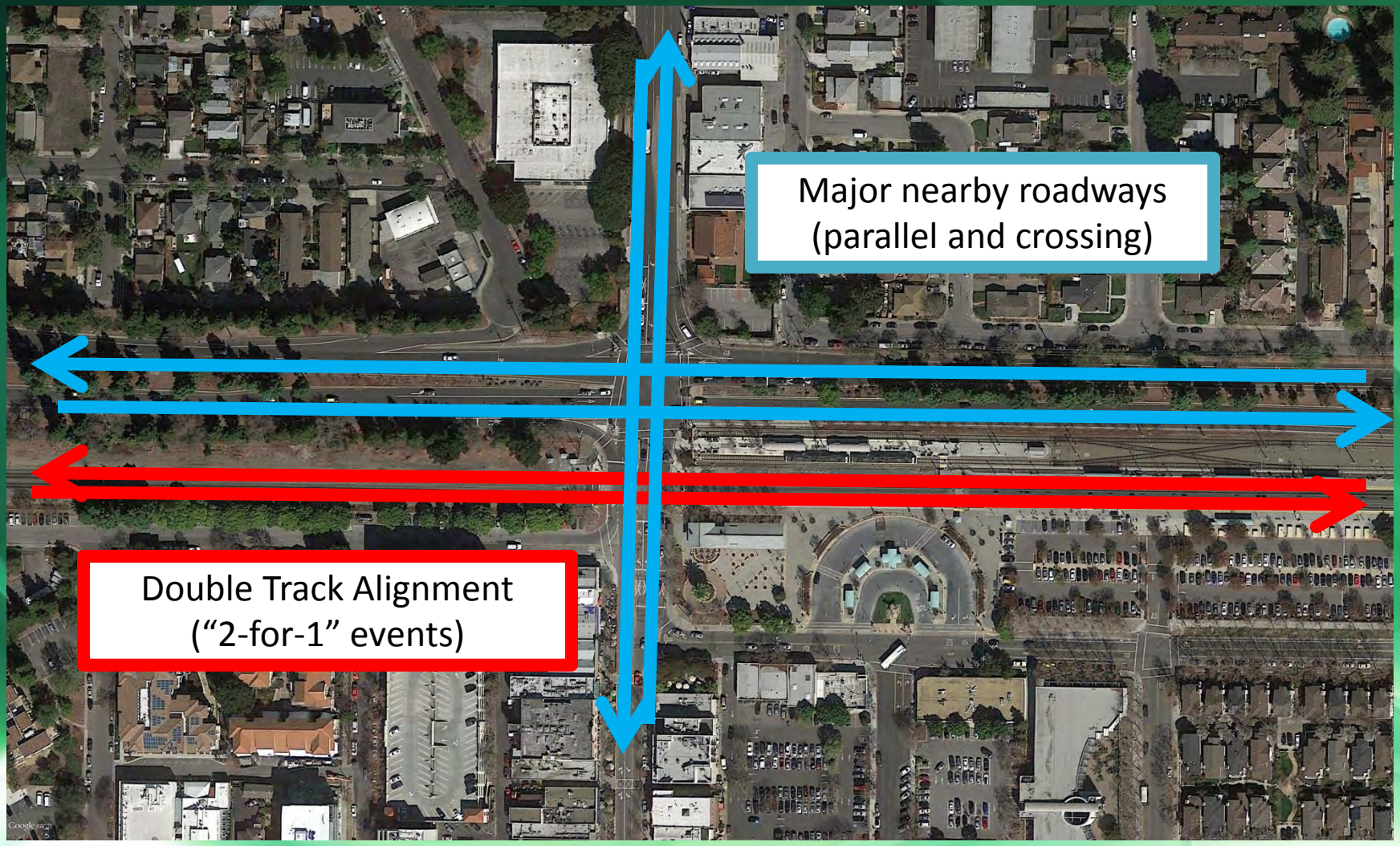
Background – Key Project

- CEQA-required transportation impact analysis
  - Bicycles
  - Pedestrians
  - Transit
  - Station parking
  - Emergency vehicle access
  - Intersections
- Analysis presented unique challenges

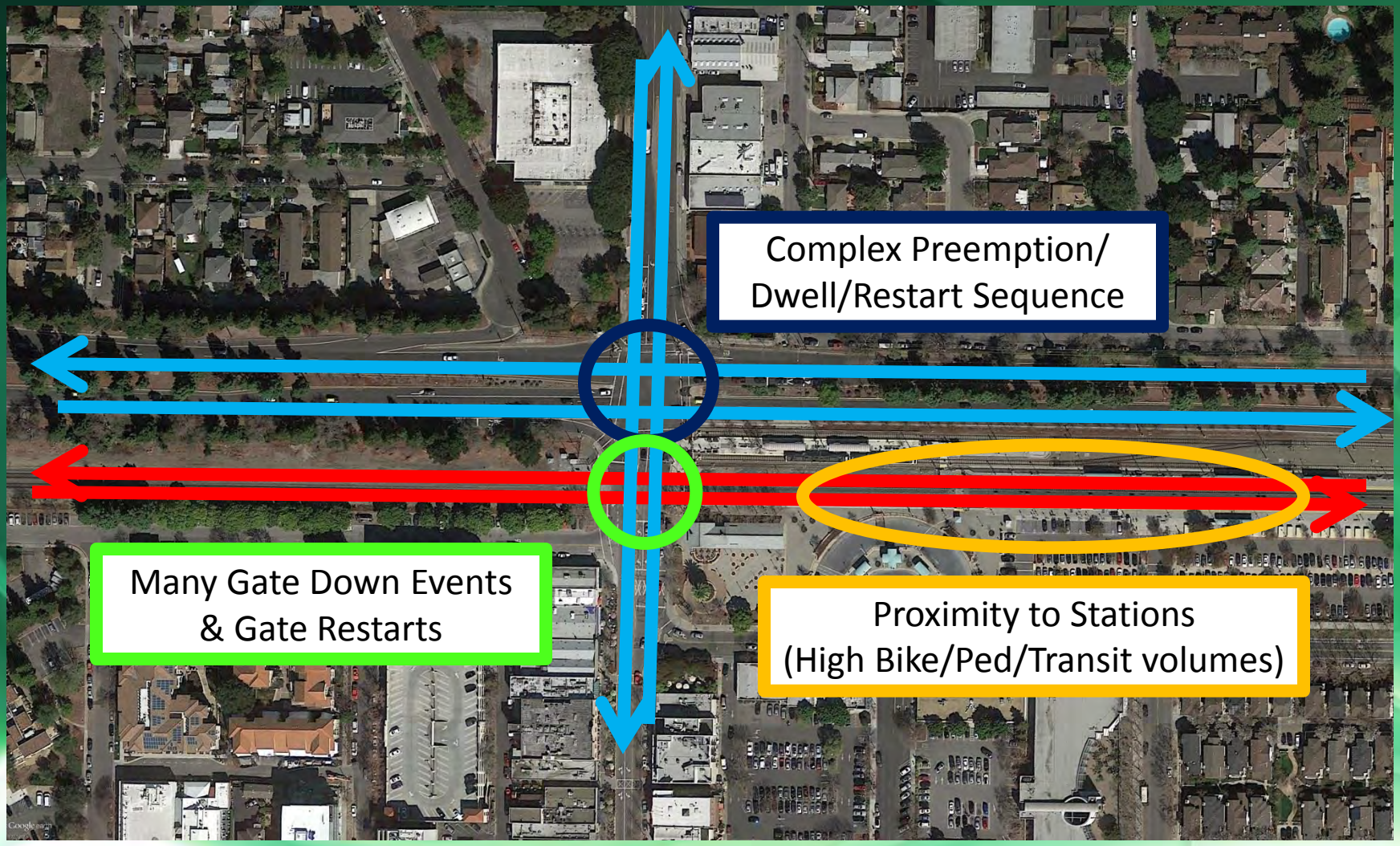
Grade Crossing Analysis Challenges



Grade Crossing Analysis Challenges



Grade Crossing Analysis Challenges



Grade Crossing Analysis Challenges

- Signal coordination on parallel corridors
- Special signal systems (Transit signal priority)
- High levels of existing congestion
- Small/large overall effect of grade crossing
- Many jurisdictions

Software Testing

- Fairly certain early on that simulation would be needed for project

- For completeness we looked at:
  - Traffix 8 (isolated HCM 2000)
  - Synchro (HCM)
  - SimTraffic
  - VISSIM

Synchro/SimTraffic

- Most commonly requested software package in San Francisco and San Mateo Counties
- More degrees of coding freedom
- Tested HCM and microsimulation

Synchro/SimTraffic

- Coding can get a bit messy

Synchro/SimTraffic - Pros

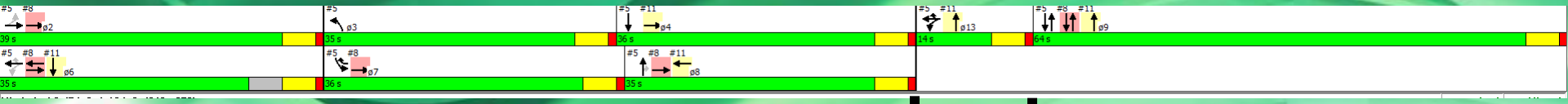
- Preemption sequence can be modeled (few drawbacks)
- Can program number of trains per hour
- Accounts for high pedestrian calls
- Model effects of coordinated signals
- Good for modeling signals without preemption

Synchro/SimTraffic - Pros

- Moderate level of effort required
- Signal optimization for future scenarios (few drawbacks)
- Randomness of model relieves some of the drawbacks
- SimTraffic worked well up to LOS D operations

Synchro/SimTraffic – Cons

- Preemption sequence requires clustering
- Preemption can only occur at a specified point in the ring-barrier system
- Restarting cycle after preemption can only occur at a specified point in ring barrier-system



Regular Operations | TC | Gate Down/Dwell

Synchro/SimTraffic - Cons

- Cannot schedule trains, only random arrivals
- Average gate down time per event only
- Cannot predictably model 2-for-1 events
- Need to remove preemption sequence if timings to be optimized to vehicle flows
- No bicycle interaction in models

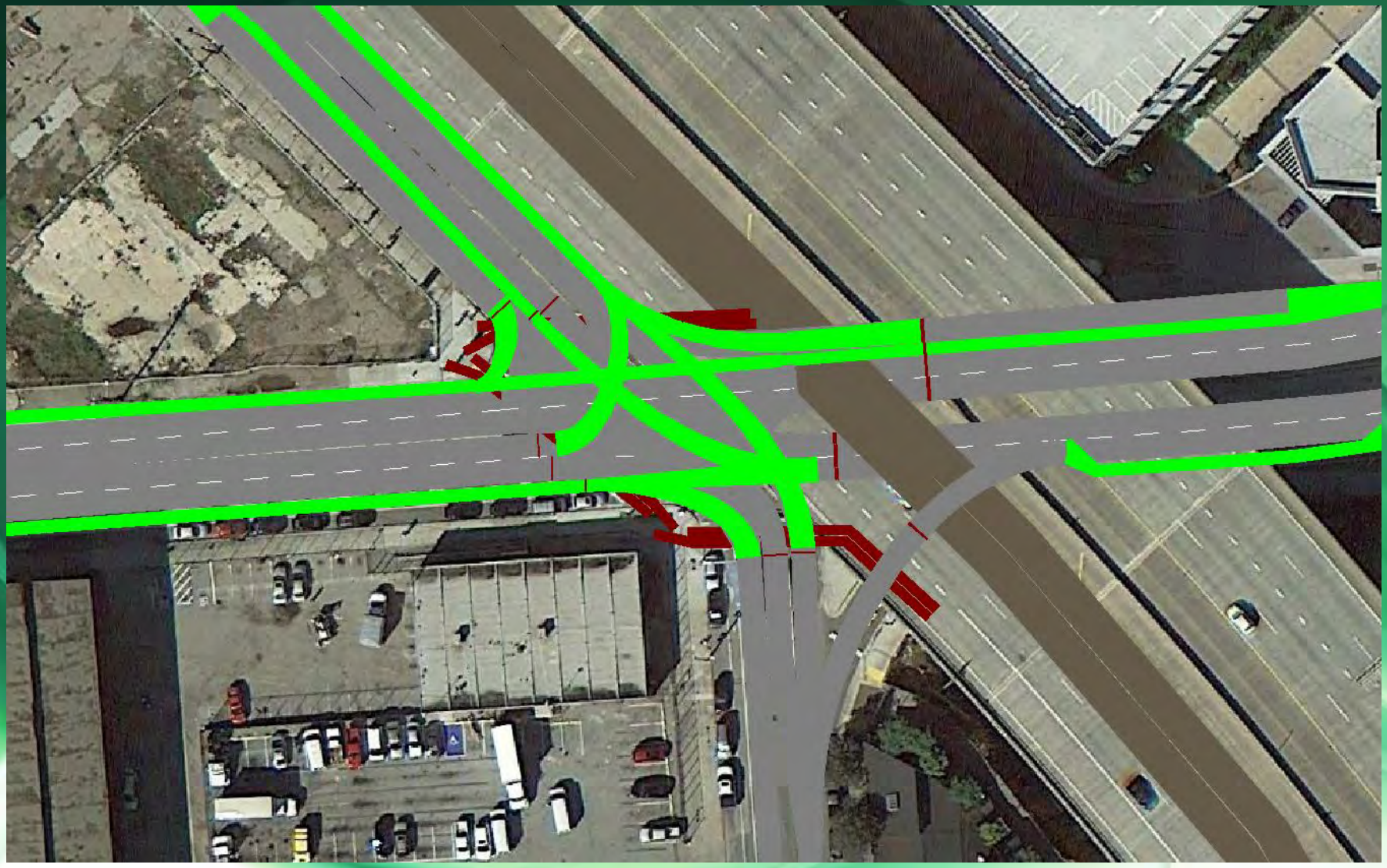
Synchro/SimTraffic – Conclusions

- SimTraffic may be appropriate when:
- Existing levels of congestion are low (LOS D)
- If grade crossing is far enough away from signal and no preemption cycle
- If 2-for-1 events do not significantly influence operations

VISSIM

- Greatest degree of coding freedom
- Caltrain study included very complex, congested intersections
- Precedent suggested that VISSIM would need to be used for some study intersections

VISSIM



VISSIM - Pros

- Properly handle all aspects of preemption
- Reflect existing and proposed train schedules in model
- Produce more accurate 2-for-1 events
- Can account for bike/ped/transit effects on intersection operations

VISSIM - Cons

- Takes a lot of effort to code and calibrate correctly
- Cannot optimize signal timings directly in program
- Model run time is longer than SimTraffic

VISSIM - Conclusions

- VISSIM may be appropriate when:
- High levels of existing congestion (LOS E-F)
- Complex intersection geometry or preemption events heavily influence operations
- Bikes/Peds/Transit affect operations
- Intersections near heavily used stations

SimTraffic/VISSIM Results Comparison

- Compared results between programs in urban (SF) and suburban (Palo Alto) settings
- Attempted to calibrate models using parameters provided in each program
- Calibrated to volumes and field observed conditions

SimTraffic/VISSIM Results Comparison

- Urban setting included:
  - Near SF 4th & King Station
  - One intersection on each side of grade crossing
  - Moderate levels of bikes and pedestrians

- Suburban setting included:
  - 1 mile between stations
  - Two intersections in parallel to tracks
  - Higher levels of existing congestion

SimTraffic/VISSIM Results Comparison

- Model run results after calibration efforts:

Intersection	SimTraffic Model		VISSIM Model	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
	Delay (LOS)	Delay (LOS)	Delay (LOS)	Delay (LOS)
San Francisco Intersections (Urban, intersections on each side)				
7th Street/ 16th Street	29.1 (C)	31.4 (C)	67.3 (E)	49.5 (D)
Owens Street/ 16th Street	40.2 (D)	24.2 (C)	10.6 (B)	10.7 (B)
Palo Alto Intersections (Suburban, intersections parallel)				
Alma Street/ Meadow Drive	51.3 (D)	71.1 (E)	72.6 (E)	62.0 (E)
Alma Street/ Charleston Road	64.9 (E)	100.9 (F)	63.5 (E)	80.5 (F)

SimTraffic/VISSIM Results Comparison

- VISSIM more closely replicated field observations at test locations, but required *significantly* more effort

Intersection	SimTraffic Model		VISSIM Model	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
	Delay (LOS)	Delay (LOS)	Delay (LOS)	Delay (LOS)
San Francisco Intersections (Urban, intersections on each side)				
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Alma Street/ Meadow Drive	51.3 (D)	71.1 (E)	72.6 (E)	62.0 (E)
Alma Street/ Charleston Road	64.9 (E)	100.9 (F)	63.5 (E)	80.5 (F)

Overall Conclusions

- Intersection analysis with grade crossings poses unique challenges

- Need to account for specific aspects of rail line operations
  - Effects of train crossing events
  - Scheduled service versus random arrivals
  - Existing intersection congestion levels
  - Influence of crossing events on operations

Overall Conclusions

Criteria	SimTraffic	VISSIM
Preemption	None/Simple	Complex
Preemption Effects	Low	High
Schedule Influence	Low	High
Bike/Ped/Transit Influence	Low	High
Existing Congestion	Low (LOS D)	High (LOS E-F)
Level of Effort Needed to Code/Calibrate	Medium	High
Choose an analysis package that fits the project's needs the best		

Special Thanks

Thank you for attending!

Attachment B

Start-ups

Stanford University
Office of Technology Licensing
2016 Annual Report

Stanford is the center for start-ups.

TRUTH **FICTION**

Fiction, of course. But there are many people who think we are “Start-up Central!”

We admit—Silicon Valley is bursting with start-ups. The region is teeming with risk-taking entrepreneurs, savvy investors, experienced managers and eager service providers. Most of those new companies are totally unconnected to Stanford. Others are connected to Stanford through students, faculty or alumni who start companies without using Stanford intellectual property. Stanford’s Office of Technology Licensing (OTL) is only involved when the company’s Stanford connection includes intellectual property that is licensed from the University—a relatively small number of companies that nonetheless have made a big impact.

Stanford’s entrepreneurial spirit is in our DNA, dating back to the founders.

Governor Leland Stanford was a risk-taking entrepreneur who came out West during the Gold Rush and made his fortune. In 1884, Leland Stanford and his wife, Jane, decided to start a university in the memory of their son who died of typhoid fever when he was 15. They made some untraditional choices: the university would be coeducational in a time when most were all-male and it would be non-denominational when most were associated with a religious organization. They were also untraditionally practical. The University’s Founding Grant specifically stated that the object of their University would be “to qualify its students for personal success, and direct usefulness in life.”

Fast forward to the 1950s. Stanford Provost Frederick Terman encouraged his students such as David Hewlett, William Packard and the Varian brothers to form companies, which they did. Provost Terman also created the first university-owned industrial park, Stanford Research Park, which played a key role in creating Silicon Valley.

Many people can remember the early 1980s, when companies such as Sun Microsystems, Silicon Graphics, Cisco, MIPS and many more arose from work that began at Stanford. In the 1990s Google, Yahoo, VMWare and others were all started by Stanford people or based on Stanford technology.

In this century, Stanford is more entrepreneurial than ever, from the President down to the undergraduate students. President Marc Tessier-Lavigne founded two start-ups and spent many years at a biotechnology company. Stanford’s former President John Hennessy took a leave of absence during his academic career to form a start-up. Other senior leaders at Stanford have worked very closely with both start-ups and well-established companies. If faculty can separate their academic responsibilities from their work with companies, then Stanford believes they can be both world-renowned academics and successful entrepreneurs.

It goes without saying that today students are often attracted to Stanford because of its entrepreneurial culture, from the courses taught, to the access to mentors, to

1975—
FIRST LICENSED START-UP
Collagen Corp.

325
LICENSES WITH EQUITY
FROM 1970–2016

the networking organizations and clubs. One outgrowth of this entrepreneurial culture was StartX, which began in 2009 as a student-run program to find more ways to engage the alumni community with early-stage founders or students. Today, it is a thriving non-profit that has helped develop and grow over 450 companies.

Visitors from all over the country and the world come to Stanford to find the secret of Stanford's entrepreneurial culture.

The secret, of course, is that there is no secret. It's a mindset. It's an approach. It's the Stanford culture.

As many people have observed about Stanford, "it's ok to experiment" —and to fail. It's also ok to be successful, wildly successful.

Although the entrepreneurial spirit has always been at Stanford, many people may be surprised to know that the University had mixed feelings about the licensing of start-ups in the early years of OTL.

In the 1970s, there weren't many start-ups. Furthermore, decisions about licensing to them were made on a case-by-case basis. As universities around the country began to develop policies and practices around licensing in the 1980s, interest in licensing began to grow. Stanford policy required that OTL grant only nonexclusive licenses to faculty-associated start-ups due to concerns about the potential conflict of interest associated with "going into business with faculty." However, in 1994, following faculty debate and consensus, Stanford modified its patent policy and its conflict of interest policy. This cleared the path for OTL to grant exclusive licenses to faculty-associated start-ups and take equity, subject to appropriate conflict of interest review. Stanford has found that this policy strikes the right balance of protecting research integrity while enabling entrepreneurial activity. It has enabled OTL to license hundreds of start-up companies, while generating over $400M from equity to support research and teaching at the University. (For more information about Stanford policies and practices with respect to start-ups, see otl.stanford.edu/documents/OTLstartupguide.pdf.)

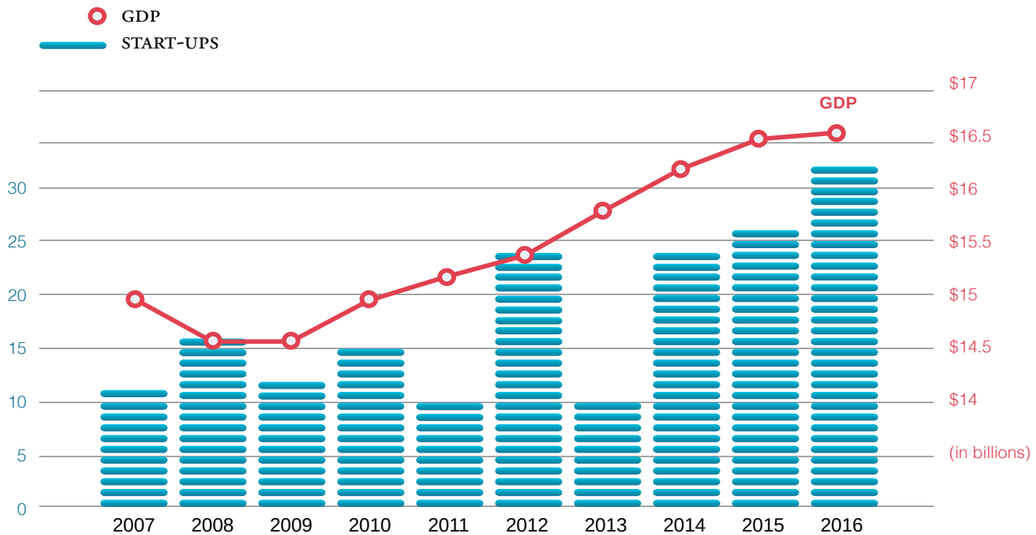
Since the 1990s, OTL has licensed many start-ups which were founded on intellectual property owned by Stanford under its patent, copyright and tangible research property policies (stanford.io/rph). Unlike many other technology transfer offices, OTL has never had the mandate to "create" new companies. Because of the Silicon Valley ecosystem and Stanford's entrepreneurial culture, OTL has had the luxury of enabling them. OTL's first license agreement to a start-up was in 1975 to Collagen Corporation, which eventually went public. Since then, OTL has licensed over 325 start-up companies, some of which were successful and many of which were not.

In the big picture scheme of Silicon Valley, Stanford start-ups are only a drop in the bucket. And within OTL, start-up licenses are only a fraction of the licenses signed every year. For many years, only about 10% of new licenses per year were to start-up companies. However, in the last few years, OTL doubled the number of licenses to start-ups per year, and granted more "options to license" to hopeful entrepreneurs. This Annual Report is focused on that special group of start-ups who have licensed technology from Stanford. The information provided herein is based on licenses between FY 2007–2016.

CALIFORNIA* START-UPS
VS STANFORD OTL START-UPS
FY 2007–2016

Seed and Angel Equity Funding investments in California from 9/1/07–8/31/16 per PrivCo

STANFORD OTL START-UPS (BY FISCAL YEAR) VS. GDP (BY CALENDAR YEAR)



The trend for the number of Stanford OTL start-ups is similar to the U.S. GDP which may indicate that OTL's start-up activity reflects the overall economic health of the country and the entrepreneur's ability to raise funding.

Fiscal Years 2007–2016

PERCENT OF LICENSES TO START-UPS

PERCENT OF START-UPS WITH FEMALE INVENTORS

PERCENT OF LICENSES TO START-UPS THAT BEGAN WITH AN OPTION AGREEMENT

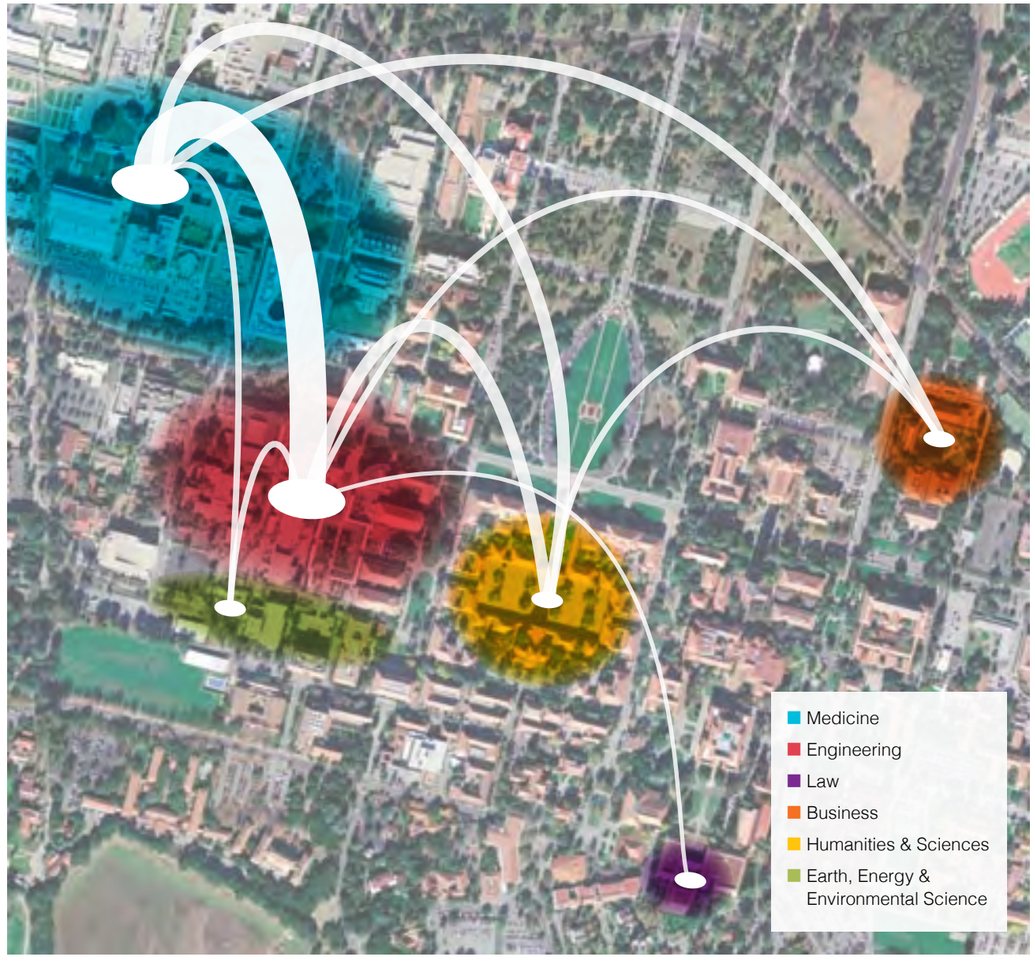
PERCENT OF START-UPS THAT LICENSED A COPYRIGHTED WORK

For the most part, the more early-stage investors (including friends and family, "angels" or venture capital funds) that are available, the more start-ups that spin out of Stanford. In some years, the investment community is more interested in investing in physical science start-ups (e.g., software, energy, self-driving cars) and other years, investors are interested in medical device, therapeutic or diagnostic companies. Investors are also interested in physical science inventions that are applied to biomedical applications, such as gene sequencing instruments, optogenetics hardware or consumer health monitoring apps.

Stanford has seven Schools: School of Medicine, School of Engineering, School of Humanities and Sciences, School of Earth, Energy & Environmental Sciences, Graduate School of Education, the School of Law and the Graduate School of Business. Stanford also has a tradition of several interdisciplinary programs through the Independent Laboratories, Centers and Institutes, which are an additional source of inventions. It is possible to separate start-ups by the School where the underlying technology originated, which indicates the type of inventions that form the basis of start-ups. The inventions from the School of Medicine and the School of Engineering are Stanford's chief source of start-up technologies. Nonetheless, twenty-two percent of start-ups in the past 10 years involve Schools other than Medicine and Engineering.

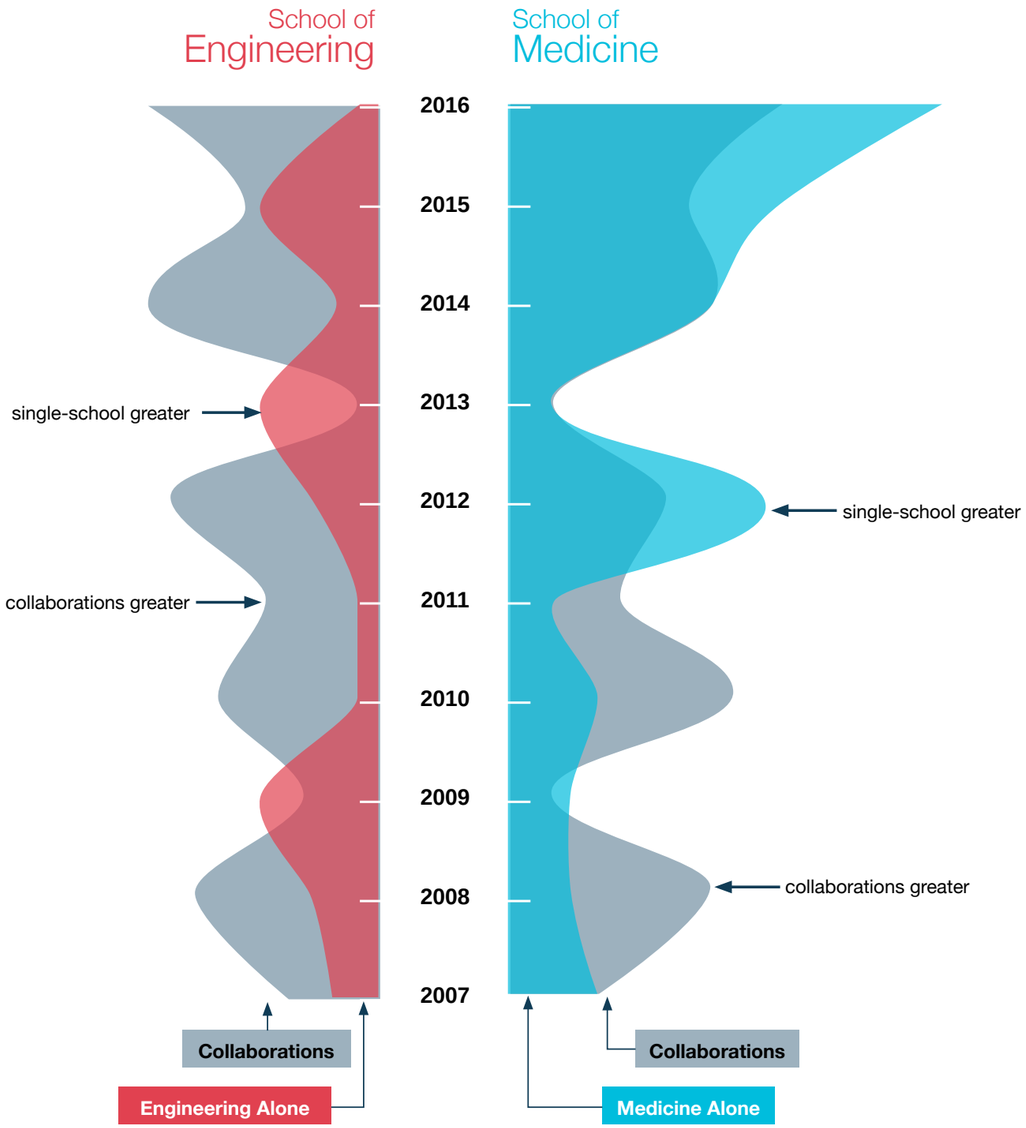
Although the University is organized by Schools and Independent Laboratories, the innovation on campus is not constrained by those administrative boundaries. Stanford has been at the forefront of interdisciplinary research and education for many years, with the Clark Center becoming a focal point in 2003. As a result, OTL has seen a steady increase in interdisciplinary inventions because researchers from the different Schools are interacting on a daily basis.

In addition to the Schools of the inventors, the technology areas of Stanford start-ups can be viewed by the nature of the inventions with broad labels for Biological Science, Physical Science or Medical Device. Some inventions are easy to categorize — a cell therapy for cancer falls under Biological Science; a battery technology falls under Physical Science; and a catheter falls under Medical Device. Many of the technologies are not as clear cut — an instrument for cancer diagnostics; an organism engineered for biofuel production; or a wireless charging system for a pacemaker — all fall into an interdisciplinary gray zone that makes the criteria relatively loose. Over time, the number and variety of these interdisciplinary inventions has grown. Nonetheless, these labels provide another view of the range of innovations being developed by start-ups.



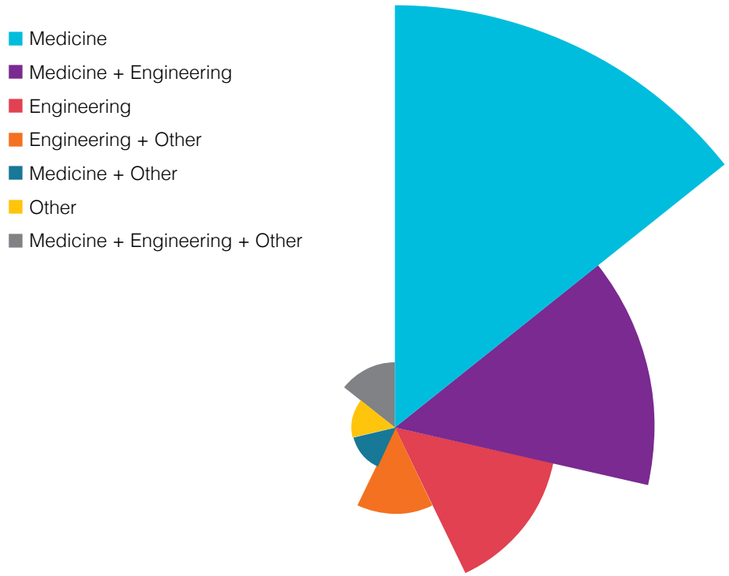
All of the Schools at Stanford are located on a single campus, unlike other large research universities which often have a separate medical campus. This physical proximity promotes innovation by making it easier to collaborate with colleagues in different fields, which is reflected in the variety of start-ups that OTL licenses. Inventions from the School of Medicine (blue) and the School of Engineering (red) make up the greatest share of start-up licenses. Nonetheless, Stanford's strength in interdisciplinary research has resulted in start-ups emanating from collaborations involving the Schools of Law (purple), Business (orange), Humanities & Sciences (yellow) and Earth, Energy & Environmental Sciences (green).

STANFORD OTL START-UP COLLABORATIONS 2007–2016

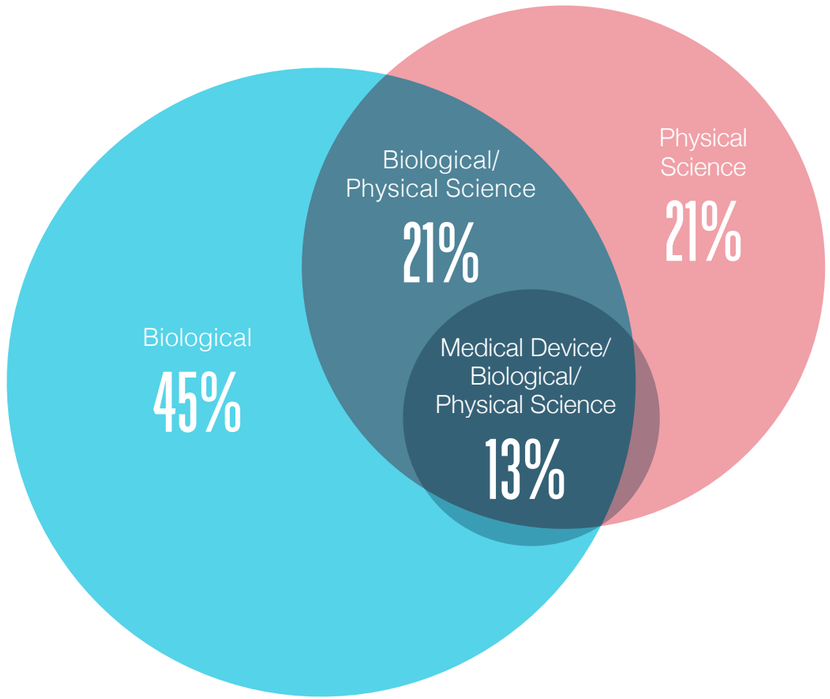


In the past ten years, the total number of start-ups licensed by OTL has grown. In that time, the School of Engineering has had more start-ups emanating from collaborations with other Schools than those based solely from Engineering. On the other hand, for the School of Medicine, the percentage of start-ups based on interdisciplinary research has decreased over time. In general, many of the interdisciplinary technologies are physical science inventions, often a platform that can be used for a life science application.

STANFORD OTL START-UPS BY SCHOOL 2007–2016



STANFORD OTL START-UPS BY INVENTION TYPE 2007–2016



START-UP SAMPLER

4C AIR

4C Air, Inc. licensed a high efficiency air filter technology developed in Professor Yi Cui's laboratory. The company is developing materials and solutions that could be used in both consumer products such as personal masks, indoor air purifiers or window screens, and in industry applications for clean rooms, hospitals, food processing equipment or exhaust systems. 4C Air's products have higher efficiency and significantly lower air resistance than the products currently on the market.

AB SYSTEMS

AB Systems is aiming to commercialize low-cost rechargeable aluminum battery technology originating from research in Professor Hongjie Dai's laboratory. The battery is made from abundant and environmentally-friendly raw materials and has superior advantages, such as: ultra-long lifetime, ultra-low cost and advanced safety. AB Systems plans to apply the innovative battery in different markets, such as grid storage, home energy storage and transportation.

BLUEPRINT GENETICS

Blueprint Genetics is changing diagnostics by providing accessible and actionable genetic testing for rare inherited diseases to all medical specialties. Based on an invention by Professor Hanlee Ji, Dr. Jason Buenrostro and Dr. Samuel Myllykangas, Blueprint has commercialized the OS-Seq technology to deliver fast, affordable and comprehensive genetic diagnostics services. Blueprint has built a genetic testing portfolio addressing >2,400 inherited disorders. They are growing quickly and, in just three years, they have processed close to 10,000 patient samples obtained from more than 500 physicians in 25 countries.

CERIBELL

Based on an invention from Music Professor Chris Chafe and Neurology Professor Josef Parvizi, Ceribell is developing a wearable seizure detection device that offers the first instant EEG recording and interpretation. This device will enable patients suffering from recurrent seizures to detect the onset of a seizure. The company has proprietary hardware and software products to acquire and convert brain signals into sound, which will allow physicians to hear changes in brain activity and make instant diagnoses.

DIGISIGHT TECHNOLOGIES

DigiSight Technologies, Inc., is a digital health company developing a mobile ophthalmic camera, Paxos Scope. The camera is designed so health care professionals can quickly capture images of the eye and retina at the point of care with their mobile device. Invented by a team of Stanford scientists led by Dr. Robert Chang, Paxos Scope has a secure image sharing and messaging feature to communicate with colleagues and coordinate care in real-time.

EPINOMICS

If the genome is the hardware of our bodies, then the epigenome may be considered the software component, since it regulates which genes are turned on and off. The epigenome may hold the key to personalized medicine because it dynamically responds to the environment and reflects an individual's state of health at any given moment. In 2012, Professors William Greenleaf and Howard Chang and their colleagues at Stanford University invented "ATAC-seq" (Assay for Transposase-Accessible Chromatin with high throughput sequencing), a breakthrough technology that can decode the epigenome. Licensed to Epinomics, the ATAC-seq and analytics platform can be used for discovering biomarkers that can be used in clinical research and advancing immuno-oncology applications.

GLOBAVIR

Globavir Biosciences, Inc. is a private biotechnology company that is developing multiple technologies licensed from Stanford. Professor Benjamin Pinsky and Dr. Jesse Waggoner invented a molecular diagnostic platform useful for detecting and differentiating Dengue virus infection in humans. This technology became the basis for Globavir's PanGlob® and DenGlob® diagnostic products. Globavir has received CE IVD regulatory approval for distribution and use in Europe and India. The company has also partnered PanGlob® with Bio-Rad as part of a multiplex test that will be launched globally in 2017.

Globavir also licensed GBV006 from Stanford. GBV006 is a combination of two FDA-approved drugs for the treatment of certain viral infections, most notably Dengue and Ebola virus. Invented by Professor Shirit Einav and her colleagues, Globavir is currently working with potential partners to start Phase Ib/IIa clinical trials in South East Asia in 2017 with the FDA and EMEA. Globavir emerged from the Stanford-StartX accelerator program, and has completed three rounds of private financing.

HEISEN RESEARCH

Heisen Research, LLC is developing a revolutionary method to validate and verify computer systems and chips based on error detection inventions from Professors Deming Chen's and Subhasish Mitra's laboratories. The technology reduces bug trace length by 1 million times, enabling a process that is ultimately 100 times faster and much more cost effective than the current state-of-the-art techniques used in industry. This detection system could provide a range of companies — from automotive manufacturers to search companies to semiconductor design houses — with a faster validation process that makes development more efficient and frees up engineering staff to take on even more complex projects.

IRHYTHM TECHNOLOGIES

As a specialist in heart rhythm problems, Dr. Uday Kumar always thought there had to be a better way to monitor patients suspected of having abnormal heart rhythms when they were outside of the clinic, going about their usual activities. Traditionally, patients were given a large cassette player-sized device which they attached to their bodies via electrodes in order to capture and record their heart rhythm throughout the day and night.

When he was a fellow in the Stanford Biodesign Program in 2005-06, Kumar (now a Consulting Associate Professor of Bioengineering) set his sights on finding a more cost-effective, user-friendly solution. He founded iRhythm Technologies, Inc. in 2006 to develop and commercialize his invention, which was the basis for the ZIO Patch®. The ZIO Patch® extended continuous ambulatory cardiac monitoring system has now been used by more than 500,000 patients. It is one of dozens of devices to emerge from the Biodesign Program's innovation process, which has become the international model for inventing new medical technologies. Based on the company's continued growth and adoption across the U.S., iRhythm Technologies, Inc. went public in October 2016.

LEX MACHINA

Professor Mark Lemley established the Intellectual Property Litigation Clearinghouse, (IPLC) at the Stanford Law School to examine intellectual property litigation. At the IPLC, he led the development of a system that could be used to analyze legal historical performance, to compute corresponding correlations between statistical variables and to calculate ongoing legal trends based on legal documents. In 2010, the IPLC spun out into a start-up, Lex Machina, Inc. and the tools created at Stanford were licensed to the company. Lex Machina further developed those technologies and was acquired by LexisNexis in 2015.

PROBIUSDX

ProbiusDx, Inc. is developing a broad spectrum, "embedded" point-of-care diagnostic solution based on an electronic sensing platform developed by Professors Roger Howe and Boris Murmann along with Chaitanya Gupta and Ross Walker. This portable device can analyze multiple target proteins in real time, enabling doctors to rapidly deliver appropriate therapy to patients in need of critical care within clinical settings. The company has plans to introduce the technology for blood-draw quality checks and for a broad screening panel in the emergency care setting before working toward a wider range of personalized diagnostics applications.

SELTEN PHARMA

In 2011, Professor Edda Spiekerkoetter and a team of Stanford researchers discovered that low doses of the drug FK506 activates a signaling pathway which is implicated in pulmonary arterial hypertension (PAH). PAH is a rare disease with a mean life expectancy of 2 to 5 years from the time of diagnosis if untreated. Patients diagnosed with PAH (mostly young women) have a poor prognosis, a compromised quality of life and no current treatment options to prevent the disease from progressing. Shortly after the clinical trials of FK506 for PAH began, Selten Pharma, LLC licensed the technology from Stanford. Selten developed a new, convenient formulation and then devised a second-generation compound. Selten Pharma was recently acquired by Vivus, Inc. to further the commercialization of FK506 for this indication.

ZENFLOW

In 2014, a Stanford Biodesign fellowship team created a novel minimally invasive treatment for the symptoms of benign prostatic hyperplasia (BPH or enlarged prostate). Excited by the prospect of developing a solution that could help hundreds of millions of men worldwide, inventors Nick Damiano and Shreya Mehta completed their fellowships and founded a company called Zenflow, Inc. The invention, licensed from Stanford, became the basis for the company's primary product called the Spring System. In early 2016, Zenflow began first-in-human clinical trials for this device in Europe and New Zealand.

FY 2016 YEAR IN REVIEW

STANFORD RECEIVED

$94.22M

IN GROSS ROYALTY REVENUE FROM

779

TECHNOLOGIES, WITH ROYALTIES RANGING FROM

$10.05

to

$62,000,000.

7/779

INVENTIONS GENERATED

$1M

OR MORE IN ROYALTIES, WHILE

731

INVENTIONS BROUGHT IN

<$100,000

IN ROYALTIES EACH. CUMULATIVELY, THIS LONG-TAIL CREATES A STEADY ROYALTY BASE FOR STANFORD.

WE FILED

289

PATENTS.

WE SIGNED

141

LICENSE AGREEMENTS.

32

LICENSES WERE TO COMPANIES DEFINED AS A "START-UP BASED PRIMARILY ON STANFORD TECHNOLOGY".

OF ONE HUNDRED FORTY ONE LICENSES SIGNED

54 WERE NONEXCLUSIVE | 48 WERE EXCLUSIVE | 39 WERE OPTION AGREEMENTS

ROYALTY DISTRIBUTION

STANFORD'S ROYALTY-SHARING POLICY PROVIDES FOR THE DISTRIBUTION OF CASH NET ROYALTIES (GROSS ROYALTIES LESS 15% FOR OTL'S ADMINISTRATIVE EXPENSES, MINUS DIRECT EXPENSES) TO INVENTORS, THEIR DEPARTMENTS AND THEIR SCHOOLS. IN ADDITION, THE UNIVERSITY ASSESSES AN INFRASTRUCTURE CHARGE ON THE DEPARTMENT AND SCHOOL SHARES OF ROYALTY INCOME. INVENTORS RECEIVED PERSONAL INCOME OF $24.0M, DEPARTMENTS RECEIVED $21.0M AND SCHOOLS RECEIVED $20.8M. OTL ALSO SHARED $840,000 WITH OTHER INSTITUTIONS BASED ON ARRANGEMENTS FOR HANDLING JOINT INVENTIONS ON BEHALF OF OTHER ORGANIZATIONS, OR UNDER AGREEMENTS WITH THE HOWARD HUGHES MEDICAL INSTITUTE (HHMI) OR THE DEPARTMENT OF VETERANS AFFAIRS (VA).

inventors **$24M**

departments **$21M**

schools **$20.8M**

EXPENSES

OUR OPERATING BUDGET FOR THE YEAR (NOT INCLUDING PATENT EXPENSES) WAS

$8.9M.

OTL SPENT

$10.2M

ON PATENT AND OTHER LEGAL EXPENSES, WITH

$6.9M

REIMBURSED BY LICENSEES.

WE TAKE A FINANCIAL RISK EACH TIME WE DECIDE TO FILE FOR A PATENT. IN THIS PERIOD OF TREMENDOUS CHANGE IN THE INTELLECTUAL PROPERTY LANDSCAPE AS COURT CASES DETERMINE NEW PATENT LAW, WE MUST WEIGH THE LIKELIHOOD OF LICENSING A TECHNOLOGY VERSUS THE EXPENSE OF PATENTING OR LITIGATION. WE ARE BEING MORE SELECTIVE IN OUR FILINGS NOW THAN IN THE PAST BECAUSE THE U.S. PATENT OFFICE IS REQUIRING MORE DATA TO SUPPORT THE INVENTION AND ISSUING FEWER BROAD PATENTS. THE PATENT LANDSCAPE IS NOT FAVORABLE TO PATENTEES THESE DAYS.

NEW DISCLOSURES

IN FY 2016, WE RECEIVED 472 NEW TECHNOLOGY DISCLOSURES. ABOUT 50% OF THE INVENTIONS WERE IN THE BIOLOGICAL SCIENCES, 40% WERE IN THE PHYSICAL SCIENCES AND 10% OF THE INVENTIONS WERE CONSIDERED TO BE BOTH.

STANFORD TRADEMARK ENFORCEMENT FUND (STEF)

AN ALLOCATION TO THE STANFORD TRADEMARK ENFORCEMENT FUND IS BEING USED TO PROTECT THE STANFORD NAME, ASSOCIATED LOGOS AND TRADEMARKS, AS WELL AS TO HELP FUND OTL. THIS FUNDING IS PROVIDED BY A SMALL PORTION OF THE DEPARTMENT AND SCHOOL ROYALTY SHARES.

EQUITY

AS OF AUGUST 31, 2016, STANFORD HELD EQUITY IN

149

COMPANIES AS A RESULT OF A LICENSE AGREEMENT.

IN FY 2016 WE RECEIVED

$3.96M

IN LIQUIDATED EQUITY FROM

THIRTEEN

COMPANIES.

FOR INSTITUTIONAL CONFLICT-OF-INTEREST REASONS AND INSIDER TRADING CONCERNS, THE STANFORD MANAGEMENT COMPANY SELLS OUR PUBLIC EQUITIES AS SOON AS STANFORD CAN LIQUIDATE RATHER THAN HOLDING EQUITY TO MAXIMIZE RETURN.

WE TOOK EQUITY IN 29 OF THE 32 START-UP COMPANIES WITH NEW LICENSES IN FY 2016.

WHAT'S NEW

CHALLENGES OF THE FUTURE

OTL is facing its first big revenue challenge in almost 20 years now that our biggest royalty-producing patent has expired. In those 20 years, the number of invention disclosures has increased from 200 to over 450 a year and OTL has grown from a staff of 20 to 44 as our active caseload has almost tripled and interest in intellectual property has heightened. It is clear that Stanford faculty are interested in both publishing their research results and filing patents on their promising discoveries. Students are also much more sophisticated in their understanding of and interest in patents and commercialization. The challenge is that the trend in patent law and court cases has been to weaken patents or, at a minimum, to make patents much more vulnerable to challenge. Thus, the likelihood of another big revenue winner is much more uncertain. Nonetheless, the University understands the importance of supporting innovation and technology transfer and is committed to ensuring that OTL has the resources to serve the Stanford community.

OTL is always thinking about how to improve its operations to be as efficient and effective as possible. To help with this goal, OTL has worked with different Graduate School of Business Alumni Consulting Teams (ACT) several times in the past to get an outside perspective on OTL. This year, the very strong ACT team of David Pritchard, Sam Pai and Deborah Byron provided us with excellent suggestions on how to move forward in this uncertain time. We continue to work with them and OTL staff to implement their recommendations.

NEW RESEARCH PROGRAMS

Stanford, like so many other universities, is embarking into an era where research funding involves new ways of handling intellectual property and licensing. For example, The Parker Institute for Cancer Immunotherapy at the School of Medicine and the Chan/Zuckerberg Initiative provide significant funding for Stanford researchers in collaboration with other institutions. These complex arrangements require deep thinking about how best to transfer inventions that result from extensive collaborative work among researchers. University technology transfer practice is evolving as the Government, industry, foundations and universities rethink and reevaluate how university discoveries can be moved into the marketplace faster and more effectively.

TECHNOLOGY DEVELOPMENT

As discussed earlier in this Annual Report, universities are increasingly asked to examine their role in facilitating technology development and maturation, entrepreneurial activity and start-up formation. In 2013, with former President Hennessy's financial support, the Stanford Innovation Program (SIP) started as an experiment to use University funding to further develop unlicensed inventions to become more licensable. Because the funds are not for "research" but for "development", the projects must have strong endorsement by OTL and active faculty involvement. They require milestone-driven benchmarks and quarterly in-person reporting. Now in its third year, SIP has funded 17 projects, with 7 of them to date resulting in a likely or actual license. Although SIP is not intended to help create start-ups, the likely licensees of SIP projects are often Stanford start-ups who are willing to take the risk on these early stage projects.

COPYRIGHT GUIDE

Copyright is an intellectual property right that is often misunderstood, particularly in the context of commercialization. In order to provide our researchers with information and guidance about copyright licensing issues, we developed a *Creator's Guide to Commercializing Copyrighted Work* which is available in hard copy and on the web (stanford.io/copyrightguide). We hope this will be a valuable resource for creators as they develop software and other copyrighted works which may be distributed or commercialized.

CHINA

OTL continues to explore how best to work with Chinese companies, particularly in markets that are unique to China. We understand that relationships and trust are important to successful collaborations and have made regular visits to China and Hong Kong to build that foundation. China is a market that cannot be ignored and, as their intellectual property system matures, Chinese patents may become important for licensing. For most universities, this is still uncharted territory but we believe it is important to develop good, long-term relationships in China as the opportunity arises.

KEEPING THE ENGINE RUNNING

In our ongoing effort to provide efficient service to Stanford inventors, we are very pleased to have updated our Standard Operating Procedures (SOPs) and the information on our new and improved internal wiki. We have also been continuously improving our robust and complex relational database and recently incorporated an intuitive web-based interface. Our database is the repository of all information for our inventions and we use it every day for everything. If the whole office staff suddenly disappeared, someone could recreate OTL by relying on the wiki, our database and our website!

CHANGING OF THE GUARD

OTL has only had two Directors in 47 years, which is remarkable in itself. After 25 years of leading OTL and 10 years managing technologies in the office before that, our Executive Director Katharine Ku has announced her plans to retire. Stanford has engaged a search firm to find OTL's third director and a search committee will be appointed by Vice Provost and Dean of Research Ann Arvin. Ku will continue to head the office until the new Executive Director takes the helm.

INDUSTRIAL CONTRACTS OFFICE

NEW INDUSTRY SPONSORED RESEARCH AGREEMENTS

IN FY 2016, ICO FINALIZED

169

NEW INDUSTRY SPONSORED RESEARCH AGREEMENTS (SRAS), WHERE COMPANIES FUND AND SOMETIMES COLLABORATE ON RESEARCH PROJECTS IN STANFORD LABORATORIES.

THE SCHOOL OF MEDICINE ACCOUNTED FOR JUST OVER HALF OF THESE SRAS, WITH

88

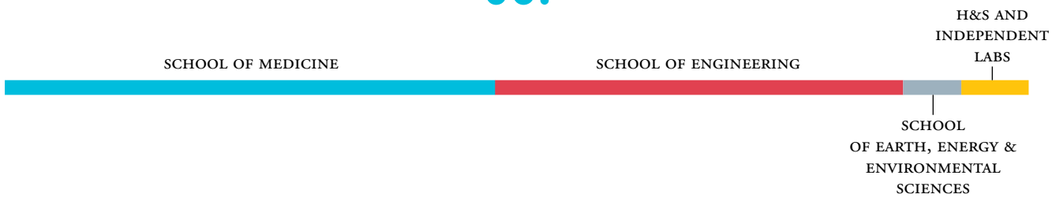
AGREEMENTS; THE SCHOOL OF ENGINEERING ACCOUNTED FOR JUST OVER A THIRD, WITH

60.

THE SCHOOL OF EARTH, ENERGY & ENVIRONMENTAL SCIENCES ACCOUNTED FOR ANOTHER

10

AGREEMENTS WITH THE REMAINDER FROM PROJECTS IN THE SCHOOL OF HUMANITIES & SCIENCES AND THE INDEPENDENT LABORATORIES.



MATERIAL TRANSFER AGREEMENTS

AS USUAL, MATERIAL TRANSFER AGREEMENTS (MTAS) CONTINUED TO ACCOUNT FOR THE LARGEST NUMBER OF ICO AGREEMENTS—WITH ABOUT

420

NEW MTAS FOR INCOMING MATERIALS AND

146

OUTGOING MTAS.

ANOTHER

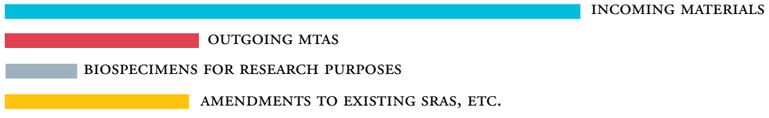
52

AGREEMENTS COVERED STANFORD INVESTIGATORS SENDING OUT BIOSPECIMENS FOR RESEARCH PURPOSES.

OTHER ICO AGREEMENTS INCLUDED MORE THAN

131

AMENDMENTS TO EXISTING SPONSORED RESEARCH AGREEMENTS, PLUS NEW COLLABORATIONS, DATA SHARING, EQUIPMENT LOANS, NON-DISCLOSURE AND OTHER RESEARCH-RELATED AGREEMENTS.



SCHOOL OF MEDICINE

During the year, ICO finalized a multi-year agreement for the "Baseline Study" with Baseline Study LLC, a company being formed by Alphabet's Verily Life Sciences LLC. The Baseline Study is a multi-cohort, long term, observational, epidemiological study to collect human data and samples for scientific and medical research. The goal is to understand human health and the transition to disease. Stanford and Duke University are participating. **Professor Sam Gambhir** (Radiology) is leading the work at Stanford.

Oncology professor Hanlee Ji received funding from Aduro Biotech, Inc. Dr. Ji's laboratory will use clinical genomics to identify immunogenic neoantigens in colorectal cancer in order to develop a precision vaccine for colorectal cancer.

SCHOOL OF ENGINEERING

Johnson and Johnson Vision Care, Inc. signed a master research agreement and funded three projects in **Professor Gerry Fuller's laboratory** (Chemical Engineering). The goal of these projects is to better understand the nature of tear film across contact lenses and the cornea.

Stanford has had a long and productive relationship with Siemens Medical Solutions, including two master research agreements and many research projects. In the past fiscal year, ICO put in place another master research agreement with Siemens – this time with their Corporate Technology Group. The projects funded under this master research agreement include:

- "Generation of Real-time Optimization-based Controllers on the Siemens Design Building Automation System" and "Optimal Controller Tuning Method for Power System Oscillation Damping" for **Professor Stephen Boyd** (Electrical Engineering) to develop more efficient optimization of systems.
- "Application of Reinforcement Learning to Self-Organizing Manufacturing Systems" for **Professor Tsachy Weissman** (Electrical Engineering) to develop an algorithm to reduce costs and boost productivity in self-organized manufacturing systems.
- "Optimal Operation of Water Supply Network via Distributed Optimization and Convex Relaxation" for **Professor Yinyu Ye** (Management Science and Engineering) to improve efficiency of water supply networks.

IN MEMORIAM

Sergey Marechek

Bernard A. Shoor

Office of Technology Licensing
3000 El Camino Real
Building 5, Suite 300
Palo Alto, CA 94306
650-725-0651
otl.stanford.edu

DESIGN: ARTEFACT DESIGN, INC.

Attachment C

Stanford Report, October 24, 2012

Study shows Stanford alumni create nearly $3 trillion in economic impact each year

A study by two Stanford professors determines that companies founded by the university's alumni generate trillions in annual revenue and have created 5.4 million jobs.

BY JAMIE BECKETT

Stanford Technology Ventures Program

Students take part in an interactive innovation exercise during Stanford Entrepreneurship Week.

Stanford University has long been known as one of the world's leading centers for innovation and a breeding ground for the entrepreneurs who created – and continue to shape – Silicon Valley. Now, for the first time, a study puts into perspective the sheer scale of the university's economic impact, not just in Silicon Valley and California but across the globe.

The study, released today, estimates that companies formed by Stanford entrepreneurs generate world revenues of $2.7 trillion annually and have created 5.4 million jobs since the 1930s.

The study, "Stanford University's Economic Impact via Innovation and Entrepreneurship," describes the results of a large-scale, systematic survey of Stanford alumni and faculty conducted in 2011 by Charles Eesley, an assistant professor in the Stanford School of Engineering, and William F. Miller, the Herbert Hoover Professor of Public and Private Management Emeritus in the Stanford Graduate School of Business and a professor emeritus of computer science. [Download an executive summary.]

Based on results of that survey, the professors estimate that Stanford alumni and faculty have created 39,900 companies since the 1930s, which if gathered collectively into an independent nation would constitute the world's 10th largest economy.

"Stanford's history is one of pioneering innovations in research, transferring discoveries to the broader community, and educating tomorrow's leaders and entrepreneurs," said Stanford President John L. Hennessy. "As this study illustrates, our faculty, students and alumni have had – and will continue to have – a tremendous impact on the global economy and on improving people's lives."

Courtesy of Stanford Technology Ventures Program

Students developing a product use-case scenario as part of an entrepreneurship class.

Companies founded by Stanford alumni include tech giants like Google, Hewlett-Packard and Cisco Systems, companies that form the backbone of Silicon Valley, as well as a continuing stream of startups that feed the region's innovation pipeline and contribute to its robust economy.

"The people, research and ideas of Stanford Engineering have been a catalyst for some of the world's best-known companies," said James D. Plummer, the Frederick Emmons Terman Dean of the School of Engineering and the John M. Fluke Professor of Electrical Engineering. "While the findings of the Stanford Innovation Survey are a tribute to the successful entrepreneurial legacy of our community, they also provide inspiration for our students, researchers and faculty to fulfill the full promise of science and technology to be the drivers of economic and societal prosperity in the 21st century."

Although Stanford is best known for its contributions to Silicon Valley, the university's influence stretches beyond high technology to include automaker Tesla Motors, financial companies like Charles Schwab and widely recognized consumer brands like Gap, Nike, Netflix and Trader Joe's.

"Stanford has been the wellspring of some of the most enduring companies of our time," said Roelof Botha, a partner at Sequoia Capital, which funded the study. "It's been our privilege to partner with alumni like Larry & Sergey, Jerry & David, Sandy & Len, James, Jen-Hsun, Reid,

and Trip, and we will continue to look to Stanford to nurture the next generation of legendary founders."

In addition to quantifying Stanford's economic impact, the report examines Stanford's role in fostering entrepreneurship and describes how the university creates an ecosystem that encourages creativity and entrepreneurship across schools and disciplines.

It also includes a look at the rise of social innovation at the university, estimating that in addition to 39,900 for-profit organizations, graduates and faculty have created more than 30,000 non-profit organizations. Among the best-known of these is Kiva, a microfinance organization, The Special Olympics and Acumen Fund, which supports entrepreneurs in developing economies.

"Multidisciplinary learning, management knowledge and leadership skills are highly relevant to an ever-increasing diversity of organizations that strive to solve systemic global problems like health care delivery, public education, and sustainable development," said Garth Saloner, the Philip H. Knight Professor and Dean of the Graduate School of Business. "Many of these are management challenges at their core."

Other key findings of the survey include:

- 29 percent of respondents reported being entrepreneurs who founded an organization (for-profit or nonprofit)
- 32 percent of alumni described themselves as an investor, early employee or a board member in a startup at some point in their careers
- 25 percent of faculty respondents (some of whom are also alumni) reported founding or incorporating a firm at some point in their careers
- Among survey respondents who became entrepreneurs in the past decade, 55 percent reported choosing to study at Stanford because of its entrepreneurial environment.

The university's reputation as an innovation epicenter draws people from all over the world interested in exploring ideas and who, in many cases, remain in the region. One-quarter of entrepreneurs who graduated after 1990 formed their companies within 20 miles of the university. (Among the engineering graduates whose firms dot Silicon Valley, that number rises to 31 percent.) Thirty-nine percent of all alumni founded firms located within 60 miles of Stanford – roughly a one-hour drive.

Statewide, California is home to an estimated 18,000 firms created by Stanford alumni, generating annual worldwide sales of about $1.27 trillion and employing more than 3 million people.

Jamie Beckett is the director of communications and alumni relations at the School of Engineering.

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Dan Stober, Stanford News Service: (650) 721-6965, dstober@stanford.edu

Attachment F

2012
Porter Drive Transportation Committee

Bob Burkhardt

Transportation Committee

4/5/2012

© 2012 Stanford University

Agenda

- Existing infrastructure at 3172 Porter
- Infrastructure needed
- The costs associated with what we need

© 2012 Stanford University

Existing Infrastructure at 3172 Porter

- Marguerite Shuttles
- 1050A – paid by School of Medicine
- VA – Paid by SHC
- RP – Paid by Research Park Occupants
- Parking – 199 regular spaces, we currently use about 208
  - Don’t know how the new location will change folks commute plans, we need to survey

© 2012 Stanford University

1050A Shuttle – About 30 minutes

Marguerite

Effective Thursday, March 1, 2012

1050 ARASTRADERO

1050 A

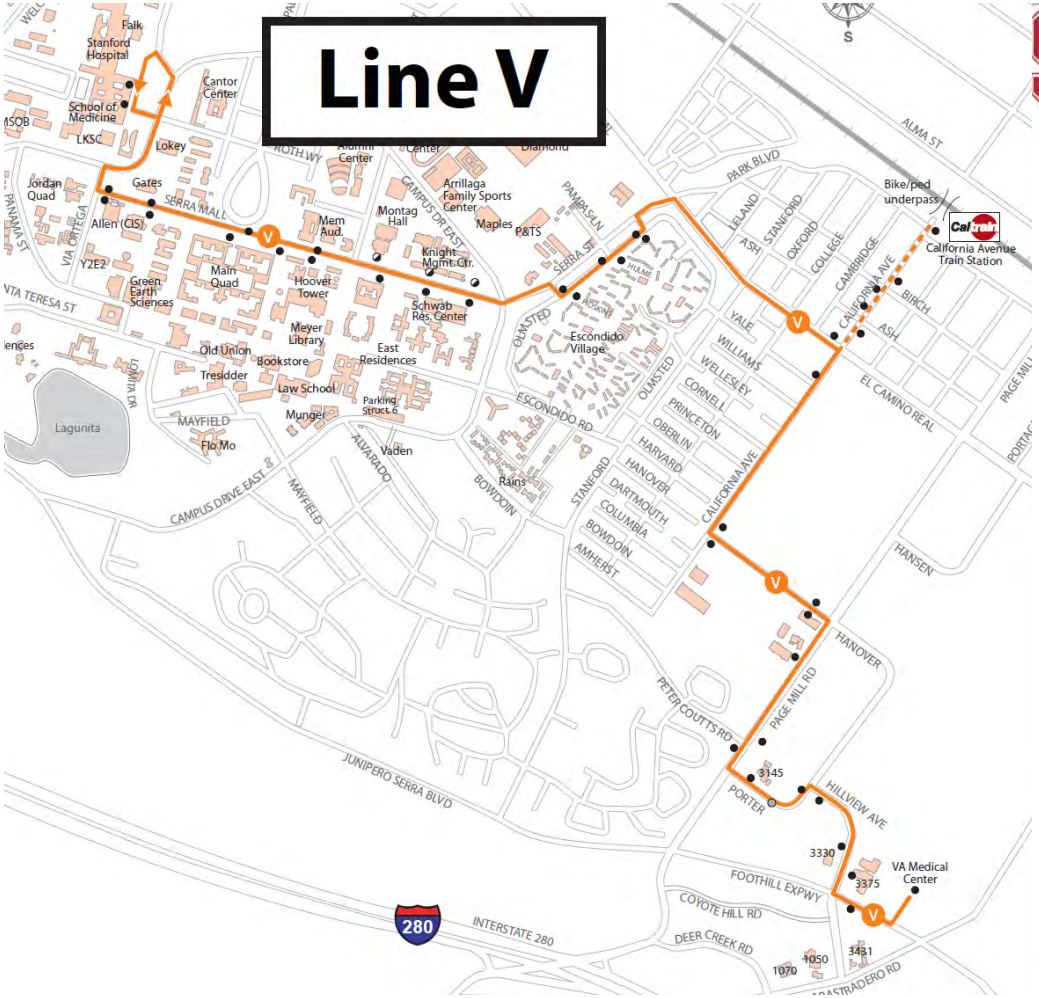
- Weekdays (excluding university holidays)
- Serves additional stops along route (check sign at stop/ask driver)

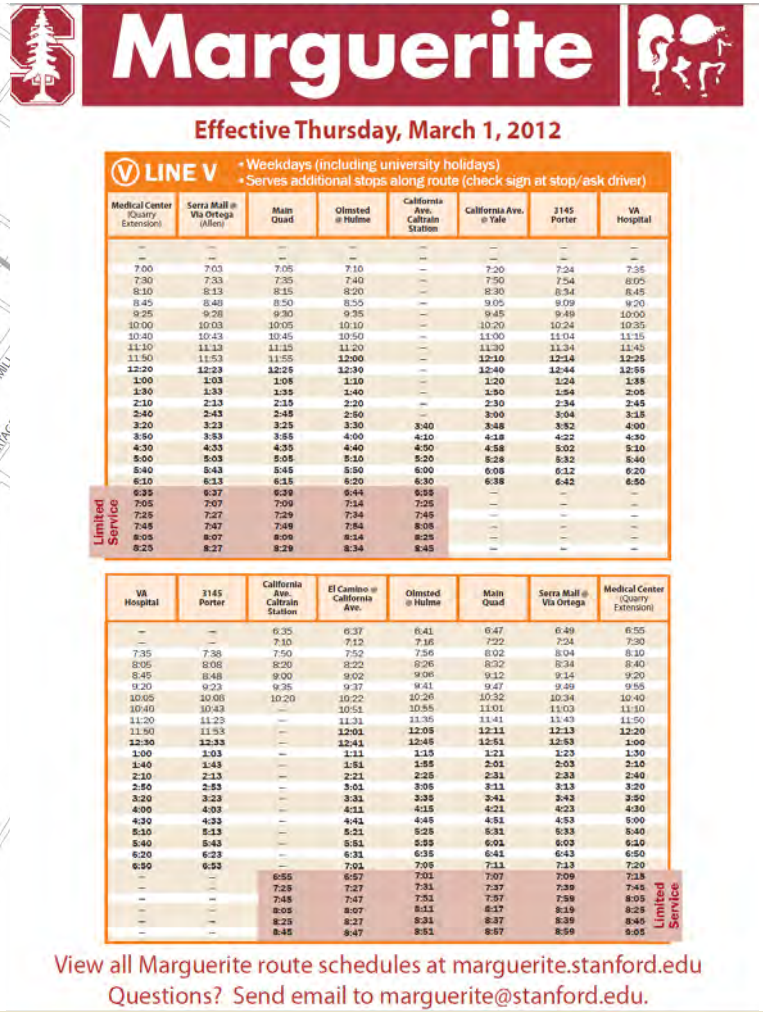
MSOB (Campus Dr. @ Panama)	1050 / 1070 Arastradero	1050 / 1070 Arastradero	3375 Hillview	3145 Porter	MSOB (Campus Dr. @ Panama)
8:20	8:35	8:35	8:38	8:41	8:55
9:00	9:15	9:15	9:18	9:21	9:35
9:40	9:55	9:55	9:58	10:01	10:15
10:15	10:30	10:30	10:33	10:36	10:45
10:45	11:00	11:00	11:03	11:06	11:15
11:15	11:30	11:30	11:33	11:36	11:45
11:45	**12:00**	**12:00**	**12:03**	**12:06**	**12:15**
12:15	**12:30**	**12:30**	**12:33**	**12:36**	**12:45**
12:45	**1:00**	**1:00**	**1:03**	**1:06**	**1:15**
1:15	**1:30**	**1:30**	**1:33**	**1:36**	**1:45**
1:45	**2:00**	**2:00**	**2:03**	**2:06**	**2:15**
2:15	**2:30**	**2:30**	**2:33**	**2:36**	**2:45**
2:45	**3:00**	**3:00**	**3:03**	**3:06**	**3:15**
3:15	**3:30**	**3:30**	**3:33**	**3:36**	**3:45**
3:45	**4:00**	**4:00**	**4:03**	**4:06**	**4:25**
4:25	**4:40**	**4:40**	**4:43**	**4:46**	**5:05**
5:05	**5:20**	**5:20**	**5:23**	**5:26**	**5:45**
5:45	**6:00**	**6:00**	**6:03**	**6:06**	**6:20**

View all Marguerite route schedules at marguerite.stanford.edu
Questions? Send email to marguerite@stanford.edu.

© 2012 Stanford University

VA Shuttle – About 40 minutes





Marguerite

Effective Thursday, March 1, 2012

V LINE V

- Weekdays (including university holidays)
- Serves additional stops along route (check sign at stop/ask driver)

Medical Center (Quarry Extension)	Serra Mall @ Via Ortega (Allen)	Main Quad	Olmsted @ Hulme	California Ave. Caltrain Station	California Ave. @ Yale	3145 Porter	VA Hospital
–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
7:00	7:03	7:05	7:10	–	7:20	7:24	7:35
7:30	7:33	7:35	7:40	–	7:50	7:54	8:05
8:10	8:13	8:15	8:20	–	8:30	8:34	8:45
8:45	8:48	8:50	8:55	–	9:05	9:09	9:20
9:25	9:28	9:30	9:35	–	9:45	9:49	10:00
10:00	10:03	10:05	10:10	–	10:20	10:24	10:35
10:40	10:43	10:45	10:50	–	11:00	11:04	11:15
11:10	11:13	11:15	11:20	–	11:30	11:34	11:45
11:50	11:53	11:55	12:00	–	12:10	12:14	12:25
12:20	12:23	12:25	12:30	–	12:40	12:44	12:55
1:00	1:03	1:05	1:10	–	1:20	1:24	1:35
1:30	1:33	1:35	1:40	–	1:50	1:54	2:05
2:10	2:13	2:15	2:20	–	2:30	2:34	2:45
2:40	2:43	2:45	2:50	–	3:00	3:04	3:15
3:20	3:23	3:25	3:30	3:40	3:48	3:52	4:00
3:50	3:53	3:55	4:00	4:10	4:18	4:22	4:30
4:30	4:33	4:35	4:40	4:50	4:58	5:02	5:10
5:00	5:03	5:05	5:10	5:20	5:28	5:32	5:40
5:40	5:43	5:45	5:50	6:00	6:08	6:12	6:20
6:10	6:13	6:15	6:20	6:30	6:38	6:42	6:50
6:35	6:37	6:39	6:44	6:55	–	–	–
7:05	7:07	7:09	7:14	7:25	–	–	–
7:25	7:27	7:29	7:34	7:45	–	–	–
7:45	7:47	7:49	7:54	8:05	–	–	–
8:05	8:07	8:09	8:14	8:25	–	–	–
8:25	8:27	8:29	8:34	8:45	–	–	–

Limited Service

VA Hospital	3145 Porter	California Ave. Caltrain Station	El Camino @ California Ave.	Olmsted @ Hulme	Main Quad	Serra Mall @ Via Ortega	Medical Center (Quarry Extension)
–	–	6:35	6:37	6:41	6:47	6:49	6:55
–	–	7:10	7:12	7:16	7:22	7:24	7:30
7:35	7:38	7:50	7:52	7:56	8:02	8:04	8:10
8:05	8:08	8:20	8:22	8:26	8:32	8:34	8:40
8:45	8:48	9:00	9:02	9:06	9:12	9:14	9:20
9:20	9:23	9:35	9:37	9:41	9:47	9:49	9:55
10:05	10:08	10:20	10:22	10:26	10:32	10:34	10:40
10:40	10:43	–	10:51	10:55	11:01	11:03	11:10
11:20	11:23	–	11:31	11:35	11:41	11:43	11:50
11:50	11:53	–	12:01	12:05	12:11	12:13	12:20
12:30	12:33	–	12:41	12:45	12:51	12:53	1:00
1:00	1:03	–	1:11	1:15	1:21	1:23	1:30
1:40	1:43	–	1:51	1:55	2:01	2:03	2:10
2:10	2:13	–	2:21	2:25	2:31	2:33	2:40
2:50	2:53	–	3:01	3:05	3:11	3:13	3:20
3:20	3:23	–	3:31	3:35	3:41	3:43	3:50
4:00	4:03	–	4:11	4:15	4:21	4:23	4:30
4:30	4:33	–	4:41	4:45	4:51	4:53	5:00
5:10	5:13	–	5:21	5:25	5:31	5:33	5:40
5:40	5:43	–	5:51	5:55	6:01	6:03	6:10
6:20	6:23	–	6:31	6:35	6:41	6:43	6:50
6:50	6:53	–	7:01	7:05	7:11	7:13	7:20
–	–	6:55	6:57	7:01	7:07	7:09	7:18
–	–	7:25	7:27	7:31	7:37	7:39	7:48
–	–	7:48	7:47	7:51	7:57	7:59	8:05
–	–	8:05	8:07	8:11	8:17	8:19	8:25
–	–	8:25	8:27	8:31	8:37	8:39	8:45
–	–	8:45	8:47	8:51	8:57	8:59	9:05

Limited Service

View all Marguerite route schedules at marguerite.stanford.edu
Questions? Send email to marguerite@stanford.edu.

STANFORD SCHOOL OF MEDICINE

irt INFORMATION RESOURCES & TECHNOLOGY

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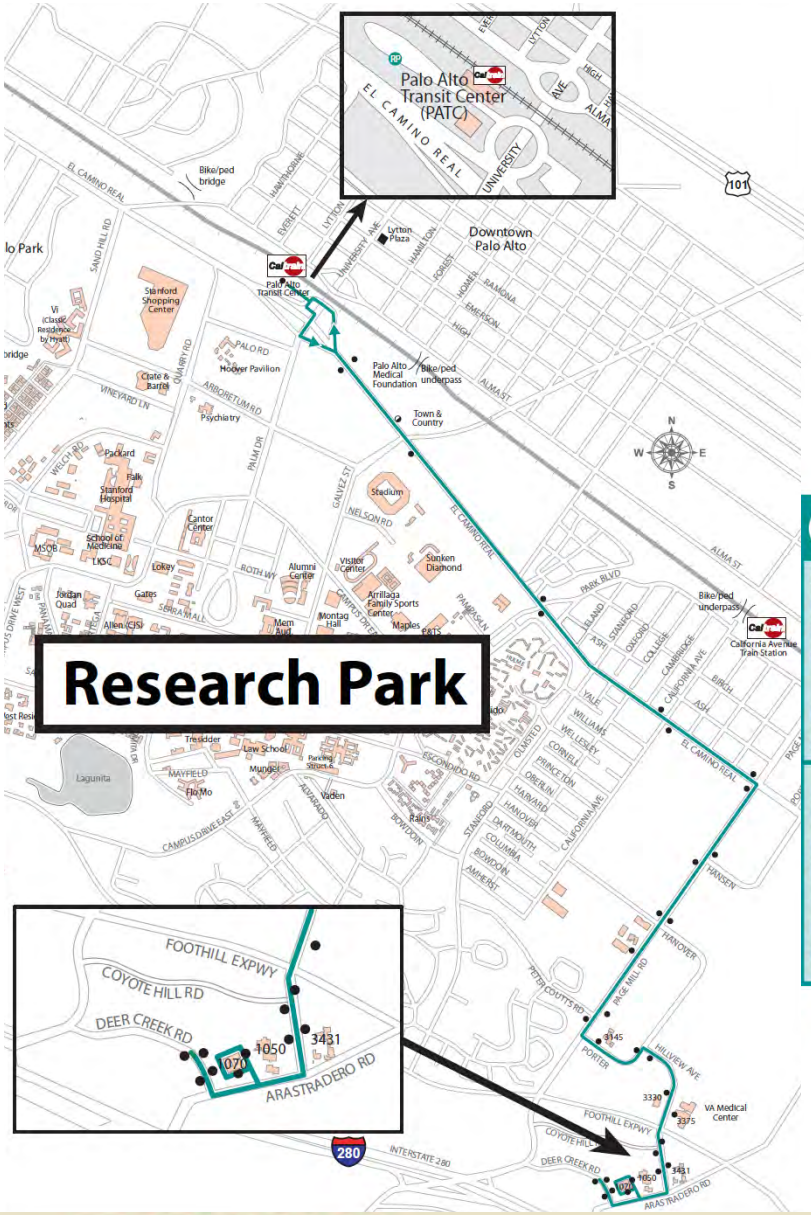
RP shuttle – Random 18, 30,40 minutes



Marguerite

Effective Thursday, March 1, 2012

RESEARCH PARK

- Weekdays (including university holidays)
- Serves additional stops along route (check sign at stop/ask driver)

	Palo Alto Transit Center (Bus depot)	El Camino Real @ California	Page Mill @ El Camino Real	Page Mill @ Hanover	3145 Porter	Hillview @ Coyote Hill	1050 / 1070 Arastradero	3475 Deer Creek
MORNING	6:28	6:34	6:37	6:39	6:42	6:47	6:50	6:55
	7:10	7:16	7:19	7:21	7:24	7:29	7:32	7:37
	7:28	7:34	7:37	7:39	7:42	7:47	7:50	7:55
	7:58	8:04	8:07	8:09	8:12	8:17	8:20	8:25
	8:28	8:34	8:37	8:39	8:42	8:47	8:50	8:55
	8:58	9:04	9:07	9:09	9:12	9:17	9:20	9:25
	9:28	9:34	9:37	9:39	9:42	9:47	9:50	9:55

	3475 Deer Creek	1050 / 1070 Arastradero	Hillview @ Coyote Hill	3145 Porter	Page Mill @ Hanover	El Camino Real @ Page Mill	El Camino Real @ California	Palo Alto Transit Center (Caltrain platform)
EVENING	3:43	3:45	3:51	3:54	3:57	4:00	4:02	4:13
	4:25	4:27	4:33	4:36	4:39	4:42	4:44	4:57
	5:03	5:05	5:11	5:14	5:17	5:20	5:22	5:33
	5:25	5:27	5:33	5:36	5:39	5:42	5:44	5:57
	6:03	6:05	6:11	6:14	6:17	6:20	6:22	6:33
	6:28	6:30	6:36	6:39	6:42	6:45	6:47	6:58
	6:58	7:00	7:06	7:09	7:12	7:15	7:17	7:28
	7:28	7:30	7:36	7:39	7:42	7:45	7:47	7:58

View all Marguerite route schedules at marguerite.stanford.edu
Questions? Send email to marguerite@stanford.edu.

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Existing Infrastructure 3172 Porter

- Have a document that describes how to find your own commute.
- Vanpool information
- Bike routes
- Local Bus stops (89, 101, 102, 103, 104, DB DB1)
- Local eateries, banks and pharmacies

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What is needed

- Additional parking
- Additional vehicles to schedule
  - All of the SMP vehicles are fully booked.
  - Campus to Campus reserved parking
  - Fleet of street legal golf carts
- Augmentation to the existing shuttle system
- Bikes, Bike parking and repair
- Pathways between buildings for easy access
- Cross walks and Sidewalks

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Parking

- There are only 199 spots on the parking plan
- We need room for 4 service vehicles
  - SMP110, SMP I/AB, Facilities, IRT Networking
  - We need space for bicycle parking (2 spaces for 33 bikes)
  - We are using 208 today, not counting changes in commute patterns.
- We need to have a plan
  - Incentive for parking at 1050/1070 or Hillview?
  - Find some offsite parking that can be used easily?

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Bicycles

- Need at least one bike repair station
- Need a compact bike shelter
- Need a fleet of bicycles
  - How many? We can assume 10
  - Cost? We can assume $300
  - Total cost $3000

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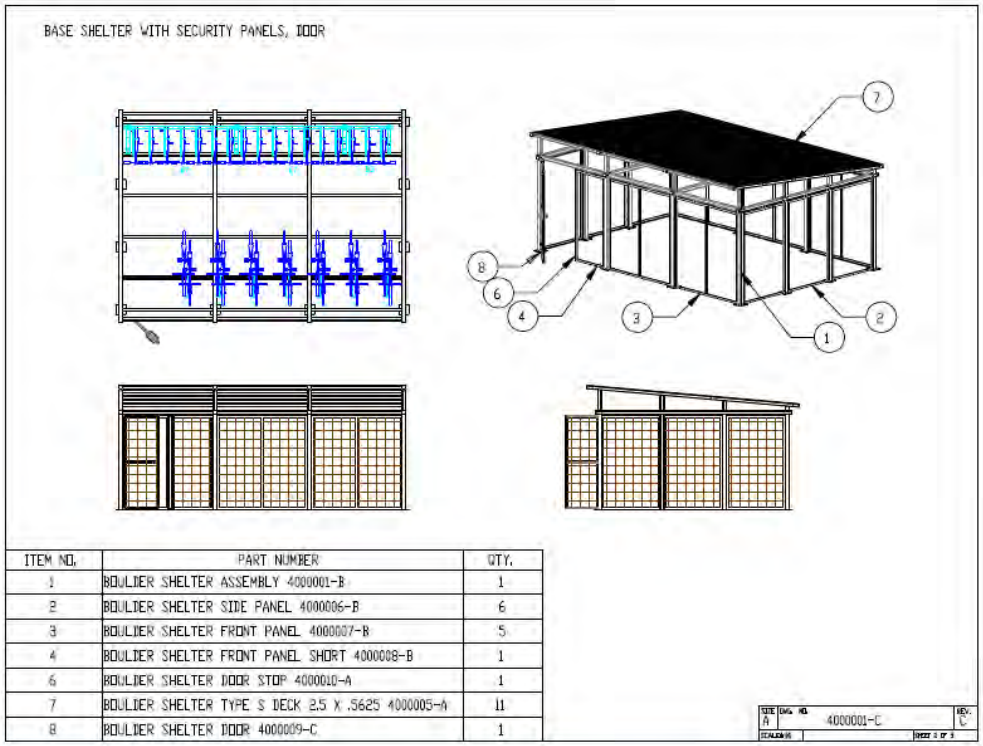
Compact Bicycle Shelter



ITEM NO.	PART NUMBER	QTY.
1	BOULDER SHELTER ASSEMBLY 4000001-B	1
2	BOULDER SHELTER SIDE PANEL 4000006-B	6
3	BOULDER SHELTER FRONT PANEL 4000007-B	5
4	BOULDER SHELTER FRONT PANEL SHORT 4000008-B	1
6	BOULDER SHELTER DOOR STOP 4000010-A	1
7	BOULDER SHELTER TYPE S DECK 2.5 X .5625 4000005-A	11
8	BOULDER SHELTER DOOR 4000009-C	1

ASSUMPTIONS	MEDIUM
Dimensions (LxWxH)	**15'11" x 16' x 10'7"**
Sales Tax Rate	

LARGE STANDARD SHELTER	MEDIUM	
Structure	$	16,021
Panels (Wire Mesh)	$	13,009
Total	$	29,030
Sales Tax	$	2,395
Freight	$	3,250
TOTAL COST INCLUDING TAX/FREIGHT	**$**	**34,675**

BIKE RACKS	MEDIUM	
Dero Deckers	$	-
Ultra Space Savers	$	4,059
Swerves	$	-
Fixit	$	-
Total	**$**	**4,059**
Sales Tax	$	335
Freight	$	431
TOTAL COSST INCLUDING TAX/FREIGHT	**$**	**4,825**

TOTAL COST FOR SHELTER & BIKE RACKS $ 39,499.84

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Bicycle Repair Station

- Bike Repair Station - $1500
- To be included in project

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Shuttles – 1050A

- 1050A Shuttle is the most direct connection to campus.
  - Have this shuttle stop at 3145 directly from and to campus and then proceed to the VA or Arastradero
  - Every 10 minutes to campus (9am-5pm), $361,920 Augmenting the 1050A shuttle route with two additional shuttles

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Shuttles - RP

- RP goes to/from Caltrain
  - Only morning and afternoon
  - Doesn't meet the 4:04pm southbound train, one of 3 that goes past San Jose and one of the 2 that stop at Palo Alto
  - Requires a 20 minute wait for north bound trains arriving at 7:36am and 8:36am
- There is currently up to a 30 minute wait for a shuttle from some trains

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Shuttles – RP

- Recommend augmenting this shuttle for morning and evening access to Caltrain

- Palo Alto Train Express Morning/Evening 7-9am, 4-6pm, $90,480 augmenting RP to fill in the gaps

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Shuttles – VA

- VA is the only midday shuttle that goes through campus
- Stops at California Avenue at El Camino
- Stops at Cal Ave Caltrain
- Currently about 40 minute schedule
- This should run on a 10 minute schedule from 11:30am to 1:30pm to allow people to get to/ from campus and California Avenue restaurants - $45,240

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Shuttles

- Shuttles cost $87/hour
  - If there are available shuttles
- If we need to purchase a shuttle the small one that is currently serving SMP is about $130k
- We may need to buy 2 shuttles in order to increase the frequency

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Street Legal Golf Carts

- Street legal golf carts (start with 5, potentially more) - $15k each
- Current cars are oversubscribed with only 2 cars available for 200 folks
- Golf carts can not go over barrier at California Ave and Hanover
  - The path is confusing - paint a red follow-me line on the road to direct the golf carts along the approved path between Porter and LKSC
- Charging station - Porter and LKSC (6@$16K)

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Street Legal Golf Cars

- Expected cost savings of $15,000/year
  - Theoretical employee cost $120k/year
  - 30 minutes savings per trip
  - 2 trips per day
  - 1 hour savings per day
  - $288/day or $15k/year

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Street Legal LSV (low speed vehicles) 25 MPH with AC motors $10,000 - $15000

Charging stations handle 2 golf carts, need 3 at Porter and 3 on campus

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Alternate Transportation

- These options are detailed in a word document

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Augmented transportation options

- Park and ride collection points
- Various locations around the bay area where we have large populations of folks
- Google has a pick up in Los Gatos that goes directly to their campus
- Checking on the cost for this type of option
  - San Francisco
  - Millbrae
  - Gilroy

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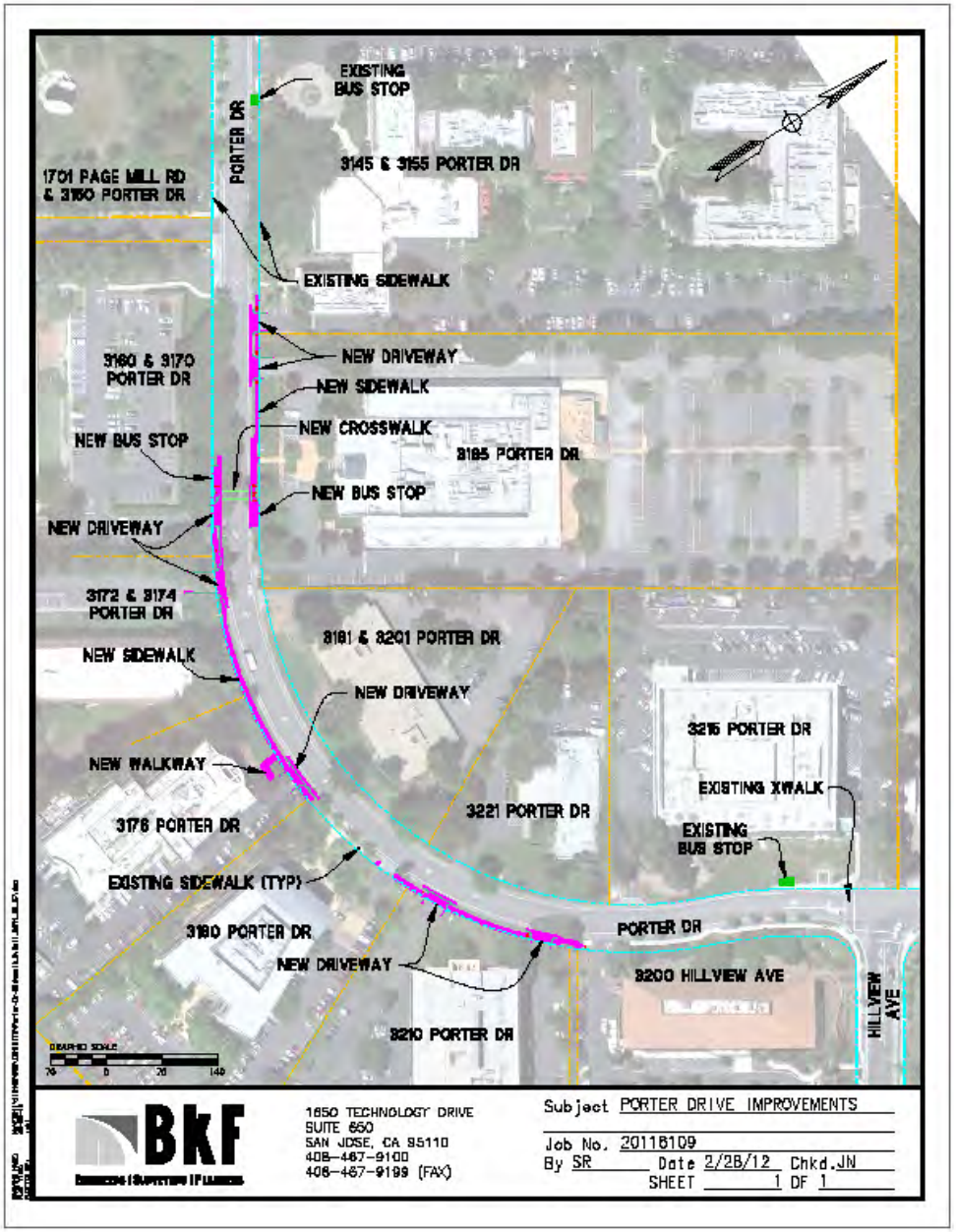
Cross Walk to 3145 Porter & Sidewalks

- Sidewalks in front of 3145 and cross walk – June 4, 2012
- Balance of sidewalks – July 16, 2012
- Need pathways between buildings for easier access



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Bike Paths

Existing bike path

Bike path on hill

New bike path to avoid having to go down and then up the hill again

Allow easier more direct access to the south.

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Total Cost

	Cost	Qty	Total First Year	Ongoing Operational Costs
Bike Storage	$40,000	1	$40,000	
Fleet of Bicycles	$300	10	$3000	
Augment 1050A	$361,920	1	$361,920	$361,920
Augment RP	$90,480	1	$90,480	$90,480
Augment VA	$45,240	1	$45,240	$45,240
Shuttle Buses (2)	$130,000	2	$260,000	
Street Legal Golf Carts (5)	$15,000	5	$75,000	
Charging Stations (6)	$16,156	6	$96,936	
Pedistal (6)	$1,262	6	$7,572	
Installation (6)	$1,500	6	$9,000	
Cross Walks / Sidewalks	$100,000	1	$100,000	
Total			$1,089,148	$497,640

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Questions?

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Attachment G

Stanford | LAND BUILDINGS & REAL ESTATE
Land Use & Environmental Planning

January 16, 2018

Kristina Loquist
Santa Clara County BOS
Office of Supervisor Joe Simitian
70 West Hedding Street, 10th floor
San Jose, CA 95110

Subject: CA/RR/D Request for Marguerite Data

Dear Ms. Loquist:

Stanford has received the request for Marguerite Shuttle ridership data from the group Citizens for Responsible Rail Design (CA/RR/D). Specifically, CA/RR/D is requesting data related to the Marguerite Shuttles' connections with Caltrain service at the Palo Alto Transit Center.

Automatic Passengers Counters

As noted by CA/RR/D, the Marguerite Shuttle does have Automatic Passengers Counters (APCs) installed. The APC data is collected and stored within the ETA/SPOT cloud. It records both boarding and alighting data and is available to us for review. However, this data is not yet used by the Marguerite Operations team as it has been found to be inaccurate. It appears that some older Marguerite buses have wiring that causes the APC data to undercount ridership. Until those buses are replaced and any other technical issues are resolved, Marguerite operators will continue to rely on manual counts of boardings, which is recorded by Marguerite drivers throughout each day and reported to the Marguerite Operations Team on a monthly basis.

Below is an example of bus stop activity for the Y Line in early December which illustrates that there are significant variations between the manual data set and the APC data. The full data set for the Y Line is attached for review. The Marguerite team does believe that as new buses are phased in, the APCs will become more accurate.

Date	Daily Boardings of Line Y	
	Manual	APC
1-Dec	2,068	13
4-Dec	2,238	600
5-Dec	2,218	284

Marguerite Ridership reported to Joint Powers Board

We are attaching several datasets that address CARRD's request for Marguerite ridership data. Stanford receives a grant from Caltrain to operate the first- and last-mile service to Caltrain. As part of the grant requirements, Stanford reports total ridership numbers for those lines that serve the Palo Alto Transit Center to the Joint Powers Board (JPB) on a monthly basis. Data submitted to the JPB for 2016 and 2017 are attached. It should be noted that these data reflect:

- *Total* ridership on the relevant Marguerite lines, without regard to whether a rider embarks or disembarks at the Caltrain station; therefore, the total ridership numbers are larger than the number of Caltrain riders;

- Ridership by Stanford Research Park, campus, hospital, and shopping center populations. The data are not limited to riders associated with the facilities in the unincorporated County.

The data provided to JPB does cannot readily be translated to Caltrain ridership by the Stanford campus population.

Marguerite boardings at Palo Alto Intermodal Transit Center

To better equate the Marguerite boarding data to Caltrain ridership, we have collected average daily boarding data at the Palo Alto Transit Center for 2016 and 2017 data for those lines that operate at the station.

Average Daily Boardings of Marguerite Shuttles at PATC by Route

	Average Daily Boardings	
Route	**2017**	**2016**
X	1,310	1,479
Y	635	687
SE	10	21
S	32	31
P	466	464
O	4	6
N	8	9
MC	393	420
Total	**2,857**	**3,115**

Source: Marguerite Shuttle, manual bus driver counts, 2016 and 2017

Note, however, that these data also include riders traveling to and from the hospitals and shopping center, and do not include Stanford campus commuters who access Caltrain by foot or bicycle.

****

The Transit Capacity Analysis, like the Traffic Impact Analysis, completed to support the 2018 General Use Permit application relied upon the Stanford Commuter Survey to estimate the number of existing and future Caltrain riders. This is a more accurate and conservative approach than relying on Marguerite ridership data, as many Caltrain riders choose to ride bikes or walk from the station to campus. Use of the Stanford Commuter

Survey data also provides a more accurate estimate of Stanford Caltrain riders, as opposed to Marguerite ridership data which includes non-Stanford riders.

Let me know if you have additional questions or needs.

Sincerely,

Lesley Lowe, AICP CTP
Senior Environmental Planner
Land Use and Environmental Planning | Stanford University

Attachments

Attachment H

Stanford University Marguerite

SHUTTLE RIDERSHIP REPORT

ROUTE	Marguerrite
STATION (OR CITY)	Palo Alto

WEEKLY TOTALS FOR MONTH OF **December-17**

WEEK ENDING	OPERATING DAYS	PASSENGERS
1-Dec	1	6951
8-Dec	5	35112
15-Dec	5	34641
22-Dec	5	27661
29-Dec	5	5376
MONTHLY TOTALS	21	109741

Marguerrite	Average Daily	Reporting Month Totals
Monthly Ridership (Unlinked Pax Trips)		109,741
AWR		5,226
Monthly Service Days		21
Vehicle Revenue Hours	216	4,536
Vehicle Operating Hours	234	4,914
Vehicle Revenue Miles	2619	54,999
Vehicle Operating Miles	2910	61,110
Total Passenger Miles	0.53	58,163
Peak Vehicle Quantity	27	27
Fuel - Diesel	0	0
Fuel - BioDiesel	291	6,117
Fuel - Gas	0	0
Fuel - CNG	0	0
Fuel - Other (Electricity, 2KW Per Mile)	1263	26,523
Major Mechanical		0
Minor Mechanical		0
Reportable Accidents: Non-Preventable		0
Reportable Accidents: Preventable		0
Reportable Accident: Total		0
All Accidents: Non-Preventable		0
All Accidents: Preventable		0
All Accidents: Total		0

NOTES:	Describe Mechanical, Accident, or any other important information.
NOTES:	Describe Mechanical, Accident, or any other important information.
NOTES:	Describe Mechanical, Accident, or any other important information.
NOTES:	Describe Mechanical, Accident, or any other important information.

Was any scheduled service lost this month for any reason? (Y / N)	N
If any service was lost this month, please input the total lost scheduled service hours.	
If any service was lost this month, please input the total lost scheduled service miles.	

Attachment I

1/1 - 1/3	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon								0
Medical Center					7			7
MCH					121			121
Line N						21	17	0
Line O						32	16	0
Line P								0
Research Park								0
Line S								0
Shopping Express						505	615	0
Line X								0
Line Y								0
Total By Day	**0**	**0**	**0**	**0**	**128**			

Combined Total:	128

1/4 - 1/10	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	251	291	271	290	261			**1364**
Medical Center	474	448	140	427	541			**2030**
MCH								**0**
Line N	33	22	25	19	21	58	14	**120**
Line O	8	4	16	35	60	18	22	**123**
Line P	1228	1094	1387	1027	1068			**5804**
Research Park	575	426	648	531	471			**2651**
Line S	76	73	87	68	58			**362**
Shopping Express	298	278	274	220	320	613	488	**1390**
Line X	2312	2236	2210	2156	2144			**11058**
Line Y	2130	2199	1831	2095	2068			**10323**
Total By Day	**7385**	**7071**	**6889**	**6868**	**7012**			

Combined Total:	35225

1/11 - 1/17	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	272	293	298	285	254			**1402**
Medical Center	673	555	328	544	642			**2742**
MCH								**0**
Line N	19	31		34	53	30	16	**137**
Line O	14	17	28	29	65	57	30	**153**
Line P	1222	1292	1324	1125	971			**5934**
Research Park	605	575	613	476	555			**2824**
Line S	80	63	67	79	75			**364**
Shopping Express	232	188	247	172	220	667	483	**1059**
Line X	2177	2213	2196	2283	2095			**10964**
Line Y	2136	2308	2240	2421	2292			**11397**
Total By Day	**7430**	**7535**	**7341**	**7448**	**7222**			

Combined Total:	36976

1/18 - 1/22	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon		290	273	323	267			**1153**
Medical Center	147	739	494	819	563			**2762**
MCH	547							**547**
Line N		15	23	17		36	16	**55**
Line O		17	22	39	16	29	10	**94**
Line P		1152	1361	1226	1235			**4974**
Research Park	168	680	574	558	540			**2520**
Line S		102		73	56			**231**
Shopping Express	193	245	245	247	307	500	567	**1237**
Line X		2241	2386	2163	1532			**8322**
Line Y		2375	2119	2254	2396			**9144**
Total By Day	**1055**	**7856**	**7497**	**7719**	**6912**			

Combined Total:	**31039**

1/25 - 1/29	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	287	298	351	310	262			**1508**
Medical Center	701	726	647	598	421			**3093**
MCH								**0**
Line N	10	18	20	27	30	25	30	**105**
Line O	10	27	20	23	40	29	21	**120**
Line P	1331	1325	1277	1334	1213			**6480**
Research Park	640	616	654	667	533			**3110**
Line S	81	84	68	76	65			**374**
Shopping Express	252	249	188	239	239	343	427	**1167**
Line X	2195	2290	2327	2288	2256			**11356**
Line Y	2238	2298	2254	2209	2350			**11349**
Total By Day	**7745**	**7931**	**7806**	**7771**	**7409**			

Combined Total:	**38662**

BOH	5427
MC	10634
MCH	668
N	680
O	754
P	23192
RP	11105
S	1331
SE	10061
X	41700
Y	42213
Total:	**147765**

2/1 - 2/7	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	294	269	282	248	212	0	0	**1305**
Medical Center	506	496	504	548	639	0	0	**2693**
MCH	0	0	0	0	0	0	0	**0**
Line N	32	27	31	37	50	19	25	**177**
Line O	24	23	35	27	44	49	15	**153**
Line P	1140	1242	1135	1185	1133	0	0	**5835**
Research Park	616	589	561	633	534	0	0	**2933**
Line S	73	84	60	70	55	0	0	**342**
Shopping Express	239	230	214	195	351	525	447	**1229**
Line X	2344	2476	2177	2121	2151	0	0	**11269**
Line Y	2249	2235	2420	2280	2235	0	0	**11419**
Total By Day	**7517**	**7671**	**7419**	**7344**	**7404**	**593**	**487**	

Combined Total:	37355

2/8 - 2/14	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	304	299	279	254	249	0	0	**1385**
Medical Center	629	361	726	547	510	0	0	**2773**
MCH	0	0	0	0	0	0	0	**0**
Line N	32	30	29	32	61	39	54	**184**
Line O	25	30	19	26	59	56	24	**159**
Line P	1257	1214	1215	1189	1189	0	0	**6064**
Research Park	639	670	607	664	502	0	0	**3082**
Line S	70	76	65	73	65	0	0	**349**
Shopping Express	225	206	231	257	305	739	683	**1224**
Line X	2121	2205	2234	2250	2208	0	0	**11018**
Line Y	2099	2262	2123	2234	2166	0	0	**10884**
Total By Day	**7401**	**7353**	**7528**	**7526**	**7314**	**834**	**761**	

Combined Total:	37122

2/15 - 2/21	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	81	315	281	296	293	0	0	**1266**
Medical Center	254	495	724	560	561	0	0	**2594**
MCH	655	0	0	0	0	0	0	**655**
Line N	0	18	38	47	71	30	6	**174**
Line O	0	31	53	12	41	46	19	**137**
Line P	0	1318	1157	1271	1214	0	0	**4960**
Research Park	107	636	578	618	421	0	0	**2360**
Line S	0	78	58	57	49	0	0	**242**
Shopping Express	307	225	252	262	257	518	445	**1303**
Line X	0	2067	2208	2262	2236	0	0	**8773**
Line Y	0	2072	2450	2368	1992	0	0	**8882**
Total By Day	**1404**	**7255**	**7799**	**7753**	**7135**	**594**	**470**	

Combined Total:	31346

2/22 - 2/28	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	326	344	335	278	300	0	0	**1583**
Medical Center	587	623	739	558	488	0	0	**2995**
MCH	0	0	0	0	0	0	0	**0**
Line N	32	46	26	20	85	35	19	**209**
Line O	29	23	37	66	50	36	21	**205**
Line P	1326	1014	1248	1314	1145	0	0	**6047**
Research Park	619	548	604	622	513	0	0	**2906**
Line S	108	72	59	72	63	0	0	**374**
Shopping Express	327	308	242	230	297	573	342	**1404**
Line X	2084	2313	2214	2128	2315	0	0	**11054**
Line Y	2076	2137	2221	2071	2167	0	0	**10672**
Total By Day	**7514**	**7428**	**7725**	**7359**	**7423**	**644**	**382**	

Combined Total:	37449

2/29	Monday	Weekly Total By Route
Bohannon	280	**280**
Medical Center	542	**542**
MCH	0	**0**
Line N	36	**36**
Line O	25	**25**
Line P	1234	**1234**
Research Park	500	**500**
Line S	87	**87**
Shopping Express	231	**231**
Line X	2081	**2081**
Line Y	2123	**2123**
Total By Day	**7139**	

Combined Total:	**7139**
BOH	5819
MC	11597
MCH	655
N	780
O	679
P	24140
RP	11781
S	1394
SE	5391
X	44195
Y	43980
Total:	**150411**

3/1 - 3/6	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon		285	301	318	283	0	0	**1187**
Medical Center		653	686	599	490	0	0	**2428**
MCH		0	0	0	0	0	0	**0**
Line N		23	21	21	39	44	12	**104**
Line O		18	18	22	47	36	15	**105**
Line P		1226	1137	1228	1088	0	0	**4679**
Research Park		603	537	589	513	0	0	**2242**
Line S		84	95	94	57	0	0	**330**
Shopping Express		228	239	282	321	665	451	**1070**
Line X		2189	2194	2219	2370	0	0	**8972**
Line Y		2148	2213	2148	2123	0	0	**8632**
Total By Day	**0**	**7457**	**7441**	**7520**	**7331**	**745**	**478**	

Combined Total:	**29749**

3/7 - 3/13	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	286	313	341	341	306	0	0	**1587**
Medical Center	646	521	813	677	487	0	0	**3144**
MCH	0	0	0	0	0	0	0	**0**
Line N	31	23	34	46	68	38	11	**202**
Line O	42	18	25	31	34	31	15	**150**
Line P	1335	1113	1239	1262	1199	0	0	**6148**
Research Park	639	543	465	637	510	0	0	**2794**
Line S	90	98	60	62	57	0	0	**367**
Shopping Express	287	253	224	258	320	566	386	**1342**
Line X	2510	2111	2167	2227	2263	0	0	**11278**
Line Y	2181	2117	2190	2312	2199	0	0	**10999**
Total By Day	**8047**	**7110**	**7558**	**7853**	**7443**	**635**	**412**	

Combined Total:	38011

3/14 - 3/20	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	313	277	341	275	256	0	0	**1462**
Medical Center	597	769	520	517	539	0	0	**2942**
MCH	0	0	0	0	0	0	0	**0**
Line N	33	25	28	74	50	35	18	**210**
Line O	30	38	17	35	62	68	9	**182**
Line P	1066	1046	1003	1049	936	0	0	**5100**
Research Park	550	592	570	532	517	0	0	**2761**
Line S	65	73	66	68	66	0	0	**338**
Shopping Express	248	220	310	304	321	548	539	**1403**
Line X	1867	2085	2006	2064	1995	0	0	**10017**
Line Y	2051	2193	2058	2180	1823	0	0	**10305**
Total By Day	**6820**	**7318**	**6919**	**7098**	**6565**	**651**	**566**	

Combined Total:	34720

3/21 - 3/27	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	272	314	271	274	260	0	0	**1391**
Medical Center	768	748	862	615	565	0	0	**3558**
MCH	0	0	0	0	0	0	0	**0**
Line N	36	30	33	43	40	24	21	**182**
Line O	32	32	27	35	30	36	25	**156**
Line P	1123	1127	1118	1080	1012	0	0	**5460**
Research Park	647	605	609	626	549	0	0	**3036**
Line S	55	77	53	61	43	0	0	**289**
Shopping Express	250	261	236	240	301	576	581	**1288**
Line X	1982	2174	2125	1903	1918	0	0	**10102**
Line Y	2242	2132	2014	1850	1817	0	0	**10055**
Total By Day	**7407**	**7500**	**7348**	**6727**	**6535**	**636**	**627**	

Combined Total:	35517

3/28 - 3/31	Monday	Tuesday	Wednesday	Thursday	Weekly Total By Route
Bohannon	257	244	257	241	**999**
Medical Center	812	720	780	858	**3170**
MCH	0	0	0	0	**0**
Line N	29	17	35	60	**141**
Line O	23	29	43	42	**137**
Line P	1307	1269	1140	1188	**4904**
Research Park	680	600	485	571	**2336**
Line S	53	58	56	53	**220**
Shopping Express	277	107	248	201	**833**
Line X	2087	2152	2283	2196	**8718**
Line Y	1982	2116	1997	2134	**8229**
Total By Day	**7507**	**7312**	**7324**	**7544**	

Combined Total:	**29687**

BOH	6626
MC	15242
MCH	0
N	1042
O	965
P	26291
RP	13169
S	1544
SE	10248
X	49087
Y	48220
Total:	**172434**

4/1 - 4/3	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon					234	0	0	**234**
Medical Center					725	0	0	**725**
MCH					0	0	0	**0**
Line N					68	23	34	**68**
Line O					42	33	34	**42**
Line P					1111	0	0	**1111**
Research Park					398	0	0	**398**
Line S					51	0	0	**51**
Shopping Express					270	573	421	**270**
Line X					2256	0	0	**2256**
Line Y					1925	0	0	**1925**
Total By Day	**0**	**0**	**0**	**0**	**7080**	**629**	**489**	

Combined Total:	**7080**

4/4 - 4/10	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	217	212	270	238	205	0	0	**1142**
Medical Center	767	780	806	769	613	0	0	**3735**
MCH	0	0	0	0	0	0	0	**0**
Line N	20	23	21	24	56	57	26	**144**
Line O	27	44	24	32	53	57	0	**180**
Line P	692	802	920	1092	1123	0	0	**4629**
Research Park	539	561	497	486	413	0	0	**2496**
Line S	70	39	49	41	46	0	0	**245**
Shopping Express	264	235	219	206	261	577	433	**1185**
Line X	1600	1730	2030	1988	2096	0	0	**9444**
Line Y	1815	2132	2021	2058	1986	0	0	**10012**
Total By Day	**6011**	**6558**	**6857**	**6934**	**6852**	**691**	**459**	

Combined Total:	33212

4/11 - 4/17	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	259	238	298	268	260	0	0	**1323**
Medical Center	836	685	783	802	652	0	0	**3758**
MCH	0	0	0	0	0	0	0	**0**
Line N	24	16	35	36	27	37	30	**138**
Line O	24	25	21	25	23	34	14	**118**
Line P	1013	1142	1183	1194	740	0	0	**5272**
Research Park	493	631	547	363	488	0	0	**2522**
Line S	57	55	57	53	50	0	0	**272**
Shopping Express	217	219	243	259	248	504	420	**1186**
Line X	2067	1979	2098	2163	2048	0	0	**10355**
Line Y	2070	2236	2256	2237	2026	0	0	**10825**
Total By Day	**7060**	**7226**	**7521**	**7400**	**6562**	**575**	**464**	

Combined Total:	35769

4/18 - 4/24	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	267	209	296	297	244	0	0	**1313**
Medical Center	731	793	820	766	771	0	0	**3881**
MCH	0	0	0	0	0	0	0	**0**
Line N	19	17	25	25	55	28	16	**141**
Line O	24	29	37	24	40	37	13	**154**
Line P	1088	1152	1172	1179	1022	0	0	**5613**
Research Park	537	525	589	627	363	0	0	**2641**
Line S	57	72	57	64	48	0	0	**298**
Shopping Express	210	281	260	213	267	421	463	**1231**
Line X	2076	2172	2169	2100	2171	0	0	**10688**
Line Y	2107	2201	2164	2155	2281	0	0	**10908**
Total By Day	**7116**	**7451**	**7589**	**7450**	**7262**	**486**	**492**	

Combined Total:	36868

4/25 - 4/30	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	262	242	297	292	227	0		**1320**
Medical Center	851	805	699	760	670	0		**3785**
MCH	0	0	0	0	0	0		**0**
Line N	15	17	23	21	60	63		**199**
Line O	28	29	34	0	20	2		**113**
Line P	1095	1117	1149	1051	1035	0		**5447**
Research Park	616	630	606	431	492	0		**2775**
Line S	79	75	72	63	72	0		**361**
Shopping Express	265	315	242	227	311	296		**1656**
Line X	2016	2211	2226	2246	2048	0		**10747**
Line Y	2089	1913	2175	2225	2224	0		**10626**
Total By Day	**7316**	**7354**	**7523**	**7316**	**7159**	**361**	**0**	

Combined Total:	**37029**

BOH	5332
MC	15884
MCH	0
N	941
O	829
P	22072
RP	10832
S	1227
SE	9340
X	43490
Y	44296
Total:	**154243**

5/1	Sunday	Weekly Total By Route
Bohannon	0	**0**
Medical Center	0	**0**
MCH	0	**0**
Line N	35	**35**
Line O	20	**20**
Line P	0	**0**
Research Park	0	**0**
Line S	0	**0**
Shopping Express	385	**385**
Line X	0	**0**
Line Y	0	**0**
Total By Day	**440**	

Combined Total:	**440**

5/2 - 5/8	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	264	254	291	264	211	0	0	**1284**
Medical Center	800	646	632	800	670	0	0	**3548**
MCH	0	0	0	0	0	0	0	**0**
Line N	21	28	18	91	34	52	20	**264**
Line O	19	15	20	59	52	35	18	**218**
Line P	976	1173	1110	976	987	0	0	**5222**
Research Park	493	584	508	493	438	0	0	**2516**
Line S	58	62	60	58	54	0	0	**292**
Shopping Express	240	228	243	1010	207	483	350	**2761**
Line X	2082	2077	2181	2082	2102	0	0	**10524**
Line Y	2165	2048	2044	2165	2226	0	0	**10648**
Total By Day	**7118**	**7115**	**7107**	**7998**	**6981**	**570**	**388**	

Combined Total:	37277

5/9 - 5/15	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	247	238	272	1531	223	0	0	**2511**
Medical Center	726	716	736	4274	662	0	0	**7114**
MCH	0	0	0	0	0	0	0	**0**
Line N	23	21	24	307	29	50	37	**491**
Line O	20	8	11	256	37	65	22	**419**
Line P	1086	1186	1118	6308	1108	0	0	**10806**
Research Park	580	538	411	3096	425	0	0	**5050**
Line S	60	82	69	352	64	0	0	**627**
Shopping Express	261	232	277	3372	279	637	604	**5662**
Line X	2034	2199	2143	12558	2084	0	0	**21018**
Line Y	2115	2293	2187	12763	2189	0	0	**21547**
Total By Day	**7152**	**7513**	**7248**	**44817**	**7100**	**752**	**663**	

Combined Total:	75245

5/16 - 5/22	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	293	285	278	2804	235	0	0	**3895**
Medical Center	660	709	756	7774	622	0	0	**10521**
MCH	0	0	0	0	0	0	0	**0**
Line N	23	24	21	551	30	91	16	**756**
Line O	16	27	31	457	32	100	14	**677**
Line P	1045	1221	1271	11851	1273	0	0	**16661**
Research Park	667	650	584	5717	495	0	0	**8113**
Line S	74	78	80	701	81	0	0	**1014**
Shopping Express	232	253	260	6498	285	597	475	**8600**
Line X	2168	2282	2175	23186	2191	0	0	**32002**
Line Y	2151	2274	2270	23698	2129	0	0	**32522**
Total By Day	**7329**	**7803**	**7726**	**83237**	**7373**	**788**	**505**	

Combined Total:	114761

5/23 - 5/29	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	284	281	272	4179	243	0	0	**5259**
Medical Center	759	823	684	11280	690	0	0	**14236**
MCH	0	0	0	0	0	0	0	**0**
Line N	20	20	28	792	26	50	9	**945**
Line O	20	23	26	711	45	59	21	**905**
Line P	1014	1247	1250	17675	1049	0	0	**22235**
Research Park	182	569	513	8295	401	0	0	**9960**
Line S	56	74	60	1070	45	0	0	**1305**
Shopping Express	254	259	196	9329	319	544	352	**11253**
Line X	1637	2182	2275	33639	1758	0	0	**41491**
Line Y	2047	2205	2157	34569	1997	0	0	**42975**
Total By Day	**6273**	**7683**	**7461**	**121539**	**6573**	**653**	**382**	

121539

Combined Total:	150564

5/30 - 5/31	Monday	Tuesday	Weekly Total By Route
Bohannon	0	266	**266**
Medical Center	36	706	**742**
MCH	198	0	**198**
Line N	0	15	**15**
Line O	0	24	**24**
Line P	0	1213	**1213**
Research Park	0	579	**579**
Line S	0	69	**69**
Shopping Express	213	253	**466**
Line X	0	2193	**2193**
Line Y	0	2244	**2244**
Total By Day	**447**	**7562**	

Combined Total:	**8009**

BOH	13215
MC	36161
MCH	198
N	2506
O	2263
P	56137
RP	26218
S	3307
SE	29127
X	107228
Y	109936
Total:	**386296**

6/1 - 6/5	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon			225	193	171	0	0	**589**
Medical Center			719	752	762	0	0	**2233**
MCH			0	0	0	0	0	**0**
Line N			27	38	34	28	16	**99**
Line O			23	28	30	28	9	**81**
Line P			1082	1081	742	0	0	**2905**
Research Park			506	470	532	0	0	**1508**
Line S			24	73	66	0	0	**163**
Shopping Express			259	269	273	707	361	**801**
Line X			2209	2118	1859	0	0	**6186**
Line Y			2132	2042	1993	0	0	**6167**
Total By Day	**0**	**0**	**7206**	**7064**	**6462**	**763**	**386**	

Combined Total:	**20732**

6/6 - 6/12	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	252	272	271	275	193	0	0	**1263**
Medical Center	797	750	745	704	626	0	0	**3622**
MCH	0	0	0	0	0	0	0	**0**
Line N	41	38	68	64	24	23	24	**235**
Line O	21	31	25	69	10	25	33	**156**
Line P	1208	1154	1094	1109	1088	0	0	**5653**
Research Park	547	595	567	476	458	0	0	**2643**
Line S	68	73	72	75	59	0	0	**347**
Shopping Express	226	251	325	282	286	757	427	**1370**
Line X	1984	2257	2296	2167	2057	0	0	**10761**
Line Y	2081	2237	2233	2165	1909	0	0	**10625**
Total By Day	**7225**	**7658**	**7696**	**7386**	**6710**	**805**	**484**	

Combined Total:	36675

6/13 - 6/19	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	252	283	314	303	210	0	0	**1362**
Medical Center	787	929	828	836	734	0	0	**4114**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	911	959	1010	942	808	0	0	**4630**
Research Park	592	637	537	554	504	0	0	**2824**
Line S	89	51	60	92	74	0	0	**366**
Shopping Express	0	0	0	0	0	464	564	**0**
Line X	1915	2094	2037	2073	1888	0	0	**10007**
Line Y	2122	2092	2078	1962	1828	0	0	**10082**
Total By Day	**6668**	**7045**	**6864**	**6762**	**6046**	**464**	**564**	

Combined Total:	33385

6/20 - 6/26	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	258	269	295	268	273	0	0	**1363**
Medical Center	872	680	968	873	991	0	0	**4384**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	1074	1019	1227	1205	1020	0	0	**5545**
Research Park	607	657	588	593	501	0	0	**2946**
Line S	62	41	71	70	46	0	0	**290**
Shopping Express	0	0	0	0	0	617	318	**0**
Line X	2021	2213	2195	2192	2286	0	0	**10907**
Line Y	2303	2396	2344	2388	2258	0	0	**11689**
Total By Day	**7197**	**7275**	**7688**	**7589**	**7375**	**617**	**318**	

Combined Total:	37124

6/27 - 6/30	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	299	274	209	302				**1084**
Medical Center	854	963	917	908				**3642**
MCH	0	0	0	0				**0**
Line N	0	0	0	0				**0**
Line O	0	0	0	0				**0**
Line P	1030	1103	1051	1240				**4424**
Research Park	646	626	557	431				**2260**
Line S	61	63	65	61				**250**
Shopping Express	0	0	0	0				**0**
Line X	2254	2123	2148	2375				**8900**
Line Y	2451	2515	2522	2154				**9642**
Total By Day	**7595**	**7667**	**7469**	**7471**	**0**	**0**	**0**	

Combined Total:	**30202**

BOH	5661
MC	17995
MCH	0
N	425
O	332
P	23157
RP	12181
S	1416
SE	6386
X	46761
Y	48205
Total:	**162519**

7/1 - 7/3	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon					247	0	0	**247**
Medical Center					779	0	0	**779**
MCH					0	0	0	**0**
Line N					0	0	0	**0**
Line O					0	0	0	**0**
Line P					980	0	0	**980**
Research Park					430	0	0	**430**
Line S					47	0	0	**47**
Shopping Express					0	759	174	**0**
Line X					2172	0	0	**2172**
Line Y					1937	0	0	**1937**
Total By Day	**0**	**0**	**0**	**0**	**6592**	**759**	**174**	

Combined Total:	**6592**

7/4 - 7/10	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	0	291	308	263	248	0	0	**1110**
Medical Center	35	653	781	850	883	0	0	**3202**
MCH	188	0	0	0	0	0	0	**188**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	0	1106	1017	1001	1011	0	0	**4135**
Research Park	0	547	602	544	505	0	0	**2198**
Line S	0	67	67	65	69	0	0	**268**
Shopping Express	274	0	0	0	0	475	328	**274**
Line X	0	2257	2377	2216	2295	0	0	**9145**
Line Y	0	2263	2130	2122	2152	0	0	**8667**
Total By Day	**497**	**7184**	**7282**	**7061**	**7163**	**475**	**328**	

Combined Total:	29187

7/11 - 7/17	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	268	294	295	293	287	0	0	**1437**
Medical Center	765	961	838	872	929	0	0	**4365**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	1010	1110	1125	1127	995	0	0	**5367**
Research Park	591	662	442	584	429	0	0	**2708**
Line S	62	59	76	93	63	0	0	**353**
Shopping Express	0	0	0	0	0	435	161	**0**
Line X	2105	2052	1832	2442	2124	0	0	**10555**
Line Y	2187	2278	2230	2215	2292	0	0	**11202**
Total By Day	**6988**	**7416**	**6838**	**7626**	**7119**	**435**	**161**	

Combined Total:	35987

7/18 - 7/24	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	314	319	310	289	237	0	0	**1469**
Medical Center	802	797	783	694	764	0	0	**3840**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	1044	1058	1077	1046	1128	0	0	**5353**
Research Park	592	609	579	589	475	0	0	**2844**
Line S	56	83	73	72	75	0	0	**359**
Shopping Express	0	0	0	0	0	482	208	**0**
Line X	2310	2375	1694	2399	2368	0	0	**11146**
Line Y	2171	2446	2550	2258	2203	0	0	**11628**
Total By Day	**7289**	**7687**	**7066**	**7347**	**7250**	**482**	**208**	

Combined Total:	36639

7/25 - 7/31	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	272	257	254	243	266	0	0	**1292**
Medical Center	806	831	772	920	840	0	0	**4169**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	1036	1166	1238	1075	1040	0	0	**5555**
Research Park	527	581	530	604	458	0	0	**2700**
Line S	73	62	66	77	45	0	0	**323**
Shopping Express	0	0	0	0	0	185	306	**491**
Line X	2187	2253	2278	2400	2266	0	0	**11384**
Line Y	2229	2389	2263	2404	2101	0	0	**11386**
Total By Day	**7130**	**7539**	**7401**	**7723**	**7016**	**185**	**306**	

Combined Total:	**37300**

BOH	5555
MC	16355
MCH	188
N	0
O	0
P	21390
RP	10880
S	1350
SE	3787
X	44402
Y	44820
Total:	**148727**

8/1 - 8/7	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	291	279	289	290	267	0	0	**1416**
Medical Center	819	969	693	834	703	0	0	**4018**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	780	1061	1252	1027	1111	0	0	**5231**
Research Park	269	235	265	249	197	0	0	**1215**
Line S	101	84	72	69	55	0	0	**381**
Shopping Express	0	0	0	0	0	136	236	**0**
Line X	2150	2198	1641	2309	2206	0	0	**10504**
Line Y	2242	2347	2366	2293	2171	0	0	**11419**
Total By Day	**6652**	**7173**	**6578**	**7071**	**6710**	**136**	**236**	

Combined Total:	34184

8/8 - 8/14	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	252	304	210	297	295	0	0	**1358**
Medical Center	793	841	891	840	798	0	0	**4163**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	976	578	1070	888	893	0	0	**4405**
Research Park	256	275	261	260	219	0	0	**1271**
Line S	49	77	79	56	69	0	0	**330**
Shopping Express	0	0	0	0	0	156	232	**0**
Line X	2053	2081	2201	2188	1960	0	0	**10483**
Line Y	2220	2388	2346	2326	1881	0	0	**11161**
Total By Day	**6599**	**6544**	**7058**	**6855**	**6115**	**156**	**232**	

Combined Total:	33171

8/15 - 8/21	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	271	278	282	181	224	0	0	**1236**
Medical Center	770	863	806	745	738	0	0	**3922**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	939	999	938	991	881	0	0	**4748**
Research Park	238	284	256	268	187	0	0	**1233**
Line S	71	59	68	66	69	0	0	**333**
Shopping Express	0	0	0	0	0	189	228	**0**
Line X	1631	1668	2162	1946	1898	0	0	**9305**
Line Y	2115	2136	2366	1955	1594	0	0	**10166**
Total By Day	**6035**	**6287**	**6878**	**6152**	**5591**	**189**	**228**	

Combined Total:	30943

8/22 - 8/28	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	230	203	250	245	256	0	0	**1184**
Medical Center	742	886	820	850	858	0	0	**4156**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	903	944	967	979	835	0	0	**4628**
Research Park	279	239	265	229	182	0	0	**1194**
Line S	68	77	44	60	52	0	0	**301**
Shopping Express	0	0	0	0	0	140	24	**0**
Line X	1896	2065	1874	1999	1923	0	0	**9757**
Line Y	2078	1825	1940	2002	1944	0	0	**9789**
Total By Day	**6196**	**6239**	**6160**	**6364**	**6050**	**140**	**24**	

Combined Total:	31009

8/29 - 8/31	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	302	244	268					**814**
Medical Center	745	700	580					**2025**
MCH	0	0	0					**0**
Line N	0	0	0					**0**
Line O	0	0	0					**0**
Line P	922	912	795					**2629**
Research Park	249	245	249					**743**
Line S	81	74	74					**229**
Shopping Express	0	0	0					**0**
Line X	1709	1688	1814					**5211**
Line Y	2070	2002	2049					**6121**
Total By Day	**6078**	**5865**	**5829**	**0**	**0**	**0**	**0**	

Combined Total:	**17772**

BOH	6008
MC	18284
MCH	0
N	0
O	0
P	21641
RP	5656
S	1574
SE	1341
X	45260
Y	48656
Total:	**148420**

9/1 - 9/4	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon				205	245	0	0	**450**
Medical Center				669	781	0	0	**1450**
MCH				0	0	0	0	**0**
Line N				0	0	0	0	**0**
Line O				0	0	0	0	**0**
Line P				747	832	0	0	**1579**
Research Park				504	425	0	0	**929**
Line S				75	50	0	0	**125**
Shopping Express				0	0	0	0	**0**
Line X				1795	1557	0	0	**3352**
Line Y				1943	1621	0	0	**3564**
Total By Day	**0**	**0**	**0**	**5938**	**5511**	**0**	**0**	

Combined Total:	**11449**

9/5 - 9/11	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	0	272	259	230	245	0	0	**1006**
Medical Center	22	2852	918	792	796	0	0	**5380**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	0	0	**0**
Line O	0	0	0	0	0	0	0	**0**
Line P	0	897	927	941	909	0	0	**3674**
Research Park	0	506	550	563	411	0	0	**2030**
Line S	0	65	68	60	52	0	0	**245**
Shopping Express	133	0	0	0	0	277	354	**133**
Line X	0	1562	1802	1772	1761	0	0	**6897**
Line Y	0	2124	2014	1851	1710	0	0	**7699**
Total By Day	**155**	**8278**	**6538**	**6209**	**5884**	**277**	**354**	

*Labor day

Combined Total:	27064

9/12 - 9/18	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	291	293	244	267	231	0	0	**1326**
Medical Center	742	889	855	748	700	0	0	**3934**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	0	0	0	0	4	13	**0**
Line O	0	0	0	0	0	15	12	**0**
Line P	944	834	964	970	914	0	0	**4626**
Research Park	505	486	519	555	434	0	0	**2499**
Line S	63	66	74	112	54	0	0	**369**
Shopping Express	0	0	0	0	0	354	473	**0**
Line X	1715	1841	1854	1736	1714	0	0	**8860**
Line Y	1898	1930	2112	1998	1874	0	0	**9812**
Total By Day	**6158**	**6339**	**6622**	**6386**	**5921**	**373**	**498**	

Combined Total:	31426

9/19 - 9/25	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	192	186	220	287	238	0	0	**1123**
Medical Center	836	883	858	885	720	0	0	**4182**
MCH	0	0	0	0	0	0	0	**0**
Line N	18	13	9	23	75	44	24	**138**
Line O	5	3	14	19	75	47	10	**116**
Line P	1049	949	1014	1009	962	0	0	**4983**
Research Park	495	399	397	471	409	0	0	**2171**
Line S	59	67	58	54	52	0	0	**290**
Shopping Express	179	155	202	153	246	672	728	**935**
Line X	1959	2151	2079	2024	2001	0	0	**10214**
Line Y	2023	2085	1950	1731	1864	0	0	**9653**
Total By Day	**6815**	**6891**	**6801**	**6656**	**6642**	**763**	**762**	

Combined Total:	33805

9/26 - 9/30	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	175	252	265	248	295			**1235**
Medical Center	820	907	917	859	827			**4330**
MCH	0	0	0	0	0			**0**
Line N	0	15	12	49	110			**186**
Line O	14	23	12	32	97			**178**
Line P	1070	1123	1149	1110	1069			**5521**
Research Park	458	446	393	461	361			**2119**
Line S	60	93	64	56	59			**332**
Shopping Express	179	216	173	196	319			**1083**
Line X	1966	1919	1583	1994	1899			**9361**
Line Y	2155	2278	2036	1968	2059			**10496**
Total By Day	**6897**	**7272**	**6604**	**6973**	**7095**	**0**	**0**	

Combined Total:	**34841**

BOH	5140
MC	19276
MCH	0
N	409
O	378
P	20383
RP	9748
S	1361
SE	5009
X	38684
Y	41224
Total:	**141612**

10/1 - 10/2	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon						0	0	**0**
Medical Center						0	0	**0**
MCH						0	0	**0**
Line N						100	19	**0**
Line O						63	24	**0**
Line P						0	0	**0**
Research Park						0	0	**0**
Line S						0	0	**0**
Shopping Express						789	582	**0**
Line X						0	0	**0**
Line Y						0	0	**0**
Total By Day	**0**	**0**	**0**	**0**	**0**	**952**	**625**	

Combined Total:	0

10/3 - 10/9	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	243	295	230	276	164	0	0	**1208**
Medical Center	870	832	1008	801	803	0	0	**4314**
MCH	0	0	0	0	0	0	0	**0**
Line N	3	3	8	0	40	57	12	**54**
Line O	12	6	25	26	67	11	11	**136**
Line P	1058	894	1120	1098	1016	0	0	**5186**
Research Park	456	519	543	504	387	0	0	**2409**
Line S	74	62	84	84	67	0	0	**371**
Shopping Express	162	186	142	168	151	643	525	**809**
Line X	1766	2222	1420	2030	1930	0	0	**9368**
Line Y	1985	1957	2099	2091	2056	0	0	**10188**
Total By Day	**6629**	**6976**	**6679**	**7078**	**6681**	**711**	**548**	

Combined Total:	34043

10/10 - 10/16	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	236	262	250	230	255	0	0	**1233**
Medical Center	802	969	895	784	912	0	0	**4362**
MCH	0	0	0	0	0	0	0	**0**
Line N	0	3	0	43	25	56	16	**71**
Line O	19	20	21	24	37	0	8	**121**
Line P	1135	1162	1158	1057	1156	0	0	**5668**
Research Park	479	527	504	475	528	0	0	**2513**
Line S	63	69	74	63	60	0	0	**329**
Shopping Express	205	151	145	175	205	731	533	**881**
Line X	1910	1950	1983	2052	2116	0	0	**10011**
Line Y	2015	2009	2006	2182	2387	0	0	**10599**
Total By Day	**6864**	**7122**	**7036**	**7085**	**7681**	**787**	**557**	

Combined Total:	35788

10/17 - 10/23	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	285	303	326	273	245	0	0	**1432**
Medical Center	949	857	903	878	846	0	0	**4433**
MCH	0	0	0	0	0	0	0	**0**
Line N	2	0	31	18	46	33	11	**97**
Line O	9	10	41	69	0	31	11	**129**
Line P	1082	1116	1131	1161	1006	0	0	**5496**
Research Park	493	480	474	471	322	0	0	**2240**
Line S	52	64	74	63	65	0	0	**318**
Shopping Express	165	137	205	216	320	462	480	**1043**
Line X	2012	2107	2055	1958	739	0	0	**8871**
Line Y	2067	1957	2044	2073	2084	0	0	**10225**
Total By Day	**7116**	**7031**	**7284**	**7180**	**5673**	**526**	**502**	

Combined Total:	34284

10/24 - 10/30	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	264	295	300	300	271	0	0	**1430**
Medical Center	780	768	822	920	939	0	0	**4229**
MCH	0	0	0	0	0	0	0	**0**
Line N	32	19	17	35	34	19	14	**170**
Line O	20	24	0	22	29	31	13	**139**
Line P	1071	1463	1166	1363	1076	0	0	**6139**
Research Park	474	481	506	487	443	0	0	**2391**
Line S	100	77	67	80	71	0	0	**395**
Shopping Express	214	234	291	163	282	393	382	**1959**
Line X	2028	2045	2170	2133	2051	0	0	**10427**
Line Y	1843	2337	2316	2275	2017	0	0	**10788**
Total By Day	**6826**	**7743**	**7655**	**7778**	**7213**	**443**	**409**	

Combined Total:	38067

31-Oct	Monday	Weekly Total By Route
Bohannon	296	**296**
Medical Center	916	**916**
MCH	0	**0**
Line N	23	**23**
Line O	23	**23**
Line P	1186	**1186**
Research Park	630	**630**
Line S	69	**69**
Shopping Express	182	**182**
Line X	1845	**1845**
Line Y	2055	**2055**
Total By Day	**7225**	

Combined Total:	**7225**

BOH	5599
MC	18254
MCH	0
N	719
O	707
P	23675
RP	10183
S	1482
SE	9619
X	40522
Y	43855
Total:	**154615**

11/1 - 11/6	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon		279	330	274	243	0	0	**1126**
Medical Center		810	996	944	803	0	0	**3553**
MCH								**0**
Line N		24	28	31	53	26	19	**136**
Line O		40	29	19	50	15	7	**138**
Line P		1235	1162	1071	1084	0	0	**4552**
Research Park		548	503	525	447	0	0	**2023**
Line S		71	70	77	59	0	0	**277**
Shopping Express		221	231	202	251	537	464	**905**
Line X		2117	2018	2097	2016	0	0	**8248**
Line Y		2034	2028	2229	2101	0	0	**8392**
Total By Day	**0**	**7379**	**7395**	**7469**	**7107**	**578**	**490**	

Combined Total:	29350

11/7 - 11/13	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	324	183	288	181	242	0	0	**1218**
Medical Center	922	960	962	988	645	0	0	**4477**
MCH								**0**
Line N	33	31	37	18	51	10	19	**170**
Line O	44	27	23	39	42	54	7	**175**
Line P	1284	1216	1147	1147	1239	0	0	**6033**
Research Park	572	517	555	521	396	0	0	**2561**
Line S	70	60	75	67	60	0	0	**332**
Shopping Express	225	232	234	178	258	536	458	**1127**
Line X	2049	2064	2041	2025	2094	0	0	**10273**
Line Y	1971	2238	2252	2061	2353	0	0	**10875**
Total By Day	**7494**	**7528**	**7614**	**7225**	**7380**	**600**	**484**	

Combined Total:	37241

11/14 - 11/20	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	227	254	331	298	254	0	0	**1364**
Medical Center	946	958	974	866	822	0	0	**4566**
MCH								**0**
Line N	31	27	27	41	37	14	21	**163**
Line O	27	28	33	56	74	29	11	**218**
Line P	1219	1238	1171	1106	1065	0	0	**5799**
Research Park	560	552	510	540	451	0	0	**2613**
Line S	80	85	75	77	47	0	0	**364**
Shopping Express	188	239	226	215	245	485	444	**1113**
Line X	2060	2187	2070	2147	2168	0	0	**10632**
Line Y	2161	2230	2219	2272	2005	0	0	**10887**
Total By Day	**7499**	**7798**	**7636**	**7618**	**7168**	**528**	**476**	

Combined Total:	37719

11/21 - 11/27	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	257	250	165	0	0	0	0	**672**
Medical Center	927	890	647	0	0	0	0	**2464**
MCH				141	247			**388**
Line N	39	13	25	8	0	19	9	**85**
Line O	20	19	14	4	0	10	18	**57**
Line P	858	894	493	0	0	0	0	**2245**
Research Park	499	521	264	0	0	0	0	**1284**
Line S	71	64	41	0	0	0	0	**176**
Shopping Express	226	191	0	0	253	447	385	**670**
Line X	2020	1983	1554	0	0	0	0	**5557**
Line Y	1940	2180	1554	0	0	0	0	**5674**
Total By Day	**6857**	**7005**	**4757**	**153**	**500**	**476**	**412**	

Combined Total:	19272

11/28 - 11/30	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Weekly Total By Route
Bohannon	239	191	272					**702**
Medical Center	883	973	949					**2805**
MCH								**0**
Line N	16	29	19					**64**
Line O	22	28	31					**81**
Line P	1086	1124	1048					**3258**
Research Park	516	415	514					**1445**
Line S	56	71	61					**188**
Shopping Express	226	229	219					**674**
Line X	2023	2120	2197					**6340**
Line Y	2154	2131	2167					**6452**
Total By Day	**7221**	**7311**	**7477**	**0**	**0**	**0**	**0**	

Combined Total:	**22009**

BOH	5082
MC	17865
MCH	388
N	755
O	820
P	21887
RP	9926
S	1337
SE	8245
X	41050
Y	42280
Total:	**149635**

12/1 - 12/2	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon				282	263	**545**
Medical Center				824	935	**1759**
MCH						**0**
Line N				22	34	**56**
Line O				38	45	**83**
Line P				1001	1029	**2030**
Research Park				557	433	**990**
Line S				71	59	**130**
Shopping Express				204	249	**453**
Line X				2143	2168	**4311**
Line Y				2260	2146	**4406**
Total By Day	**0**	**0**	**0**	**7402**	**7361**	

Combined Total:	**14763**

12/5 - 12/9	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	251	319	235	233	294	**1332**
Medical Center	872	952	869	916	806	**4415**
MCH						**0**
Line N	13	12	32	19	31	**107**
Line O	17	21	36	15	32	**121**
Line P	1205	1090	1179	1255	1126	**5855**
Research Park	506	535	493	562	445	**2541**
Line S	70	59	70	65	71	**335**
Shopping Express	270	206	210	223	225	**1134**
Line X	1950	2109	1944	2218	1946	**10167**
Line Y	2163	1981	2256	2130	2184	**10714**
Total By Day	**7317**	**7284**	**7324**	**7636**	**7160**	

Combined Total:	36721

12/12 - 12/16	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	290	320	306	234	191	**1341**
Medical Center	892	879	742	1016	812	**4341**
MCH						**0**
Line N	12	30	32	46	36	**156**
Line O	14	27	35	44	35	**155**
Line P	1097	1195	1074	1078	947	**5391**
Research Park	549	526	569	508	440	**2592**
Line S	75	60	69	75	78	**357**
Shopping Express	172	211	199	274	215	**1071**
Line X	2114	2302	2040	2230	1903	**10589**
Line Y	2103	1930	1930	2329	1895	**10187**
Total By Day	**7318**	**7480**	**6996**	**7834**	**6552**	

Combined Total:	36180

12/19 - 12/23	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	211	113	173	121	66	**684**
Medical Center	781	616	762	589	324	**3072**
MCH			1182	8086	793	**10061**
Line N	6	5				**11**
Line O	18	8				**26**
Line P	878	601				**1479**
Research Park	478	393	267	212	94	**1444**
Line S	49	42				**91**
Shopping Express	155	152	132	121	123	**683**
Line X	1502	1557				**3059**
Line Y	1652	1465				**3117**
Total By Day	**5730**	**4952**	**2516**	**9129**	**1400**	

Combined Total:	23727

12/26 - 12/30	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	25	95	82	98	80	**380**
Medical Center	35	490	533	474	316	**1848**
MCH	218	837	807	768	596	**3226**
Line N						**0**
Line O						**0**
Line P						**0**
Research Park	12	127	101	118	53	**411**
Line S						**0**
Shopping Express	68	129	105	129	139	**570**
Line X						**0**
Line Y						**0**
Total By Day	**358**	**1678**	**1628**	**1587**	**1184**	

Combined Total:	**6435**

BOH	4282
MC	15435
MCH	13287
N	330
O	385
P	14755
RP	7978
S	913
SE	3911
X	28126
Y	28424
Total:	**117826**

Attachment J

1/2 - 1/6	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	44	188	240	173	234	**879**
Medical Center	53	692	905	877	838	**3365**
MCH	205	1296	0	0	0	**1501**
Line N			10	4	4	**18**
Line O			4	6	12	**22**
Line P			836	590	865	**2291**
Research Park	13	333	514	515	435	**1810**
Line S			59	84	56	**199**
Shopping Express	103	177	129	175	164	**748**
Line X			1828	1744	1655	**5227**
Line Y			1743	1695	1720	**5158**
Total By Day	**418**	**2686**	**6268**	**5863**	**5983**	

Combined Total:	21218

1/9 - 1/13	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	297	334	285	281	296	**1493**
Medical Center	927	949	891	906	712	**4385**
MCH	0	0	0	0	0	**0**
Line N	15	22	27	27	46	**137**
Line O	15	24	15	24	58	**136**
Line P	1167	1692	1197	1288	1158	**6502**
Research Park	529	587	541	451	459	**2567**
Line S	86	59	69	78	76	**368**
Shopping Express	263	267	301	203	275	**1309**
Line X	2226	1993	2106	2129	1927	**10381**
Line Y	2263	2306	1952	2225	2419	**11165**
Total By Day	**7788**	**8233**	**7384**	**7612**	**7426**	

Combined Total:	38443

1/16 - 1/20	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon		326	320	337	296	**1279**
Medical Center	75	1002	907	923	767	**3674**
MCH	444	0	0	0	0	**444**
Line N		27	35	34	47	**143**
Line O		32	6	20	30	**88**
Line P		1209	1390	1258	1161	**5018**
Research Park	151	569	436	605	429	**2190**
Line S		72	64	69	64	**269**
Shopping Express	268	253	281	242	312	**1356**
Line X		2081	2087	2087	2145	**8400**
Line Y		2229	2326	2282	1977	**8814**
Total By Day	**938**	**7800**	**7852**	**7857**	**7228**	

Combined Total:	31675

1/23 - 1/27	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	176	291	324	256	256	**1303**
Medical Center	1029	890	786	846	819	**4370**
MCH	0	0	0	0	0	**0**
Line N	25	23	20	28	30	**126**
Line O	25	16	18	19	64	**142**
Line P	1282	1331	1364	1278	1178	**6433**
Research Park	570	540	581	526	467	**2684**
Line S	75	95	66	76	65	**377**
Shopping Express	263	262	229	241	240	**1235**
Line X	2167	2229	2101	2092	2227	**10816**
Line Y	2242	2161	2137	1991	1810	**10341**
Total By Day	**7854**	**7838**	**7626**	**7353**	**7156**	

Combined Total:	37827

1/30 - 1/31	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	318	328				**646**
Medical Center	863	905				**1768**
MCH	0	0				**0**
Line N	35	32				**67**
Line O	17	13				**30**
Line P	1277	1350				**2627**
Research Park	641	586				**1227**
Line S	76	84				**160**
Shopping Express	215	151				**366**
Line X	2033	2058				**4091**
Line Y	2089	2121				**4210**
Total By Day	**7564**	**7628**	**0**	**0**	**0**	

Combined Total:	**15192**

BOH	5600
MC	17562
MCH	1945
N	491
O	418
P	22871
RP	10478
S	1373
SE	5014
X	38915
Y	39688
Total:	**144355**

02/1 - 02/3	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon			329	326	260	**915**
Medical Center			669	918	903	**2490**
MCH			0	0	0	**0**
Line N			20	33	52	**105**
Line O			16	15	37	**68**
Line P			1350	1208	1258	**3816**
Research Park			583	556	434	**1573**
Line S			72	74	75	**221**
Shopping Express			226	222	255	**703**
Line X			2008	2149	2263	**6420**
Line Y			1983	2222	2140	**6345**
Total By Day	**0**	**0**	**7256**	**7723**	**7677**	

Combined Total:	**22656**

02/4 - 02/10	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	300	347	337	275	279	**1538**
Medical Center	818	878	881	959	829	**4365**
MCH	0	0	0	0	0	**0**
Line N	28	24	30	32	27	**141**
Line O	23	32	27	35	30	**147**
Line P	1340	1450	1322	1338	1201	**6651**
Research Park	576	573	550	587	474	**2760**
Line S	87	82	88	88	68	**413**
Shopping Express	236	228	220	290	212	**1186**
Line X	2141	2439	2342	2300	2201	**11423**
Line Y	2301	2432	2454	2254	2553	**11994**
Total By Day	**7850**	**8485**	**8251**	**8158**	**7874**	

Combined Total:	40618

02/13- 02/17	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	287	283	273	267	269	**1379**
Medical Center	911	836	868	819	846	**4280**
MCH	0	0	0	0	0	**0**
Line N	24	32	27	30	28	**141**
Line O	28	36	23	29	31	**147**
Line P	1222	1198	1184	1316	1211	**6131**
Research Park	573	568	546	573	426	**2686**
Line S	64	66	63	80	51	**324**
Shopping Express	211	184	247	233	274	**1149**
Line X	2229	2271	2177	2120	2457	**11254**
Line Y	2197	2115	2157	2255	2254	**10978**
Total By Day	**7746**	**7589**	**7565**	**7722**	**7847**	

Combined Total:	38469

02/20 - 02/24	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	107	296	292	259	259	**1213**
Medical Center	188	858	943	894	804	**3687**
MCH	0	765	0		0	**765**
Line N	0	36	27	43	22	**128**
Line O	0	26	19	27	41	**113**
Line P	0	1305	1267	1193	1073	**4838**
Research Park	86	600	588	555	466	**2295**
Line S	0	86	85	72	45	**288**
Shopping Express	254	248	238	197	240	**1177**
Line X	0	2364	2252	2139	2058	**8813**
Line Y	0	2330	2257	2236	1867	**8690**
Total By Day	**635**	**8914**	**7968**	**7615**	**6875**	

Combined Total:	32007

02/27 - 02/28	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	279	273				**552**
Medical Center	851	864				**1715**
MCH	0	0				**0**
Line N	20	28				**48**
Line O	25	24				**49**
Line P	1195	1232				**2427**
Research Park	541	520				**1061**
Line S	72	85				**157**
Shopping Express	201	255				**456**
Line X	2151	2194				**4345**
Line Y	2219	2399				**4618**
Total By Day	**7554**	**7874**	**0**	**0**	**0**	

Combined Total:	**15428**

BOH	5597
MC	16537
MCH	765
N	563
O	524
P	23863
RP	10375
S	1403
SE	4671
X	42255
Y	42625
Total:	**149178**

03/1 - 03/3	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon			280	266	213	**759**
Medical Center			861	966	661	**2488**
MCH						**0**
Line N			24	47	41	**112**
Line O			23	85	38	**146**
Line P			1346	1256	1157	**3759**
Research Park			548	688	464	**1700**
Line S			75	53	65	**193**
Shopping Express			219	208	247	**674**
Line X			2175	2190	2053	**6418**
Line Y			2176	2121	2118	**6415**
Total By Day	**0**	**0**	**7727**	**7880**	**7057**	

Combined Total:	22664

03/6 - 03/10	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	287	310	186	267	209	**1259**
Medical Center	872	947	924	914	818	**4475**
MCH						**0**
Line N	31	27	24	51	70	**203**
Line O	22	28	30	48	43	**171**
Line P	1301	1216	1272	1301	1192	**6282**
Research Park	658	507	583	553	439	**2740**
Line S	72	87	79	62	65	**365**
Shopping Express	244	267	238	215	285	**1249**
Line X	2105	2138	2038	2281	2085	**10647**
Line Y	2150	2228	2579	2334	2107	**11398**
Total By Day	**7742**	**7755**	**7953**	**8026**	**7313**	

Combined Total:	38789

03/13 - 03/17	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	206	228	281	276	233	**1224**
Medical Center	856	887	935	880	815	**4373**
MCH						**0**
Line N	32	35	37	44	52	**200**
Line O	31	26	31	25	39	**152**
Line P	1230	1123	1314	1256	1100	**6023**
Research Park	531	571	499	537	410	**2548**
Line S	67	64	60	67	57	**315**
Shopping Express	237	226	297	209	233	**1202**
Line X	2005	1491	2119	2129	2042	**9786**
Line Y	2019	2074	2009	2079	1956	**10137**
Total By Day	**7214**	**6725**	**7582**	**7502**	**6937**	

Combined Total:	35960

03/20 - 03/24	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	231	289	258	265	297	**1340**
Medical Center	851	864	985	857	869	**4426**
MCH						**0**
Line N	35	31	45	51	34	**196**
Line O	32	36	32	40	22	**162**
Line P	1336	1261	1184	1119	1088	**5988**
Research Park	398	579	544	451	364	**2336**
Line S	73	73	76	55	66	**343**
Shopping Express	269	284	271	240	264	**1328**
Line X	1623	2316	2199	2207	2229	**10574**
Line Y	2057	2185	2132	2149	1975	**10498**
Total By Day	**6905**	**7918**	**7726**	**7434**	**7208**	

Combined Total:	37191

03/27 - 03/31	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	234	254	255	263	233	**1239**
Medical Center	931	914	910	887	755	**4397**
MCH						**0**
Line N	23	32	27	43	42	**167**
Line O	16	19	29	24	40	**128**
Line P	1115	1023	1113	1063	983	**5297**
Research Park	481	529	551	517	413	**2491**
Line S	80	70	68	70	52	**340**
Shopping Express	312	225	296	209	247	**1289**
Line X	1946	2153	2072	2071	1982	**10224**
Line Y	2050	1943	1923	1985	1902	**9803**
Total By Day	**7188**	**7162**	**7244**	**7132**	**6649**	

Combined Total:	**35375**

BOH	5821
MC	20159
MCH	0
N	878
O	759
P	27349
RP	11815
S	1556
SE	5742
X	47649
Y	48251
Total:	**169979**

04/3 - 04/7	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	233	312	288	248	250	**1331**
Medical Center	792	868	885	943	788	**4276**
MCH						**0**
Line N	27	65	28	31	40	**191**
Line O	34	35	37	14	32	**152**
Line P	1117	1115	1170	1261	1248	**5911**
Research Park	517	497	516	538	427	**2495**
Line S	72	79	78	88	58	**375**
Shopping Express	296	263	193	174	272	**1198**
Line X	2018	2184	2130	2252	2088	**10672**
Line Y	2237	2377	2144	2174	2151	**11083**
Total By Day	**7343**	**7795**	**7469**	**7723**	**7354**	

Combined Total:	37684

04/10 - 04/14	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	264	274	235	196	203	**1172**
Medical Center	761	765	940	876	757	**4099**
MCH						**0**
Line N	32	20	23	71	63	**209**
Line O	42	19	14	20	0	**95**
Line P	1156	1151	1237	1279	1042	**5865**
Research Park	583	566	599	583	421	**2752**
Line S	66	60	68	73	42	**309**
Shopping Express	226	215	177	197	292	**1107**
Line X	1959	2103	2123	2020	1972	**10177**
Line Y	2025	1880	1919	2036	1769	**9629**
Total By Day	**7114**	**7053**	**7335**	**7351**	**6561**	

Combined Total:	35414

04/17 - 04/21	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	287	311	288	242	221	**1349**
Medical Center	833	853	951	779	807	**4223**
MCH						**0**
Line N	26	32	36	18	44	**156**
Line O	12	20	9	17	16	**74**
Line P	1251	1189	1232	1179	1032	**5883**
Research Park	557	568	575	570	445	**2715**
Line S	73	62	78	62	64	**339**
Shopping Express	193	263	201	239	259	**1155**
Line X	1961	2187	2118	1998	1897	**10161**
Line Y	2009	2180	2091	2069	1932	**10281**
Total By Day	**7202**	**7665**	**7579**	**7173**	**6717**	

Combined Total:	36336

04/24 - 04/28	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	265	257	262	306	265	**1355**
Medical Center	884	950	851	828	769	**4282**
MCH						**0**
Line N	16	17	15	35	58	**141**
Line O	20	38	20	26	17	**121**
Line P	1219	1141	1161	1091	991	**5603**
Research Park	593	574	466	600	540	**2773**
Line S	69	78	74	72	57	**350**
Shopping Express	170	223	162	207	203	**965**
Line X	1863	1845	1808	2059	1976	**9551**
Line Y	2049	2060	2136	2117	2122	**10484**
Total By Day	**7148**	**7183**	**6955**	**7341**	**6998**	

Combined Total:	**35625**

BOH	5207
MC	16880
MCH	0
N	697
O	442
P	23262
RP	10735
S	1373
SE	4425
X	40561
Y	41477
Total:	**145059**

05/1 - 05/5	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	278	343	282	259	267	**1429**
Medical Center	908	539	690	922	720	**3779**
MCH						**0**
Line N	29	10	34	33	28	**134**
Line O	16	25	24	35	35	**135**
Line P	1112	1165	1266	1176	996	**5715**
Research Park	568	509	534	508	451	**2570**
Line S	60	68	76	66	62	**332**
Shopping Express	151	175	166	160	168	**820**
Line X	1829	1937	1937	2127	1942	**9772**
Line Y	2168	2083	2101	2089	1952	**10393**
Total By Day	**7119**	**6854**	**7110**	**7375**	**6621**	

Combined Total:	35079

05/8 - 05/12	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	284	281	274	279	238	**1356**
Medical Center	900	841	939	836	759	**4275**
MCH						**0**
Line N	19	33	31	36	16	**135**
Line O	38	27	39	27	55	**186**
Line P	1197	1068	1184	1155	1049	**5653**
Research Park	552	502	507	547	430	**2538**
Line S	80	80	93	83	60	**396**
Shopping Express	169	203	142	152	192	**858**
Line X	2132	1991	2046	2102	1991	**10262**
Line Y	2037	2138	1827	2301	1751	**10054**
Total By Day	**7408**	**7164**	**7082**	**7518**	**6541**	

Combined Total:	35713

05/15 - 05/19	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	277	245	307	270	254	**1353**
Medical Center	943	883	887	865	674	**4252**
MCH						**0**
Line N	46	38	23	24	42	**173**
Line O	36	35	27	26	3	**127**
Line P	1109	1031	1039	1105	1168	**5452**
Research Park	591	542	554	562	414	**2663**
Line S	64	66	64	68	49	**311**
Shopping Express	175	135	165	169	136	**780**
Line X	2014	2033	1930	2063	1942	**9982**
Line Y	1601	2013	2053	2116	2159	**9942**
Total By Day	**6856**	**7021**	**7049**	**7268**	**6841**	

Combined Total:	35035

05/22 - 05/22	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	262	293	307	299	231	**1392**
Medical Center	804	881	851	784	710	**4030**
MCH						**0**
Line N	29	23	38	31	20	**141**
Line O	21	26	40	32	35	**154**
Line P	1233	1181	1239	1134	966	**5753**
Research Park	550	589	571	576	375	**2661**
Line S	64	93	59	59	52	**327**
Shopping Express	158	180	164	139	141	**782**
Line X	1981	1789	2014	1979	1854	**9617**
Line Y	2156	2077	1910	2045	1831	**10019**
Total By Day	**7258**	**7132**	**7193**	**7078**	**6215**	

Combined Total:	34876

05/29 - 05/31	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon		306	291			**597**
Medical Center	76	794	825			**1695**
MCH	108					**108**
Line N		30	31			**61**
Line O		21	14			**35**
Line P		1094	1127			**2221**
Research Park		557	546			**1103**
Line S		65	63			**128**
Shopping Express	211	186	155			**552**
Line X		1871	1835			**3706**
Line Y		1895	1880			**3775**
Total By Day	**395**	**6819**	**6767**	**0**	**0**	

Combined Total:	**13981**

BOH	6127
MC	18031
MCH	108
N	644
O	637
P	24794
RP	11535
S	1494
SE	3792
X	43339
Y	44183
Total:	**154684**

*Memorial Day

06/1 - 06/2	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon				259	254	**513**
Medical Center				811	443	**1254**
MCH						**0**
Line N				24	50	**74**
Line O				39	46	**85**
Line P				1123	989	**2112**
Research Park				600	488	**1088**
Line S				61	47	**108**
Shopping Express				170	153	**323**
Line X				2069	1906	**3975**
Line Y				1951	1906	**3857**
Total By Day	**0**	**0**	**0**	**7107**	**6282**	

Combined Total:	13389

06/05 - 06/09	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	254	279	316	286	218	**1353**
Medical Center	818	893	796	818	737	**4062**
MCH						**0**
Line N	20	16	26	24	23	**109**
Line O	29	26	12	21	16	**104**
Line P	1143	1175	1098	1158	1021	**5595**
Research Park	604	568	585	558	509	**2824**
Line S	68	68	82	75	65	**358**
Shopping Express	167	140	161	156	181	**805**
Line X	1949	1873	1885	1742	1798	**9247**
Line Y	1950	1887	1961	1769	2012	**9579**
Total By Day	**7002**	**6925**	**6922**	**6607**	**6580**	

Combined Total:	34036

06/12 - 06/16	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	246	292	266	275	232	**1311**
Medical Center	891	777	874	902	824	**4268**
MCH						**0**
Line N	32	54	37	45	23	**191**
Line O	54	47	42	62	19	**224**
Line P	1088	1034	1092	991	948	**5153**
Research Park	607	605	617	614	559	**3002**
Line S	80	75	73	67	65	**360**
Shopping Express	152	193	143	180	213	**881**
Line X	2098	2071	1558	1923	1908	**9558**
Line Y	2076	2018	2020	1889	1989	**9992**
Total By Day	**7324**	**7166**	**6722**	**6948**	**6780**	

Combined Total:	34940

06/19 - 06/23	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	256	225	266	239	188	**1174**
Medical Center	745	755	807	742	740	**3789**
MCH						**0**
Line N						**0**
Line O						**0**
Line P	999	894	978	917	912	**4700**
Research Park	607	611	547	614	465	**2844**
Line S	95	96	76	85	85	**437**
Shopping Express						**0**
Line X	2231	2169	2140	2256	2116	**10912**
Line Y	1949	2136	1982	2059	1729	**9855**
Total By Day	**6882**	**6886**	**6796**	**6912**	**6235**	

Combined Total:	33711

06/26 - 06/30	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	193	226	265	209	165	**1058**
Medical Center	770	798	735	784	559	**3646**
MCH						**0**
Line N						**0**
Line O						**0**
Line P	1083	974	1166	1072	997	**5292**
Research Park	599	567	546	528	458	**2698**
Line S	86	91	94	89	67	**427**
Shopping Express						**0**
Line X	2212	2330	2003	2086	2261	**10892**
Line Y	1829	2087	2041	2369	2019	**10345**
Total By Day	**6772**	**7073**	**6850**	**7137**	**6526**	

Combined Total:	**34358**

***Summer Closure**

BOH	5409
MC	17019
MCH	0
N	374
O	413
P	22852
RP	12456
S	1690
SE	2009
X	44584
Y	43628
Total:	**150434**

07/3 - 07/7	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	97		228	231	220	**776**
Medical Center	433	37	763	752	601	**2586**
MCH		110				**110**
Line N						**0**
Line O						**0**
Line P	665		1027	1030	931	**3653**
Research Park	201		526	534	477	**1738**
Line S	33		74	69	73	**249**
Shopping Express						**0**
Line X	1672		2449	2432	2289	**8842**
Line Y	1398		2189	1925	1950	**7462**
Total By Day	**4499**	**147**	**7256**	**6973**	**6541**	

Combined Total:	25416

07/10 -07/14	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	202	243	253	253	241	**1192**
Medical Center	750	749	816	774	613	**3702**
MCH						**0**
Line N						**0**
Line O						**0**
Line P	972	1072	1013	930	1081	**5068**
Research Park	597	599	595	559	444	**2794**
Line S	101	86	78	101	65	**431**
Shopping Express						**0**
Line X	2429	2806	2437	2496	2288	**12456**
Line Y	1955	2144	2093	2129	1866	**10187**
Total By Day	**7006**	**7699**	**7285**	**7242**	**6598**	

Combined Total:	35830

07/17 - 07/21	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	270	252	257	225	211	**1215**
Medical Center	736	688	742	753	721	**3640**
MCH						**0**
Line N						**0**
Line O						**0**
Line P	1129	1152	1131	1169	1014	**5595**
Research Park	585	600	545	576	463	**2769**
Line S	85	83	93	79	90	**430**
Shopping Express						**0**
Line X	2322	2415	2406	2523	2387	**12053**
Line Y	1817	2092	1979	2076	2116	**10080**
Total By Day	**6944**	**7282**	**7153**	**7401**	**7002**	

Combined Total:	35782

07/24 - 07/28	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	225	248	271	220	251	**1215**
Medical Center	730	769	778	746	650	**3673**
MCH						**0**
Line N						**0**
Line O						**0**
Line P	1076	1241	1140	1106	931	**5494**
Research Park	593	590	576	553	469	**2781**
Line S	86	97	84	73	76	**416**
Shopping Express						**0**
Line X	2180	2343	2309	2498	2077	**11407**
Line Y	1835	1889	1787	2212	1932	**9655**
Total By Day	**6725**	**7177**	**6945**	**7408**	**6386**	

Combined Total:	34641

31-Jul	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	215					**215**
Medical Center	703					**703**
MCH						**0**
Line N						**0**
Line O						**0**
Line P	1100					**1100**
Research Park	558					**558**
Line S	72					**72**
Shopping Express						**0**
Line X	2218					**2218**
Line Y	1780					**1780**
Total By Day	**6646**	**0**	**0**	**0**	**0**	

Combined Total:	**6646**

***Summer Closure**

***4th of July**

BOH	**4613**
MC	**14304**
MCH	**110**
N	**0**
O	**0**
P	**20910**
RP	**10640**
S	**1598**
SE	**0**
X	**46976**
Y	**39164**
Total:	**138315**

08/1 - 08/4	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon		228	255	260	240	**983**
Medical Center		683	786	720	689	**2878**
MCH		0	0	0	0	**0**
Line N						**0**
Line O						**0**
Line P		915	962	1090	1017	**3984**
Research Park		558	560	524	446	**2088**
Line S		93	95	88	71	**347**
Shopping Express						**0**
Line X		2332	2533	2379	2350	**9594**
Line Y		2246	2263	1963	1924	**8396**
Total By Day	**0**	**7055**	**7454**	**7024**	**6737**	

Combined Total:	28270

07/7 - 07/11	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	238	251	193	269	227	**1178**
Medical Center	697	664	714	737	900	**3712**
MCH	0	0	0	0	0	**0**
Line N						**0**
Line O						**0**
Line P	924	985	986	1071	969	**4935**
Research Park	509	595	522	501	445	**2572**
Line S	76	92	91	87	86	**432**
Shopping Express						**0**
Line X	2065	2184	2187	1533	2038	**10007**
Line Y	1833	2158	2063	2125	1858	**10037**
Total By Day	**6342**	**6929**	**6756**	**6323**	**6523**	

Combined Total:	32873

08/14 - 08/18	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	205	250	271	248	177	**1151**
Medical Center	761	717	788	753	669	**3688**
MCH	0	0	0	0	0	**0**
Line N						**0**
Line O						**0**
Line P	957	952	1040	1066	1041	**5056**
Research Park	529	532	470	516	492	**2539**
Line S	87	69	68	55	76	**355**
Shopping Express						**0**
Line X	2086	2155	2259	1998	2375	**10873**
Line Y	1606	1885	1896	1863	1987	**9237**
Total By Day	**6231**	**6560**	**6792**	**6499**	**6817**	

Combined Total:	32899

08/21 - 08/25	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	272	249	230	181	212	**1144**
Medical Center	679	716	727	732	676	**3530**
MCH	0	0	0	0	0	**0**
Line N						**0**
Line O						**0**
Line P	864	994	973	1058	1000	**4889**
Research Park	495	550	536	537	466	**2584**
Line S	74	66	67	70	69	**346**
Shopping Express						**0**
Line X	1832	1978	1970	2161	1737	**9678**
Line Y	1541	1632	1705	1847	1679	**8404**
Total By Day	**5757**	**6185**	**6208**	**6586**	**5839**	

Combined Total:	30575

08/28 - 08/31	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	265	258	262	226		**1011**
Medical Center	742	723	809	787		**3061**
MCH	0	0	0	0		**0**
Line N						**0**
Line O						**0**
Line P	931	1010	1063	1064		**4068**
Research Park	547	464	501	476		**1988**
Line S	86	80	55	66		**287**
Shopping Express						**0**
Line X	2001	2025	1507	2058		**7591**
Line Y	1663	1779	1981	1819		**7242**
Total By Day	**6235**	**6339**	**6178**	**6496**	**0**	

Combined Total:	**25248**

***Summer Closure**

BOH	5467
MC	16869
MCH	0
N	0
O	0
P	22932
RP	11771
S	1767
SE	0
X	47743
Y	43316
Total:	**149865**

1-Sep	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon					181	**181**
Medical Center					705	**705**
MCH						**0**
Line N						**0**
Line O						**0**
Line P					968	**968**
Research Park					498	**498**
Line S					52	**52**
Shopping Express						**0**
Line X					1637	**1637**
Line Y					1725	**1725**
Total By Day	**0**	**0**	**0**	**0**	**5766**	

Combined Total:	**5766**

9/4 - 9/8	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon		268	280	223	166	**937**
Medical Center	136	772	760	735	674	**3077**
MCH	105					**105**
Line N						**0**
Line O						**0**
Line P		1039	971	938	961	**3909**
Research Park		418	557	552	478	**2005**
Line S		54	35	57	63	**209**
Shopping Express						**0**
Line X		2131	2011	1951	1814	**7907**
Line Y		1680	1801	1831	1676	**6988**
Total By Day	**241**	**6362**	**6415**	**6287**	**5832**	

Combined Total:	25137

9/11 - 9/15	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	254	223	255	251	215	**1198**
Medical Center	830	742	707	787	693	**3759**
MCH						**0**
Line N						**0**
Line O						**0**
Line P	966	1138	1088	1179	972	**5343**
Research Park	511	526	510	514	425	**2486**
Line S	78	85	72	70	53	**358**
Shopping Express						**0**
Line X	2178	2043	2172	1868	1956	**10217**
Line Y	1885	1887	1788	1716	1636	**8912**
Total By Day	**6702**	**6644**	**6592**	**6385**	**5950**	

Combined Total:	32273

9/18 - 9/22	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	272	287	278	275	261	**1373**
Medical Center	762	835	822	765	717	**3901**
MCH						**0**
Line N	12	22	31	12	25	**102**
Line O	23	34	27	26	60	**170**
Line P	1063	1034	867	1000	675	**4639**
Research Park	562	611	591	563	499	**2826**
Line S	68	62	58	65	60	**313**
Shopping Express	134	132	170	252	208	**896**
Line X	1754	2095	1953	1929	2020	**9751**
Line Y	1727	1759	1975	1975	2004	**9440**
Total By Day	**6377**	**6871**	**6772**	**6862**	**6529**	

Combined Total:	33411

9/25 - 9/29	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	238	228	267	257	229	**1219**
Medical Center	738	735	766	731	675	**3645**
MCH						**0**
Line N	12	20	25	27	50	**134**
Line O	64	34	45	45	73	**261**
Line P	1153	1123	1164	1206	1057	**5703**
Research Park	567	534	587	593	502	**2783**
Line S	80	71	85	70	65	**371**
Shopping Express	214	222	207	225	178	**1046**
Line X	1982	2075	2023	2101	2199	**10380**
Line Y	2093	2057	2069	1983	2047	**10249**
Total By Day	**7141**	**7099**	**7238**	**7238**	**7075**	

Combined Total:	**35791**

4-Sep	***Labor Day**
	***Summer Closure**

BOH	4908
MC	15087
MCH	105
N	236
O	431
P	20562
RP	10598
S	1303
SE	1942
X	39892
Y	37314
Total:	**132378**

10/1 - 10/6	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	290	292	329	289	318	**1518**
Medical Center	750	800	779	782	668	**3779**
MCH	12	21	37	37	48	**155**
Line N	12	21	37	37	48	**155**
Line O	26	43	33	41	56	**199**
Line P	1162	1219	1072	1186	1037	**5676**
Research Park	586	596	582	528	447	**2739**
Line S	79	77	69	61	65	**351**
Shopping Express	235	202	259	217	222	**1135**
Line X	2018	2219	2139	1986	1861	**10223**
Line Y	2071	1984	1947	2064	1926	**9992**
Total By Day	**7241**	**7474**	**7283**	**7228**	**6696**	

Combined Total:	35922

10/9 - 10/13	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	286	274	307	288	239	**1394**
Medical Center	660	837	785	783	754	**3819**
MCH	38	31	24	40		**133**
Line N	38	31	24	40	72	**205**
Line O	46	40	38	84	107	**315**
Line P	1122	1173	1194	882	1217	**5588**
Research Park	531	464	566	552	550	**2663**
Line S	58	72	65	64	79	**338**
Shopping Express	197	184	211	162	296	**1050**
Line X	2085	2130	2203	2004	2123	**10545**
Line Y	1859	2026	2100	2054	1989	**10028**
Total By Day	**6920**	**7262**	**7517**	**6953**	**7426**	

Combined Total:	36078

10/16 - 10/20	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	260	322	307	303	256	**1448**
Medical Center	776	707	798	804	721	**3806**
MCH						**0**
Line N	22	19	39	59	56	**195**
Line O	41	43	25	57	38	**204**
Line P	1135	1160	1149	1167	977	**5588**
Research Park	583	577	519	576	473	**2728**
Line S	82	80	70	78	64	**374**
Shopping Express	197	191	217	177	208	**990**
Line X	2015	2004	1921	2158	2021	**10119**
Line Y	1910	2065	2037	2088	2059	**10159**
Total By Day	**7021**	**7168**	**7082**	**7467**	**6873**	

Combined Total:	35611

10/23 - 10/27	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	258	166	348	321	286	**1379**
Medical Center	843	730	786	794	724	**3877**
MCH						**0**
Line N	22	6	40	30	63	**161**
Line O	11	39	38	18	59	**165**
Line P	1144	1093	1210	1173	1065	**5685**
Research Park	530	610	546	556	482	**2724**
Line S	85	77	45	78	65	**350**
Shopping Express	190	195	232	155	250	**1022**
Line X	2005	1669	2216	2234	1967	**10091**
Line Y	2029	2064	2097	1532	1991	**9713**
Total By Day	**7117**	**6649**	**7558**	**6891**	**6952**	

Combined Total:	35167

10/30 - 10/31	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon	290	297				**587**
Medical Center	761	760				**1521**
MCH						**0**
Line N	9	19				**28**
Line O	34	38				**72**
Line P	1141	1189				**2330**
Research Park	606	613				**1219**
Line S	63	72				**135**
Shopping Express	207	157				**364**
Line X	2066	2090				**4156**
Line Y	1895	2281				**4176**
Total By Day	**7072**	**7516**	**0**	**0**	**0**	

Combined Total:	**14588**

BOH	6326
MC	16802
MCH	288
N	744
O	955
P	24867
RP	12073
S	1548
SE	4561
X	45134
Y	44068
Total:	**157366**

11/1 - 11/3	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon			329	301	286	**916**
Medical Center			777	815	725	**2317**
MCH						**0**
Line N			27	18	28	**73**
Line O			33	29	64	**126**
Line P			1149	1104	1027	**3280**
Research Park			568	546	505	**1619**
Line S			72	71	58	**201**
Shopping Express			234	204	282	**720**
Line X			2161	1949	2067	**6177**
Line Y			1966	2076	2119	**6161**
Total By Day	**0**	**0**	**7316**	**7113**	**7161**	

Combined Total:	**21590**

11/6 - 11/10	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon						**0**
Medical Center	827	840	888	877	674	**4106**
MCH						**0**
Line N	17	26	7	40	49	**139**
Line O	16	18	21	44	45	**144**
Line P	1300	1160	1275	1306	1204	**6245**
Research Park	570	576	546	509	390	**2591**
Line S	73	73	58	65	62	**331**
Shopping Express	189	161	209	157	228	**944**
Line X	2140	2135	2309	2328	1909	**10821**
Line Y	2185	1997	2178	2209	2193	**10762**
Total By Day	**7317**	**6986**	**7491**	**7535**	**6754**	

Combined Total:	36083

11/13 - 11/17	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon						**0**
Medical Center	859	846	956	971	725	**4357**
MCH						**0**
Line N	24	18	29	38	33	**142**
Line O	15	21	26	30	41	**133**
Line P	1208	837	1176	934	1063	**5218**
Research Park	596	575	567	550	458	**2746**
Line S	72	94	62	76	74	**378**
Shopping Express	212	143	224	227	228	**1034**
Line X	1997	2260	2130	2627	1918	**10932**
Line Y	2137	2225	2259	2593	2164	**11378**
Total By Day	**7120**	**7019**	**7429**	**8046**	**6704**	

Combined Total:	36318

11/20 - 11/24	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon						**0**
Medical Center	757	870	639	47	113	**2426**
MCH				131	232	**363**
Line N	11	17	11			**39**
Line O	22	13	15	11		**61**
Line P	957	887	571			**2415**
Research Park	495	496	249			**1240**
Line S	70	73	44			**187**
Shopping Express	184	149	141		131	**605**
Line X	1974	2026	1623			**5623**
Line Y	2118	1967	1596			**5681**
Total By Day	**6588**	**6498**	**4889**	**189**	**476**	

Combined Total:	**18640**

11/27 - 11/30	Monday	Tuesday	Wednesday	Thursday	Friday	Weekly Total By Route
Bohannon						**0**
Medical Center	793	792	812	729		**3126**
MCH						**0**
Line N	18	16	38	31		**103**
Line O	20	32	25	29		**106**
Line P	1119	1103	1105	1275		**4602**
Research Park	536	566	548	579		**2229**
Line S	76	76	63	70		**285**
Shopping Express	139	173	161	199		**672**
Line X	2025	2120	2254	2365		**8764**
Line Y	2057	2272	2370	2265		**8964**
Total By Day	**6783**	**7150**	**7376**	**7542**	**0**	

Combined Total:	**28851**

***Route ended**

***23 Nov thanksgiving**

***24 Nov Black Friday**

BOH	916
MC	16332
MCH	363
N	496
O	570
P	21760
RP	10425
S	1382
SE	3975
X	42317
Y	42946
Total:	**141482**

Attachment K

WEEK ENDING	OPERATING DAYS	PASSENGERS
1-Jan	1	128
8-Jan	5	35,225
15-Jan	5	36,976
22-Jan	5	31,039
29-Jan	5	38,662
MONTHLY TOTALS	21	142,030

*For operating days, only weekdays (including holidays), not weekends.

WEEK ENDING	OPERATING DAYS	PASSENGERS
7-Feb	5	37,355
14-Feb	5	37,122
21-Feb	5	31,346
28-Feb	5	37,449
29-Feb	1	7,139
MONTHLY TOTALS	21	150,411

WEEK ENDING	OPERATING DAYS	PASSENGERS
6-Mar	4	29,749
13-Mar	5	38,011
20-Mar	5	34,720
27-Mar	5	35,517
31-Mar	4	29,687
MONTHLY TOTALS	23	167,684

WEEK ENDING	OPERATING DAYS	PASSENGERS
3-Apr	1	7,080
10-Apr	5	33,212
17-Apr	5	35,769
24-Apr	5	36,868
30-Apr	5	37,029
MONTHLY TOTALS	21	149,958

WEEK ENDING	OPERATING DAYS	PASSENGERS
1-May	0	440
8-May	5	37,277
15-May	5	75,245
22-May	5	114,761
29-May	5	150,564
31-May	2	8,009
MONTHLY TOTALS	22	386,296

WEEK ENDING	OPERATING DAYS	PASSENGERS
5-Jun	3	20,732
12-Jun	5	36,675
19-Jun	5	33,385
26-Jun	5	37,124
30-Jun	4	30,202
MONTHLY TOTALS	22	158,118

WEEK ENDING	OPERATING DAYS	PASSENGERS
3-Jul	1	6,592
10-Jul	5	29,187
17-Jul	5	35,987
24-Jul	5	36,639
31-Jul	5	37,300
MONTHLY TOTALS	21	145,705

WEEK ENDING	OPERATING DAYS	PASSENGERS
7-Aug	5	34184
14-Aug	5	33171
21-Aug	5	30943
28-Aug	5	31009
31-Aug	3	17772
MONTHLY TOTALS	23	147,079

WEEK ENDING	OPERATING DAYS	PASSENGERS
4-Sep	2	11449
11-Sep	5	27064
18-Sep	5	31426
25-Sep	5	33805
30-Sep	5	34841
MONTHLY TOTALS	22	138,585

WEEK ENDING	OPERATING DAYS	PASSENGERS
9-Oct	5	34043
16-Oct	5	35788
23-Oct	5	34284
30-Oct	5	38067
31-Oct	1	7225
MONTHLY TOTALS	21	149,407

WEEK ENDING	OPERATING DAYS	PASSENGERS
6-Nov	4	29350
13-Nov	5	37241
20-Nov	5	37719
27-Nov	5	19272
30-Nov	3	22009
MONTHLY TOTALS	22	145,591

WEEK ENDING	OPERATING DAYS	PASSENGERS
2-Dec	2	14763
9-Dec	5	36721
16-Dec	5	36180
23-Dec	5	23727
30-Nov	5	6435
MONTHLY TOTALS	22	117,826

Attachment L

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/2/2017 6:14	Unknown	3	3
11/2/2017 6:17	Unknown	0	0
11/2/2017 6:24	Unknown	0	0
11/2/2017 6:30	PATC-University Circle	15	0
11/2/2017 6:35	Galvez @ El Camino Real	1	0
11/2/2017 6:37	Galvez @ Alumni Center	1	1
11/2/2017 6:39	Serra @ Encina Hall	2	1
11/2/2017 6:40	Serra @ Manzanita Field	0	9
11/2/2017 6:48	Tresidder West	0	5
11/2/2017 6:56	Medical Center @ Quarry	0	1
11/2/2017 6:59	Quarry @ Psychiatry Bld	1	0
11/2/2017 7:08	PATC-University Circle	5	3
11/2/2017 7:16	Galvez @ Serra Mall	0	1
11/2/2017 7:17	Serra @ Encina Hall	0	3
11/2/2017 7:20	Campus @ Wilbur Lot	0	0
11/2/2017 7:21	Campus @ Mayfield N	0	1
11/2/2017 7:25	Tresidder West	1	0
11/2/2017 7:30	Via Ortega @ Y2E2	0	2
11/2/2017 7:33	Medical Center @ Quarry	1	0
11/2/2017 7:42	PATC-University Circle	39	1
11/2/2017 7:43	PATC-University Circle	1	0
11/2/2017 7:48	Galvez @ Alumni Center	2	12
11/2/2017 7:49	Galvez @ Memorial	1	3
11/2/2017 7:50	Galvez @ Serra Mall	0	6
11/2/2017 7:50	Galvez @ Serra Mall	0	0
11/2/2017 7:51	Serra @ Encina Hall	0	9
11/2/2017 7:54	Campus @ Escondido	1	0
11/2/2017 7:55	Campus @ Wilbur Field	0	1
11/2/2017 7:56	Campus @ Munger	1	0
11/2/2017 7:57	Campus @ Mayfield N	1	2
11/2/2017 8:00	Tresidder West	0	4
11/2/2017 8:04	Via Ortega @ Y2E2	0	2
11/2/2017 8:07	Quarry Ext @ Med School	1	3
11/2/2017 8:07	Quarry Ext @ Med School	0	0
11/2/2017 8:08	Medical Center @ Quarry	1	0
11/2/2017 8:12	Caltrain Platform South	0	1
11/2/2017 8:24	Unknown	1	1
11/2/2017 8:33	PATC-University Circle	41	6
11/2/2017 8:40	Galvez @ El Camino Real	0	1
11/2/2017 8:42	Galvez @ Alumni Center	0	7
11/2/2017 8:43	Galvez @ Memorial	0	1
11/2/2017 8:44	Galvez @ Serra Mall	0	14
11/2/2017 8:44	Galvez @ Serra Mall	0	0
11/2/2017 8:45	Serra @ Encina Hall	0	7
11/2/2017 8:45	Serra @ Encina Hall	0	0
11/2/2017 8:46	Serra @ Manzanita Field	0	2
11/2/2017 8:46	Serra @ Manzanita Field	0	0
11/2/2017 8:48	Campus @ Escondido	1	0
11/2/2017 8:49	Campus @ Munger	0	2
11/2/2017 8:52	Tresidder East	1	1
11/2/2017 8:52	Tresidder East	0	0
11/2/2017 8:57	Via Ortega @ Y2E2	0	2
11/2/2017 8:59	Quarry Ext @ Medical C	1	0
11/2/2017 9:00	Quarry Ext @ Medical C	1	0
11/2/2017 9:09	PATC-University Circle	8	3
11/2/2017 9:14	Galvez @ El Camino Real	1	0
11/2/2017 9:16	Galvez @ Memorial	0	1
11/2/2017 9:17	Galvez @ Serra Mall	0	1
11/2/2017 9:18	Serra @ Encina Hall	0	3
11/2/2017 9:18	Serra @ Encina Hall	0	0
11/2/2017 9:22	Campus @ Munger	0	1

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/2/2017 9:27	Tresidder East	1	2
11/2/2017 9:35	Stanford Hospital (Front)	0	0
11/2/2017 9:51	PATC-University Circle	19	4
11/2/2017 9:55	El Camino @ PAMF SB	0	1
11/2/2017 9:55	El Camino @ PAMF SB	0	0
11/2/2017 9:56	Galvez @ El Camino Real	1	1
11/2/2017 9:57	Galvez @ El Camino Real	0	0
11/2/2017 9:59	Galvez @ Memorial	1	1
11/2/2017 9:59	Galvez @ Memorial	0	0
11/2/2017 10:00	Galvez @ Serra Mall	0	4
11/2/2017 10:00	Serra @ Encina Hall	0	1
11/2/2017 10:01	Serra @ Encina Hall	0	0
11/2/2017 10:02	Serra @ Manzanita Field	1	0
11/2/2017 10:03	Campus @ Escondido	1	0
11/2/2017 10:04	Campus @ Wilbur Lot	1	0
11/2/2017 10:05	Campus @ Wilbur Field	0	1
11/2/2017 10:05	Campus @ Wilbur Field	0	0
11/2/2017 10:06	Campus @ Munger	0	1
11/2/2017 10:06	Campus @ Munger	0	0
11/2/2017 10:09	Tresidder West	0	5
11/2/2017 10:12	Via Ortega S Across from Roble	0	0
11/2/2017 10:14	Via Ortega @ Y2E2	0	1
11/2/2017 10:16	Roth @ Quarry Ext	0	2
11/2/2017 10:16	Roth @ Quarry Ext	0	0
11/2/2017 10:17	Medical Center @ Quarry	0	1
11/2/2017 10:34	PATC-University Circle	3	2
11/2/2017 10:37	Galvez @ El Camino Real	2	0
11/2/2017 10:44	Campus @ Munger	0	1
11/2/2017 10:45	Campus @ Mayfield N	1	1
11/2/2017 10:49	Tresidder West	0	1
11/2/2017 10:55	Roth @ Quarry Ext	0	1
11/2/2017 11:01	Unknown	0	0
11/2/2017 11:13	PATC-University Circle	7	5
11/2/2017 11:18	Galvez @ El Camino Real	1	0
11/2/2017 11:20	Galvez @ Memorial	0	1
11/2/2017 11:21	Serra @ Encina Hall	0	2
11/2/2017 11:24	Campus @ Escondido	0	1
11/2/2017 11:30	Tresidder West	1	1
11/2/2017 11:36	Quarry Ext @ Med School	1	1
11/2/2017 11:54	PATC-University Circle	8	3
11/2/2017 11:59	Galvez @ El Camino Real	2	0
11/2/2017 12:01	Galvez @ Alumni Center	0	2
11/2/2017 12:02	Galvez @ Memorial	0	1
11/2/2017 12:03	Galvez @ Serra Mall	0	4
11/2/2017 12:04	Serra @ Manzanita Field	0	1
11/2/2017 12:07	Campus @ Wilbur Lot	0	2
11/2/2017 12:07	Campus @ Wilbur Field	3	0
11/2/2017 12:12	Tresidder West	0	5
11/2/2017 12:19	Quarry Ext @ Med School	1	0
11/2/2017 12:20	Medical Center @ Quarry	5	0
11/2/2017 12:21	Quarry @ Psychiatry Lot	2	0
11/2/2017 12:23	Quarry @ Psychiatry Bld	0	1
11/2/2017 12:33	PATC-University Circle	2	9
11/2/2017 12:39	Galvez @ El Camino Real	1	1
11/2/2017 12:41	Galvez @ Alumni Center	1	0
11/2/2017 12:42	Galvez @ Serra Mall	0	1
11/2/2017 12:44	Serra @ Manzanita Field	1	0
11/2/2017 12:46	Campus @ Escondido	2	0
11/2/2017 12:52	Tresidder West	0	2
11/2/2017 12:54	Santa Teresa @ Lomita	0	1
11/2/2017 12:55	Via Ortega S at Roble Garage	1	0

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/2/2017 12:59	Roth @ Quarry Ext	0	1
11/2/2017 13:01	Medical Center @ Quarry	3	1
11/2/2017 13:14	PATC-University Circle	4	3
11/2/2017 13:22	Galvez @ Alumni Center	0	0
11/2/2017 13:23	Galvez @ Memorial	0	2
11/2/2017 13:23	Galvez @ Serra Mall	0	1
11/2/2017 13:24	Serra @ Encina Hall	0	2
11/2/2017 13:27	Campus @ Escondido	1	0
11/2/2017 13:32	Tresidder West	0	0
11/2/2017 13:34	Santa Teresa @ Lomita	1	1
11/2/2017 13:37	Via Ortega @ Y2E2	3	1
11/2/2017 13:40	Quarry Ext @ Med School	1	0
11/2/2017 13:41	Quarry Ext @ Medical C	0	0
11/2/2017 13:43	Quarry @ Psychiatry Bld	0	1
11/2/2017 13:54	PATC-University Circle	1	5
11/2/2017 13:54	PATC-University Circle	1	0
11/2/2017 13:59	El Camino @ PAMF SB	1	0
11/2/2017 14:00	Galvez @ El Camino Real	1	0
11/2/2017 14:02	Galvez @ Alumni Center	0	1
11/2/2017 14:05	Campus @ Escondido	1	0
11/2/2017 14:06	Campus @ Wilbur Lot	3	0
11/2/2017 14:07	Campus @ Wilbur Field	1	0
11/2/2017 14:08	Campus @ Mayfield N	0	1
11/2/2017 14:12	Tresidder West	1	5
11/2/2017 14:15	Via Ortega S at Roble Garage	0	2
11/2/2017 14:17	Via Ortega @ Y2E2	1	0
11/2/2017 14:20	Roth @ Quarry Ext	1	0
11/2/2017 14:20	Quarry Ext @ Med School	3	0
11/2/2017 14:22	Quarry Ext @ Medical C	8	0
11/2/2017 14:34	PATC-University Circle	3	15
11/2/2017 14:39	Galvez @ El Camino Real	2	0
11/2/2017 14:42	Serra @ Encina Hall	1	0
11/2/2017 14:45	Campus @ Escondido	2	1
11/2/2017 14:47	Campus @ Munger	1	0
11/2/2017 14:51	Tresidder West	4	2
11/2/2017 14:55	Via Ortega S at Roble Garage	0	1
11/2/2017 14:57	Via Ortega @ Y2E2	10	2
11/2/2017 15:00	Roth @ Quarry Ext	3	2
11/2/2017 15:01	Medical Center @ Quarry	2	7
11/2/2017 15:03	Quarry @ Psychiatry Lot	3	1
11/2/2017 15:05	Quarry @ Psychiatry Bld	2	3
11/2/2017 15:14	PATC-University Circle	4	17
11/2/2017 15:20	Galvez @ Alumni Center	1	0
11/2/2017 15:21	Serra @ Encina Hall	0	1
11/2/2017 15:24	Campus @ Escondido	3	0
11/2/2017 15:26	Campus @ Munger	0	1
11/2/2017 15:31	Tresidder West	5	5
11/2/2017 15:32	Tresidder West	1	0
11/2/2017 15:34	Santa Teresa @ Lomita	0	0
11/2/2017 15:36	Via Ortega @ Y2E2	7	5
11/2/2017 15:39	Quarry Ext @ Med School	3	1
11/2/2017 15:41	Quarry @ Psychiatry Lot	15	0
11/2/2017 15:43	Quarry @ Psychiatry Bld	0	1
11/2/2017 15:43	Quarry @ Psychiatry Bld	0	1
11/2/2017 15:54	PATC-University Circle	5	31
11/2/2017 15:59	Galvez @ El Camino Real	2	0
11/2/2017 16:01	Galvez @ Memorial	0	1
11/2/2017 16:02	Galvez @ Serra Mall	0	1
11/2/2017 16:02	Serra @ Encina Hall	0	1
11/2/2017 16:11	Tresidder West	3	1
11/2/2017 16:11	Tresidder West	1	0

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/2/2017 16:13	Santa Teresa @ Lomita	1	0
11/2/2017 16:16	Via Ortega @ Y2E2	2	0
11/2/2017 16:18	Quarry Ext @ Med School	6	1
11/2/2017 16:19	Quarry Ext @ Med School	1	0
11/2/2017 16:19	Quarry Ext @ Medical C	3	0
11/2/2017 16:21	Quarry @ Psychiatry Bld	0	1
11/2/2017 16:34	PATC-University Circle	18	20
11/2/2017 16:42	Galvez @ Alumni Center	0	1
11/2/2017 16:43	Galvez @ Memorial	3	0
11/2/2017 16:43	Galvez @ Serra Mall	0	2
11/2/2017 16:46	Campus @ Escondido	0	2
11/2/2017 16:47	Campus @ Wilbur Field	0	1
11/2/2017 16:48	Campus @ Munger	1	2
11/2/2017 16:49	Campus @ Mayfield N	1	0
11/2/2017 16:52	Tresidder West	3	2
11/2/2017 16:55	Via Ortega S at Roble Garage	0	2
11/2/2017 16:57	Via Ortega @ Y2E2	7	0
11/2/2017 16:59	Roth @ Quarry Ext	1	1
11/2/2017 17:00	Quarry Ext @ Med School	15	0
11/2/2017 17:01	Medical Center @ Quarry	13	0
11/2/2017 17:01	Medical Center @ Quarry	1	0
11/2/2017 17:03	Quarry @ Psychiatry Lot	10	0
11/2/2017 17:04	Quarry @ Psychiatry Bld	4	1
11/2/2017 17:14	PATC-University Circle	8	59
11/2/2017 17:20	Galvez @ El Camino Real	2	0
11/2/2017 17:22	Galvez @ Alumni Center	0	2
11/2/2017 17:23	Galvez @ Serra Mall	0	2
11/2/2017 17:24	Serra @ Encina Hall	1	1
11/2/2017 17:25	Serra @ Manzanita Field	0	1
11/2/2017 17:27	Campus @ Escondido	1	0
11/2/2017 17:28	Campus @ Munger	1	1
11/2/2017 17:32	Tresidder West	3	1
11/2/2017 17:34	Santa Teresa @ Lomita	1	0
11/2/2017 17:35	Via Ortega S at Roble Garage	1	2
11/2/2017 17:37	Via Ortega @ Y2E2	10	0
11/2/2017 17:40	Quarry Ext @ Med School	5	0
11/2/2017 17:41	Medical Center @ Quarry	6	0
11/2/2017 17:44	Quarry @ Psychiatry Bld	0	3
11/2/2017 17:54	PATC-University Circle	4	30
11/2/2017 18:02	Galvez @ El Camino Real	1	0
11/2/2017 18:03	Galvez @ Alumni Center	1	0
11/2/2017 18:04	Galvez @ Serra Mall	0	0
11/2/2017 18:05	Serra @ Encina Hall	0	1
11/2/2017 18:06	Serra @ Manzanita Field	0	2
11/2/2017 18:08	Campus @ Escondido	1	0
11/2/2017 18:12	Tresidder West	2	0
11/2/2017 18:14	Santa Teresa @ Lomita	0	1
11/2/2017 18:15	Via Ortega S at Roble Garage	1	0
11/2/2017 18:17	Via Ortega @ Y2E2	14	0
11/2/2017 18:17	Via Ortega @ Y2E2	1	0
11/2/2017 18:19	Roth @ Quarry Ext	1	0
11/2/2017 18:19	Quarry Ext @ Med School	9	1
11/2/2017 18:20	Medical Center @ Quarry	4	0
11/2/2017 18:22	Quarry @ Psychiatry Lot	2	0
11/2/2017 18:23	Quarry @ Psychiatry Bld	2	4
11/2/2017 18:34	PATC-University Circle	2	30
11/2/2017 18:46	Campus @ Escondido	0	1
11/2/2017 18:47	Campus @ Wilbur Lot	0	2
11/2/2017 18:51	Tresidder West	3	2
11/2/2017 18:55	Via Ortega S at Roble Garage	1	0
11/2/2017 18:57	Via Ortega @ Y2E2	1	0

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/2/2017 18:59	Roth @ Quarry Ext	0	1
11/2/2017 18:59	Galvez @ El Camino Real	2	0
11/2/2017 19:00	Quarry Ext @ Med School	7	0
11/2/2017 19:01	Quarry Ext @ Medical C	8	0
11/2/2017 19:02	Quarry @ Psychiatry Lot	6	0
11/2/2017 19:06	PATC-University Circle	0	18
11/2/2017 19:14	PATC-University Circle	4	0
11/2/2017 19:15	PATC-University Circle	1	0
11/2/2017 19:25	Serra @ Manzanita Field	0	1
11/2/2017 19:25	Serra @ Manzanita Field	0	0
11/2/2017 19:27	Campus @ Escondido	0	1
11/2/2017 19:29	Campus @ Mayfield N	0	1
11/2/2017 19:32	Tresidder West	1	0
11/2/2017 19:36	Via Ortega @ Y2E2	2	0
11/2/2017 19:38	Roth @ Quarry Ext	0	1
11/2/2017 19:40	Medical Center @ Quarry	3	2
11/2/2017 19:43	Quarry @ Psychiatry Bld	0	1
11/2/2017 19:43	Quarry @ Psychiatry Bld	0	0
11/2/2017 19:53	PATC-University Circle	2	5
11/2/2017 19:54	PATC-University Circle	0	0
11/2/2017 19:58	El Camino @ PAMF SB	1	0
11/2/2017 20:03	Campus @ Escondido	0	1
11/2/2017 20:11	Tresidder West	0	0
11/2/2017 20:16	Via Ortega @ Y2E2	1	1
11/2/2017 20:18	Roth @ Quarry Ext	1	0
11/2/2017 20:19	Medical Center @ Quarry	2	0
11/2/2017 20:21	Quarry @ Psychiatry Bld	0	1
11/2/2017 20:33	PATC-University Circle	4	4
11/2/2017 20:41	Galvez @ Serra Mall	0	1
11/2/2017 20:44	Campus @ Escondido	0	1
11/2/2017 20:44	Campus @ Escondido	0	0
11/2/2017 20:46	Campus @ Munger	0	1
11/2/2017 20:51	Tresidder West	1	1
11/2/2017 20:55	Via Ortega S at Roble Garage	2	0
11/2/2017 20:56	Via Ortega @ Y2E2	3	0
11/2/2017 20:58	Roth @ Quarry Ext	1	0
11/2/2017 20:59	Quarry Ext @ Med School	1	0
11/2/2017 21:00	Quarry Ext @ Medical C	1	0
11/2/2017 21:01	Quarry @ Psychiatry Lot	1	0
11/2/2017 21:06	PATC-University Circle	0	9
11/3/2017 12:01	Galvez @ Alumni Center	1	0
11/3/2017 12:02	Galvez @ Serra Mall	0	2
11/3/2017 12:06	Campus @ Wilbur Lot	1	0
11/3/2017 12:07	Campus @ Wilbur Field	0	0
11/3/2017 12:07	Campus @ Wilbur Field	0	0
11/3/2017 12:07	Campus @ Munger	1	0
11/3/2017 12:12	Tresidder West	0	4
11/3/2017 12:12	Tresidder West	0	0
11/3/2017 12:15	Via Ortega S at Roble Garage	1	0
11/3/2017 12:19	Quarry Ext @ Med School	5	0
11/3/2017 12:20	Medical Center @ Quarry	3	0
11/3/2017 12:22	Quarry @ Psychiatry Lot	2	0
11/3/2017 12:23	Quarry @ Psychiatry Bld	1	3
11/3/2017 12:23	Quarry @ Psychiatry Bld	0	0
11/3/2017 12:34	PATC-University Circle	3	12
11/3/2017 12:34	PATC-University Circle	0	0
11/3/2017 12:41	Galvez @ El Camino Real	0	1
11/3/2017 12:41	Galvez @ El Camino Real	0	0
11/3/2017 12:43	Galvez @ Alumni Center	1	0
11/3/2017 12:45	Serra @ Manzanita Field	1	0
11/3/2017 12:47	Campus @ Escondido	1	0

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/3/2017 12:49	Campus @ Munger	1	2
11/3/2017 12:52	Tresidder West	0	0
11/3/2017 12:57	Via Ortega @ Y2E2	3	2
11/3/2017 12:59	Roth @ Quarry Ext	0	1
11/3/2017 13:03	Quarry @ Psychiatry Bld	0	1
11/3/2017 13:13	PATC-University Circle	7	7
11/3/2017 13:18	Galvez @ El Camino Real	2	0
11/3/2017 13:21	Galvez @ Serra Mall	0	1
11/3/2017 13:22	Serra @ Encina Hall	2	0
11/3/2017 13:24	Campus @ Escondido	1	0
11/3/2017 13:26	Campus @ Wilbur Field	1	1
11/3/2017 13:27	Campus @ Munger	3	3
11/3/2017 13:28	Campus @ Mayfield N	0	1
11/3/2017 13:31	Tresidder West	1	3
11/3/2017 13:34	Santa Teresa @ Lomita	1	1
11/3/2017 13:35	Via Ortega S at Roble Garage	1	2
11/3/2017 13:37	Via Ortega @ Y2E2	1	0
11/3/2017 13:41	Quarry Ext @ Med School	4	0
11/3/2017 13:41	Medical Center @ Quarry	1	1
11/3/2017 13:53	PATC-University Circle	0	10
11/3/2017 14:12	Tresidder West	3	0
11/3/2017 14:18	Roth @ Quarry Ext	2	1
11/3/2017 14:18	Quarry Ext @ Med School	4	0
11/3/2017 14:19	Quarry Ext @ Medical C	7	0
11/3/2017 14:20	Quarry @ Psychiatry Lot	0	1
11/3/2017 14:34	PATC-University Circle	2	15
11/3/2017 14:42	Galvez @ Alumni Center	1	1
11/3/2017 14:43	Galvez @ Serra Mall	0	1
11/3/2017 14:46	Campus @ Escondido	2	0
11/3/2017 14:51	Tresidder West	5	2
11/3/2017 14:52	Tresidder West	1	0
11/3/2017 14:54	Santa Teresa @ Lomita	1	1
11/3/2017 14:55	Via Ortega S at Roble Garage	0	1
11/3/2017 14:56	Via Ortega @ Y2E2	1	0
11/3/2017 14:59	Quarry Ext @ Med School	4	0
11/3/2017 15:00	Quarry Ext @ Medical C	4	1
11/3/2017 15:02	Quarry @ Psychiatry Lot	3	0
11/3/2017 15:03	Quarry @ Psychiatry Bld	1	5
11/3/2017 15:14	PATC-University Circle	1	18
11/3/2017 15:26	Campus @ Wilbur Field	4	0
11/3/2017 15:32	Tresidder West	6	1
11/3/2017 15:36	Via Ortega @ Y2E2	5	1
11/3/2017 15:39	Roth @ Quarry Ext	3	1
11/3/2017 15:40	Quarry Ext @ Med School	2	0
11/3/2017 15:41	Quarry Ext @ Medical C	1	0
11/3/2017 15:43	Quarry @ Psychiatry Lot	0	0
11/3/2017 15:43	Quarry @ Psychiatry Lot	0	0
11/3/2017 15:45	Quarry @ Psychiatry Bld	1	6
11/3/2017 15:54	PATC-University Circle	4	13
11/3/2017 16:03	Galvez @ Serra Mall	1	1
11/3/2017 16:04	Serra @ Encina Hall	0	2
11/3/2017 16:07	Campus @ Escondido	1	1
11/3/2017 16:12	Tresidder West	1	1
11/3/2017 16:18	Roth @ Quarry Ext	1	0
11/3/2017 16:19	Quarry Ext @ Med School	5	0
11/3/2017 16:20	Medical Center @ Quarry	4	0
11/3/2017 16:21	Quarry @ Psychiatry Lot	5	0
11/3/2017 16:22	Quarry @ Psychiatry Bld	0	1
11/3/2017 16:33	PATC-University Circle	7	14
11/3/2017 16:40	Galvez @ El Camino Real	3	0
11/3/2017 16:42	Galvez @ Alumni Center	0	3

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DateTime	StopName	Boardings	Alightings
11/3/2017 16:46	Campus @ Escondido	0	2
11/3/2017 16:49	Campus @ Mayfield N	0	1
11/3/2017 16:52	Tresidder West	2	2
11/3/2017 16:55	Via Ortega S at Roble Garage	2	0
11/3/2017 16:56	Via Ortega @ Y2E2	5	0
11/3/2017 16:59	Quarry Ext @ Med School	3	0
11/3/2017 17:00	Quarry Ext @ Medical C	4	0
11/3/2017 17:02	Quarry @ Psychiatry Lot	4	0
11/3/2017 17:03	Quarry @ Psychiatry Bld	1	0
11/3/2017 17:10	PATC-University Circle	1	22
11/3/2017 17:14	PATC-University Circle	2	2
11/3/2017 17:14	PATC-University Circle	0	1
11/3/2017 17:15	PATC-University Circle	0	0
11/3/2017 17:20	Galvez @ El Camino Real	4	0
11/3/2017 17:24	Serra @ Manzanita Field	2	0
11/3/2017 17:26	Campus @ Escondido	0	3
11/3/2017 17:27	Campus @ Wilbur Lot	0	2
11/3/2017 17:32	Tresidder West	3	5
11/3/2017 17:35	Via Ortega S at Roble Garage	1	3
11/3/2017 17:37	Via Ortega @ Y2E2	17	0
11/3/2017 17:40	Quarry Ext @ Med School	5	0
11/3/2017 17:41	Quarry Ext @ Medical C	2	0
11/3/2017 17:42	Quarry @ Psychiatry Lot	1	0
11/3/2017 17:43	Quarry @ Psychiatry Bld	1	6
11/3/2017 17:55	PATC-University Circle	12	25
11/3/2017 18:02	Galvez @ El Camino Real	0	1
11/3/2017 18:08	Campus @ Escondido	0	2
11/3/2017 18:09	Campus @ Wilbur Field	1	0
11/3/2017 18:10	Campus @ Munger	0	1
11/3/2017 18:11	Campus @ Mayfield N	0	0
11/3/2017 18:12	Tresidder West	1	3
11/3/2017 18:12	Tresidder West	1	0
11/3/2017 18:14	Santa Teresa @ Lomita	1	1
11/3/2017 18:15	Via Ortega S at Roble Garage	1	0
11/3/2017 18:17	Via Ortega @ Y2E2	0	2
11/3/2017 18:18	Roth @ Quarry Ext	1	0
11/3/2017 18:19	Quarry Ext @ Med School	3	0
11/3/2017 18:20	Medical Center @ Quarry	2	0
11/3/2017 18:21	Quarry @ Psychiatry Lot	2	0
11/3/2017 18:22	Quarry @ Psychiatry Bld	0	1
11/3/2017 18:34	PATC-University Circle	4	14
11/3/2017 18:39	Galvez @ El Camino Real	1	0
11/3/2017 18:42	Galvez @ Alumni Center	1	0
11/3/2017 18:45	Campus @ Escondido	1	1
11/3/2017 18:45	Campus @ Escondido	0	0
11/3/2017 18:51	Tresidder West	0	3
11/3/2017 18:54	Santa Teresa @ Lomita	0	1
11/3/2017 18:54	Santa Teresa @ New Guinea	0	0
11/3/2017 18:57	Via Ortega S at Roble Garage	4	1
11/3/2017 19:03	Quarry @ Psychiatry Lot	3	0
11/3/2017 19:03	Quarry @ Psychiatry Lot	0	0
11/3/2017 19:15	PATC-University Circle	6	7
11/3/2017 19:19	Galvez @ El Camino Real	1	0
11/3/2017 19:22	Galvez @ Serra Mall	0	1
11/3/2017 19:24	Serra @ Manzanita Field	0	2
11/3/2017 19:26	Campus @ Escondido	0	4
11/3/2017 19:26	Campus @ Escondido	0	0
11/3/2017 19:31	Tresidder West	1	0
11/3/2017 19:34	Via Ortega S at Roble Garage	2	0
11/3/2017 19:38	Quarry Ext @ Med School	1	0
11/3/2017 19:38	Quarry Ext @ Med School	0	0

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DateTime	StopName	Boardings	Alightings
11/3/2017 19:41	Quarry @ Psychiatry Lot	1	0
11/3/2017 19:53	PATC-University Circle	1	7
11/3/2017 19:54	PATC-University Circle	0	0
11/3/2017 20:05	Campus @ Wilbur Field	0	0
11/3/2017 20:09	Tresidder West	2	0
11/3/2017 20:15	Via Ortega S at Roble Garage	1	0
11/3/2017 20:19	Quarry Ext @ Med School	1	0
11/3/2017 20:20	Medical Center @ Quarry	1	0
11/3/2017 20:22	Quarry @ Psychiatry Lot	0	0
11/3/2017 20:23	Quarry @ Psychiatry Lot	1	0
11/3/2017 20:34	PATC-University Circle	4	10
11/3/2017 20:34	PATC-University Circle	2	0
11/3/2017 20:35	PATC-University Circle	2	0
11/3/2017 20:40	Galvez @ El Camino Real	1	0
11/3/2017 20:45	Campus @ Escondido	0	5
11/3/2017 20:45	Campus @ Escondido	0	0
11/3/2017 20:47	Campus @ Munger	1	1
11/3/2017 20:51	Tresidder West	1	2
11/3/2017 20:54	Via Ortega S at Roble Garage	1	0
11/3/2017 20:56	Via Ortega @ Y2E2	3	0
11/3/2017 20:58	Roth @ Quarry Ext	0	1
11/3/2017 20:58	Roth @ Quarry Ext	0	0
11/3/2017 20:59	Medical Center @ Quarry	1	0
11/3/2017 21:00	Quarry @ Psychiatry Lot	1	0
11/3/2017 21:04	PATC-University Circle	0	8
11/3/2017 21:15	Unknown	1	1
11/3/2017 21:20	Unknown	1	1
11/3/2017 21:22	Unknown	1	1
11/3/2017 21:28	Unknown	1	1
11/4/2017 9:01	Unknown	1	1
11/4/2017 9:02	Unknown	0	0
11/7/2017 6:31	PATC-University Circle	19	0
11/7/2017 6:34	Galvez @ El Camino Real	1	0
11/7/2017 6:36	Galvez @ Alumni Center	0	2
11/7/2017 6:37	Galvez @ Memorial	1	0
11/7/2017 6:38	Serra @ Encina Hall	1	4
11/7/2017 6:40	Serra @ Manzanita Field	0	6
11/7/2017 6:43	Campus @ Munger	0	2
11/7/2017 6:49	Tresidder West	0	6
11/7/2017 6:53	Via Ortega S at Roble Garage	1	1
11/7/2017 6:56	Roth @ Quarry Ext	0	1
11/7/2017 7:08	PATC-University Circle	6	3
11/7/2017 7:14	Galvez @ Memorial	0	2
11/7/2017 7:15	Serra @ Encina Hall	0	3
11/7/2017 7:17	Campus @ Escondido	1	0
11/7/2017 7:18	Campus @ Wilbur Lot	0	1
11/7/2017 7:19	Campus @ Wilbur Field	0	1
11/7/2017 7:24	Tresidder West	1	1
11/7/2017 7:27	Santa Teresa @ Lomita	1	0
11/7/2017 7:28	Via Ortega S at Roble Garage	0	2
11/7/2017 7:35	Quarry Ext Middle	2	1
11/7/2017 7:36	Medical Center @ Quarry	1	0
11/7/2017 7:37	Quarry @ Psychiatry Lot	0	1
11/7/2017 7:43	PATC-University Circle	32	2
11/7/2017 7:47	Galvez @ El Camino Real	1	0
11/7/2017 7:49	Galvez @ Alumni Center	1	10
11/7/2017 7:50	Galvez @ Memorial	0	1
11/7/2017 7:51	Galvez @ Serra Mall	0	8
11/7/2017 7:51	Serra @ Encina Hall	0	10
11/7/2017 7:52	Serra @ Manzanita Field	0	1
11/7/2017 7:54	Campus @ Escondido	1	0

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DateTime	StopName	Boardings	Alightings
11/7/2017 7:55	Campus @ Wilbur Lot	1	0
11/7/2017 7:56	Campus @ Wilbur Field	0	1
11/7/2017 7:57	Campus @ Mayfield N	0	4
11/7/2017 8:01	Tresidder West	3	2
11/7/2017 8:05	Via Ortega @ Y2E2	0	2
11/7/2017 8:10	Medical Center @ Quarry	1	0
11/7/2017 8:20	Quarry @ Crate/Barrel	0	0
11/7/2017 8:33	PATC-University Circle	39	4
11/7/2017 8:33	PATC-University Circle	1	0
11/7/2017 8:37	Galvez @ El Camino Real	1	0
11/7/2017 8:39	Galvez @ Alumni Center	0	8
11/7/2017 8:40	Galvez @ Memorial	0	4
11/7/2017 8:40	Galvez @ Serra Mall	0	9
11/7/2017 8:41	Serra @ Encina Hall	0	8
11/7/2017 8:42	Serra @ Manzanita Field	0	3
11/7/2017 8:44	Campus @ Escondido	1	0
11/7/2017 8:45	Campus @ Wilbur Lot	1	0
11/7/2017 8:46	Campus @ Munger	0	1
11/7/2017 8:53	Tresidder West	3	4
11/7/2017 8:57	Via Ortega @ Cypress Lot	0	1
11/7/2017 9:01	Quarry Ext Middle	1	1
11/7/2017 9:02	Quarry Ext Middle	0	1
11/7/2017 9:02	Medical Center @ Quarry	0	1
11/7/2017 9:10	PATC-University Circle	5	1
11/7/2017 9:14	Galvez @ El Camino Real	2	0
11/7/2017 9:16	Galvez @ Alumni Center	0	2
11/7/2017 9:17	Galvez @ Serra Mall	0	2
11/7/2017 9:20	Campus @ Wilbur Lot	1	0
11/7/2017 9:22	Campus @ Mayfield N	2	1
11/7/2017 9:25	Tresidder West	2	0
11/7/2017 9:29	Via Ortega S at Roble Garage	0	0
11/7/2017 9:30	Via Ortega @ Y2E2	0	2
11/7/2017 9:32	Roth @ Quarry Ext	0	2
11/7/2017 9:37	Quarry Ext Middle	3	4
11/7/2017 9:52	PATC-University Circle	6	2
11/7/2017 9:53	PATC-University Circle	0	0
11/7/2017 9:53	PATC-University Circle	0	0
11/7/2017 10:00	Galvez @ Serra Mall	0	1
11/7/2017 10:00	Serra @ Encina Hall	1	1
11/7/2017 10:04	Campus @ Wilbur Field	0	1
11/7/2017 10:07	Campus @ Munger	1	4
11/7/2017 10:12	Via Ortega S at Roble Garage	1	0
11/7/2017 10:16	Medical Center @ Quarry	2	0
11/7/2017 10:34	PATC-University Circle	13	8
11/7/2017 10:38	Galvez @ Alumni Center	0	1
11/7/2017 10:39	Galvez @ Memorial	0	1
11/7/2017 10:40	Galvez @ Serra Mall	0	1
11/7/2017 10:41	Serra @ Encina Hall	0	1
11/7/2017 10:42	Serra @ Manzanita Field	1	0
11/7/2017 10:43	Campus @ Escondido	1	0
11/7/2017 10:44	Campus @ Wilbur Lot	0	1
11/7/2017 10:48	Tresidder West	0	4
11/7/2017 10:51	Tresidder West	2	1
11/7/2017 10:55	Via Ortega @ Y2E2	1	0
11/7/2017 10:58	Roth @ Quarry Ext	0	1
11/7/2017 11:00	Medical Center @ Quarry	5	1
11/7/2017 11:00	Medical Center @ Quarry	0	0
11/7/2017 11:14	PATC-University Circle	2	6
11/7/2017 11:21	Galvez @ Serra Mall	2	7
11/7/2017 11:22	Serra @ Encina Hall	0	1
11/7/2017 11:26	Campus @ Mayfield N	0	0

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DateTime	StopName	Boardings	Alightings
11/7/2017 11:32	Tresidder West	1	0
11/7/2017 11:35	Via Ortega S at Roble Garage	1	0
11/7/2017 11:37	Via Ortega @ Y2E2	1	2
11/7/2017 11:39	Roth @ Quarry Ext	0	2
11/7/2017 11:41	Medical Center @ Quarry	2	0
11/7/2017 11:55	PATC-University Circle	3	4
11/7/2017 11:59	Galvez @ El Camino Real	3	0
11/7/2017 12:01	Galvez @ Alumni Center	0	1
11/7/2017 12:03	Galvez @ Serra Mall	0	1
11/7/2017 12:06	Campus @ Escondido	3	1
11/7/2017 12:08	Campus @ Munger	0	1
11/7/2017 12:13	Tresidder West	2	2
11/7/2017 12:16	Via Ortega @ Y2E2	2	0
11/7/2017 12:19	Quarry Ext @ Med School	0	0
11/7/2017 12:19	Quarry Ext @ Med School	0	3
11/7/2017 12:20	Medical Center @ Quarry	3	0
11/7/2017 12:21	Quarry @ Psychiatry Lot	2	0
11/7/2017 12:23	Quarry @ Psychiatry Bld	0	2
11/7/2017 12:28	Caltrain Platform South	3	11
11/7/2017 12:34	PATC-University Circle	7	6
11/7/2017 12:38	Galvez @ El Camino Real	1	0
11/7/2017 12:41	Galvez @ Memorial	0	1
11/7/2017 12:41	Galvez @ Serra Mall	1	0
11/7/2017 12:44	Campus @ Escondido	0	1
11/7/2017 12:46	Campus @ Munger	0	2
11/7/2017 12:51	Tresidder West	3	3
11/7/2017 12:55	Via Ortega S at Roble Garage	1	0
11/7/2017 12:59	Quarry Ext @ Med School	1	1
11/7/2017 13:00	Medical Center @ Quarry	1	0
11/7/2017 13:03	Quarry @ Psychiatry Bld	0	1
11/7/2017 13:14	PATC-University Circle	5	3
11/7/2017 13:20	Galvez @ Memorial	0	0
11/7/2017 13:24	Campus @ Escondido	2	0
11/7/2017 13:25	Campus @ Wilbur Lot	0	1
11/7/2017 13:26	Campus @ Munger	1	0
11/7/2017 13:32	Tresidder West	1	0
11/7/2017 13:35	Santa Teresa @ New Guinea	2	1
11/7/2017 13:36	Via Ortega S at Roble Garage	1	0
11/7/2017 13:36	Via Ortega S at Roble Garage	0	0
11/7/2017 13:37	Via Ortega @ Y2E2	0	2
11/7/2017 13:40	Quarry Ext @ Med School	2	0
11/7/2017 13:40	Quarry Ext @ Medical C	3	2
11/7/2017 13:43	Quarry @ Psychiatry Bld	0	5
11/7/2017 13:53	PATC-University Circle	9	5
11/7/2017 13:58	Galvez @ El Camino Real	3	1
11/7/2017 14:00	Galvez @ Memorial	0	2
11/7/2017 14:01	Serra @ Encina Hall	0	2
11/7/2017 14:03	Campus @ Escondido	0	2
11/7/2017 14:05	Campus @ Munger	1	0
11/7/2017 14:06	Campus @ Mayfield N	0	1
11/7/2017 14:11	Tresidder West	3	0
11/7/2017 14:15	Via Ortega @ Y2E2	6	0
11/7/2017 14:18	Roth @ Quarry Ext	1	1
11/7/2017 14:19	Quarry Ext @ Med School	1	1
11/7/2017 14:20	Medical Center @ Quarry	6	0
11/7/2017 14:22	Quarry @ Psychiatry Lot	4	0
11/7/2017 14:34	PATC-University Circle	3	25
11/7/2017 14:34	PATC-University Circle	1	0
11/7/2017 14:43	Galvez @ Serra Mall	0	2
11/7/2017 14:44	Serra @ Encina Hall	0	3
11/7/2017 14:48	Campus @ Munger	2	0

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DateTime	StopName	Boardings	Alightings
11/7/2017 14:49	Campus @ Mayfield N	0	2
11/7/2017 14:52	Tresidder West	5	1
11/7/2017 15:00	Medical Center @ Quarry	4	4
11/7/2017 15:01	Quarry @ Psychiatry Lot	1	0
11/7/2017 15:13	PATC-University Circle	7	20
11/7/2017 15:20	Galvez @ El Camino Real	1	0
11/7/2017 15:22	Galvez @ Alumni Center	0	1
11/7/2017 15:30	Unknown	2	3
11/7/2017 15:32	Tresidder West	2	2
11/7/2017 15:36	Via Ortega S at Roble Garage	1	0
11/7/2017 15:37	Via Ortega @ Y2E2	6	1
11/7/2017 15:40	Roth @ Quarry Ext	1	2
11/7/2017 15:41	Quarry Ext @ Med School	4	0
11/7/2017 15:41	Quarry Ext @ Medical C	1	0
11/7/2017 15:42	Serra @ Campus Dr	0	0
11/7/2017 15:43	Serra @ Campus Dr	3	0
11/7/2017 15:43	Serra @ Campus Dr	1	0
11/7/2017 15:44	Quarry @ Psychiatry Bld	0	2
11/7/2017 15:45	Serra @ Burnham	2	0
11/7/2017 15:51	PATC-University Circle	0	5
11/7/2017 15:54	PATC-University Circle	2	12
11/7/2017 15:59	Galvez @ El Camino Real	1	0
11/7/2017 16:02	Galvez @ Serra Mall	0	1
11/7/2017 16:04	Serra @ Manzanita Field	1	0
11/7/2017 16:05	Campus @ Escondido	1	0
11/7/2017 16:07	Campus @ Wilbur Field	0	1
11/7/2017 16:08	Campus @ Mayfield N	0	1
11/7/2017 16:12	Tresidder West	1	2
11/7/2017 16:14	Santa Teresa @ Lomita	2	2
11/7/2017 16:16	Via Ortega @ Y2E2	3	2
11/7/2017 16:19	Quarry Ext @ Med School	5	0
11/7/2017 16:20	Medical Center @ Quarry	2	0
11/7/2017 16:21	Quarry @ Psychiatry Lot	2	0
11/7/2017 16:23	Quarry @ Psychiatry Bld	0	2
11/7/2017 16:34	PATC-University Circle	2	11
11/7/2017 16:41	Galvez @ Alumni Center	2	0
11/7/2017 16:45	Campus @ Wilbur Field	1	0
11/7/2017 16:47	Campus @ Munger	0	0
11/7/2017 16:51	Tresidder West	1	3
11/7/2017 16:55	Via Ortega @ Y2E2	8	0
11/7/2017 16:58	Roth @ Quarry Ext	3	0
11/7/2017 16:59	Quarry Ext @ Med School	8	0
11/7/2017 17:00	Medical Center @ Quarry	12	0
11/7/2017 17:01	Quarry @ Psychiatry Lot	1	0
11/7/2017 17:02	Quarry @ Crate/Barrel	1	0
11/7/2017 17:08	PATC-University Circle	1	36
11/7/2017 17:14	PATC-University Circle	2	1
11/7/2017 17:22	Galvez @ Alumni Center	0	1
11/7/2017 17:26	Campus @ Escondido	1	0
11/7/2017 17:30	Tresidder West	1	1
11/7/2017 17:32	Tresidder West	0	0
11/7/2017 17:40	Medical Center @ Quarry	0	0
11/7/2017 17:42	Quarry @ Psychiatry Lot	3	0
11/7/2017 17:50	PATC-University Circle	4	0
11/7/2017 17:55	PATC-University Circle	4	2
11/7/2017 18:01	Galvez @ El Camino Real	2	2
11/7/2017 18:03	Galvez @ Alumni Center	0	0
11/7/2017 18:06	Serra @ Manzanita Field	0	1
11/7/2017 18:08	Campus @ Escondido	1	4
11/7/2017 18:10	Campus @ Wilbur Field	0	1
11/7/2017 18:11	Campus @ Munger	0	0

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11/7/2017 18:13	Tresidder West	0	0
11/7/2017 18:17	Via Ortega S at Roble Garage	1	1
11/7/2017 18:18	Via Ortega @ Y2E2	2	0
11/7/2017 18:23	Quarry Ext @ Med School	12	0
11/7/2017 18:24	Medical Center @ Quarry	9	0
11/7/2017 18:26	Quarry @ Psychiatry Lot	3	0
11/7/2017 18:27	Quarry @ Psychiatry Bld	0	1
11/7/2017 18:39	PATC-University Circle	2	24
11/7/2017 18:48	Serra @ Manzanita Field	2	0
11/7/2017 18:50	Campus @ Wilbur Field	1	0
11/7/2017 18:53	Tresidder West	1	0
11/7/2017 18:56	Via Ortega S at Roble Garage	1	3
11/7/2017 18:57	Via Ortega @ Y2E2	0	1
11/7/2017 19:06	PATC-University Circle	0	1
11/7/2017 19:13	PATC-University Circle	4	1
11/7/2017 19:21	Galvez @ Serra Mall	0	1
11/7/2017 19:22	Serra @ Encina Hall	0	1
11/7/2017 19:25	Campus @ Munger	0	1
11/7/2017 19:31	Tresidder West	1	0
11/7/2017 19:35	Via Ortega S at Roble Garage	2	0
11/7/2017 19:36	Via Ortega @ Y2E2	2	0
11/7/2017 19:39	Roth @ Quarry Ext	1	0
11/7/2017 19:40	Quarry Ext @ Med School	2	0
11/7/2017 19:41	Medical Center @ Quarry	4	1
11/7/2017 19:42	Quarry @ Psychiatry Lot	0	0
11/7/2017 19:43	Quarry @ Psychiatry Bld	0	1
11/7/2017 19:53	PATC-University Circle	3	12
11/7/2017 20:04	Campus @ Escondido	0	1
11/7/2017 20:12	Tresidder West	0	0
11/7/2017 20:14	Santa Teresa @ Lomita	1	0
11/7/2017 20:15	Via Ortega S at Roble Garage	1	0
11/7/2017 20:17	Via Ortega @ Y2E2	1	0
11/7/2017 20:19	Roth @ Quarry Ext	1	0
11/7/2017 20:20	Quarry Ext @ Med School	4	0
11/7/2017 20:21	Medical Center @ Quarry	1	0
11/7/2017 20:23	Quarry @ Psychiatry Bld	0	1
11/7/2017 20:28	PATC-University Circle	0	9
11/7/2017 20:31	PATC-University Circle	1	0
11/7/2017 20:38	El Camino @ PAMF SB	0	1
11/7/2017 20:45	Campus @ Escondido	1	0
11/7/2017 20:52	Tresidder West	2	1
11/7/2017 20:55	Via Ortega S at Roble Garage	1	0
11/7/2017 20:56	Via Ortega @ Y2E2	1	0
11/7/2017 20:59	Quarry Ext @ Med School	3	0
11/7/2017 20:59	Medical Center @ Quarry	3	0
11/7/2017 21:01	Quarry @ Psychiatry Lot	2	0
11/7/2017 21:02	Quarry @ Psychiatry Bld	0	1
11/7/2017 21:05	PATC-University Circle	0	11
11/8/2017 6:15	Stock Farm Garage E	1	1
11/8/2017 6:25	Caltrain Platform South	1	1
11/8/2017 6:26	PATC-University Circle	0	0
11/8/2017 6:28	PATC-University Circle	11	1
11/8/2017 6:29	PATC-University Circle	2	1
11/8/2017 6:36	Galvez @ El Camino Real	1	0
11/8/2017 6:39	Serra @ Encina Hall	0	2
11/8/2017 6:40	Serra @ Manzanita Field	0	6
11/8/2017 6:42	Unknown	0	0
11/8/2017 6:43	Campus @ Munger	0	1
11/8/2017 6:45	Tresidder West	0	2
11/8/2017 6:48	Tresidder West	1	0
11/8/2017 6:52	Via Ortega S at Roble Garage	3	0

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DateTime	StopName	Boardings	Alightings
11/8/2017 6:57	Unknown	0	0
11/8/2017 7:08	PATC-University Circle	8	7
11/8/2017 7:13	Galvez @ Serra Mall	0	1
11/8/2017 7:14	Serra @ Encina Hall	0	1
11/8/2017 7:16	Campus @ Escondido	0	1
11/8/2017 7:24	Tresidder West	2	2
11/8/2017 7:31	Medical Center @ Quarry	1	0
11/8/2017 7:36	PATC-University Circle	0	1
11/8/2017 7:42	PATC-University Circle	36	4
11/8/2017 7:48	Galvez @ Alumni Center	1	9
11/8/2017 7:49	Galvez @ Serra Mall	0	10
11/8/2017 7:50	Serra @ Encina Hall	0	6
11/8/2017 7:51	Serra @ Manzanita Field	0	3
11/8/2017 7:53	Campus @ Wilbur Lot	2	0
11/8/2017 7:55	Campus @ Mayfield N	0	2
11/8/2017 8:00	Tresidder West	1	7
11/8/2017 8:04	Via Ortega S Across from Roble	1	0
11/8/2017 8:07	Roth @ Quarry Ext	0	1
11/8/2017 8:18	Quarry Ext Middle	3	0
11/8/2017 8:19	Quarry Ext @ Medical C	1	0
11/8/2017 8:20	Quarry Ext @ Medical C	1	0
11/8/2017 8:33	PATC-University Circle	44	7
11/8/2017 8:34	PATC-University Circle	0	0
11/8/2017 8:39	Galvez @ El Camino Real	0	1
11/8/2017 8:41	Galvez @ Alumni Center	2	7
11/8/2017 8:42	Galvez @ Memorial	1	4
11/8/2017 8:42	Galvez @ Serra Mall	0	9
11/8/2017 8:43	Serra @ Encina Hall	0	5
11/8/2017 8:44	Serra @ Manzanita Field	1	4
11/8/2017 8:46	Campus @ Escondido	1	1
11/8/2017 8:47	Campus @ Wilbur Lot	0	0
11/8/2017 8:48	Campus @ Munger	1	2
11/8/2017 8:49	Campus @ Mayfield N	0	1
11/8/2017 8:51	Tresidder West	0	5
11/8/2017 8:54	Via Ortega @ Y2E2	0	2
11/8/2017 8:56	Roth @ Quarry Ext	0	1
11/8/2017 9:00	Quarry Ext Middle	2	1
11/8/2017 9:09	PATC-University Circle	4	3
11/8/2017 9:16	Galvez @ Serra Mall	0	2
11/8/2017 9:19	Campus @ Escondido	1	0
11/8/2017 9:20	Campus @ Wilbur Field	1	0
11/8/2017 9:22	Campus @ Mayfield N	2	0
11/8/2017 9:25	Tresidder West	0	2
11/8/2017 9:29	Santa Teresa @ Lomita	0	0
11/8/2017 9:33	Roth @ Quarry Ext	0	1
11/8/2017 9:37	Quarry Ext @ Med School	1	1
11/8/2017 9:38	Medical Center @ Quarry	1	0
11/8/2017 9:52	PATC-University Circle	11	2
11/8/2017 9:56	Galvez @ El Camino Real	2	0
11/8/2017 9:58	Galvez @ Alumni Center	0	5
11/8/2017 9:59	Galvez @ Memorial	0	1
11/8/2017 10:00	Galvez @ Serra Mall	0	3
11/8/2017 10:02	Campus @ Escondido	2	0
11/8/2017 10:03	Campus @ Wilbur Lot	1	0
11/8/2017 10:04	Campus @ Wilbur Field	1	0
11/8/2017 10:05	Campus @ Munger	0	1
11/8/2017 10:06	Campus @ Mayfield N	0	1
11/8/2017 10:07	Tresidder West	0	2
11/8/2017 10:09	Santa Teresa @ Lomita	0	1
11/8/2017 10:13	Via Ortega @ Y2E2	1	3
11/8/2017 10:17	Quarry Ext Middle	1	1

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DateTime	StopName	Boardings	Alightings
11/8/2017 10:18	Medical Center @ Quarry	2	0
11/8/2017 10:19	Quarry @ Psychiatry Lot	1	0
11/8/2017 10:20	Quarry @ Crate/Barrel	0	0
11/8/2017 10:36	PATC-University Circle	9	7
11/8/2017 10:44	Galvez @ Memorial	0	2
11/8/2017 10:45	Serra @ Encina Hall	0	2
11/8/2017 10:46	Serra @ Manzanita Field	0	2
11/8/2017 10:48	Campus @ Escondido	0	0
11/8/2017 10:52	Tresidder West	0	3
11/8/2017 11:01	Medical Center @ Quarry	3	0
11/8/2017 11:03	Quarry @ Psychiatry Bld	1	1
11/8/2017 11:13	PATC-University Circle	4	6
11/8/2017 11:14	PATC-University Circle	0	0
11/8/2017 11:21	Galvez @ Alumni Center	0	0
11/8/2017 11:23	Galvez @ Serra Mall	1	1
11/8/2017 11:26	Campus @ Escondido	2	1
11/8/2017 11:27	Campus @ Munger	0	1
11/8/2017 11:31	Tresidder West	3	2
11/8/2017 11:35	Via Ortega S at Roble Garage	0	1
11/8/2017 11:38	Quarry Ext @ Med School	6	2
11/8/2017 11:40	Quarry @ Psychiatry Lot	6	2
11/8/2017 11:55	PATC-University Circle	10	11
11/8/2017 11:59	Galvez @ El Camino Real	3	1
11/8/2017 12:04	Galvez @ Alumni Center	1	4
11/8/2017 12:05	Galvez @ Serra Mall	0	1
11/8/2017 12:07	Serra @ Manzanita Field	0	1
11/8/2017 12:08	Campus @ Escondido	4	0
11/8/2017 12:14	Santa Teresa @ Lomita	1	0
11/8/2017 12:16	Via Ortega @ Y2E2	2	0
11/8/2017 12:19	Medical Center @ Quarry	4	1
11/8/2017 12:26	Caltrain Platform South	2	10
11/8/2017 12:26	PATC-University Circle	0	0
11/8/2017 12:27	PATC-University Circle	0	0
11/8/2017 15:54	Unknown	0	0
11/8/2017 15:57	Unknown	1	1
11/8/2017 19:16	Via Ortega S at Roble Garage	1	0
11/8/2017 19:17	Via Ortega @ Y2E2	5	0
11/8/2017 19:20	Quarry Ext @ Med School	4	0
11/8/2017 19:21	Quarry Ext @ Medical C	3	0
11/8/2017 19:22	Quarry Ext @ Medical C	1	0
11/8/2017 19:23	Quarry @ Psychiatry Lot	2	0
11/8/2017 19:34	PATC-University Circle	1	22
11/8/2017 19:39	Galvez @ El Camino Real	1	0
11/8/2017 19:44	Campus @ Escondido	2	1
11/8/2017 19:51	Tresidder West	4	2
11/8/2017 19:54	Santa Teresa @ Lomita	0	2
11/8/2017 19:55	Via Ortega S at Roble Garage	0	1
11/8/2017 19:57	Via Ortega @ Y2E2	2	0
11/8/2017 19:59	Roth @ Quarry Ext	1	0
11/8/2017 19:59	Quarry Ext @ Med School	6	0
11/8/2017 20:00	Medical Center @ Quarry	9	3
11/8/2017 20:02	Quarry @ Psychiatry Lot	1	0
11/8/2017 20:03	Quarry @ Psychiatry Bld	0	1
11/8/2017 20:13	PATC-University Circle	2	20
11/8/2017 20:19	Serra @ Encina Hall	1	0
11/8/2017 20:21	Campus @ Escondido	0	1
11/8/2017 20:26	Tresidder West	0	0
11/8/2017 20:31	Tresidder West	4	2
11/8/2017 20:39	Medical Center @ Quarry	1	0
11/8/2017 20:43	PATC-University Circle	0	2
11/8/2017 20:55	Unknown	0	0

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DateTime	StopName	Boardings	Alightings
11/9/2017 16:41	Roth @ Quarry Ext	0	0
11/9/2017 16:44	Santa Teresa @ Lomita	1	1
11/9/2017 16:49	Stock Farm N @ Oak	0	0
11/9/2017 16:50	Stock Farm N @ Oak	0	0
11/9/2017 16:55	Unknown	0	0
11/9/2017 17:08	Tresidder West	2	1
11/9/2017 17:11	Via Ortega S Across from Roble	1	0
11/9/2017 17:12	Via Ortega @ Y2E2	1	0
11/9/2017 17:15	Quarry Ext @ Med School	1	2
11/9/2017 17:24	PATC-University Circle	4	3
11/9/2017 17:34	Serra @ Encina Hall	5	4
11/9/2017 17:37	Campus @ Escondido	0	2
11/9/2017 17:46	Tresidder West	3	3
11/9/2017 17:48	Via Ortega S at Roble Garage	5	3
11/9/2017 17:50	Via Ortega @ Y2E2	1	0
11/9/2017 17:53	Quarry Ext @ Med School	1	0
11/9/2017 17:53	Medical Center @ Quarry	1	0
11/9/2017 17:56	Quarry @ Crate/Barrel	1	1
11/9/2017 18:07	PATC-University Circle	2	7
11/9/2017 18:08	PATC-University Circle	0	0
11/9/2017 18:13	El Camino @ PAMF SB	1	0
11/9/2017 18:16	Galvez @ El Camino Real	1	0
11/9/2017 18:20	Campus @ Escondido	1	2
11/9/2017 18:25	Unknown	0	0
11/9/2017 18:25	Tresidder West	1	1
11/9/2017 18:29	Via Ortega S at Roble Garage	2	0
11/9/2017 18:30	Via Ortega @ Y2E2	2	1
11/9/2017 18:34	Quarry Ext @ Med School	7	0
11/9/2017 18:35	Medical Center @ Quarry	2	0
11/9/2017 18:35	Medical Center @ Quarry	1	0
11/9/2017 18:36	Quarry @ Psychiatry Lot	1	0
11/9/2017 18:37	Quarry @ Crate/Barrel	0	1
11/9/2017 18:41	PATC-University Circle	0	15
11/9/2017 18:47	Galvez @ El Camino Real	2	0
11/9/2017 18:52	Campus @ Escondido	2	2
11/9/2017 19:00	Tresidder West	1	3
11/9/2017 19:03	Santa Teresa @ Lomita	1	0
11/9/2017 19:04	Via Ortega S at Roble Garage	1	0
11/9/2017 19:05	Via Ortega @ Y2E2	1	0
11/9/2017 19:08	Medical Center @ Quarry	1	0
11/9/2017 19:10	Quarry @ Psychiatry Lot	1	0
11/9/2017 19:20	PATC-University Circle	4	9
11/9/2017 19:20	PATC-University Circle	0	0
11/9/2017 19:24	Galvez @ El Camino Real	0	0
11/9/2017 19:25	Galvez @ El Camino Real	1	0
11/9/2017 19:28	Serra @ Encina Hall	0	1
11/9/2017 19:28	Serra @ Campus Dr	0	1
11/9/2017 19:30	Campus @ Escondido	1	0
11/9/2017 19:32	Campus @ Munger	0	1
11/9/2017 19:34	Tresidder West	0	0
11/9/2017 19:38	Via Ortega @ Y2E2	1	1
11/9/2017 19:38	Via Ortega @ Y2E2	1	0
11/9/2017 19:40	Roth @ Quarry Ext	1	0
11/9/2017 19:41	Quarry Ext @ Med School	1	0
11/9/2017 19:42	Medical Center @ Quarry	5	0
11/9/2017 19:42	Medical Center @ Quarry	1	0
11/9/2017 19:43	Quarry @ Psychiatry Lot	0	0
11/9/2017 19:44	Quarry @ Crate/Barrel	1	0
11/9/2017 19:54	PATC-University Circle	3	12
11/9/2017 20:04	Campus @ Escondido	0	2
11/9/2017 20:11	Tresidder West	0	0

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DateTime	StopName	Boardings	Alightings
11/9/2017 20:15	Via Ortega S at Roble Garage	1	0
11/9/2017 20:16	Via Ortega @ Y2E2	1	0
11/9/2017 20:18	Quarry Ext @ Med School	5	0
11/9/2017 20:33	PATC-University Circle	0	8
11/9/2017 20:39	Galvez @ El Camino Real	1	0
11/9/2017 20:48	Tresidder West	2	1
11/9/2017 20:49	Tresidder West	1	0
11/9/2017 20:55	Via Ortega S Across from Roble	1	0
11/9/2017 20:56	Via Ortega @ Y2E2	1	0
11/9/2017 20:58	Roth @ Quarry Ext	1	0
11/9/2017 20:58	Quarry Ext @ Med School	2	0
11/9/2017 20:59	Medical Center @ Quarry	0	0
11/9/2017 21:04	PATC-University Circle	0	9
11/10/2017 5:54	Unknown	5	5
11/10/2017 5:59	Stock Farm Garage E	1	1
11/10/2017 6:19	Serra @ Encina Hall	0	3
11/10/2017 6:20	Serra @ Manzanita Field	0	1
11/10/2017 6:23	Campus @ Munger	0	2
11/10/2017 6:25	Tresidder West	0	2
11/10/2017 6:33	Santa Teresa @ Lomita	0	1
11/10/2017 6:39	Medical Center @ Quarry	1	0
11/10/2017 6:48	PATC-University Circle	4	4
11/10/2017 6:54	Serra @ Encina Hall	0	1
11/10/2017 7:01	Tresidder West	3	2
11/10/2017 7:13	Medical Center @ Quarry	1	0
11/10/2017 7:13	Medical Center @ Quarry	1	0
11/10/2017 7:22	PATC-University Circle	14	3
11/10/2017 7:23	PATC-University Circle	4	0
11/10/2017 7:24	PATC-University Circle	1	0
11/10/2017 7:31	Galvez @ Alumni Center	0	4
11/10/2017 7:32	Galvez @ Serra Mall	0	4
11/10/2017 7:33	Serra @ Encina Hall	0	4
11/10/2017 7:34	Serra @ Manzanita Field	0	1
11/10/2017 7:35	Campus @ Escondido	0	1
11/10/2017 7:36	Campus @ Wilbur Field	0	1
11/10/2017 7:39	Tresidder West	0	3
11/10/2017 7:47	Santa Teresa @ Lomita	2	0
11/10/2017 7:48	Via Ortega S at Roble Garage	2	0
11/10/2017 7:53	Quarry Ext @ Medical C	1	0
11/10/2017 7:55	Quarry @ Psychiatry Bld	0	1
11/10/2017 8:07	PATC-University Circle	6	6
11/10/2017 8:08	PATC-University Circle	1	0
11/10/2017 8:10	PATC-University Circle	1	0
11/10/2017 8:13	El Camino @ PAMF SB	0	1
11/10/2017 8:14	Galvez @ El Camino Real	1	0
11/10/2017 8:17	Galvez @ Serra Mall	0	1
11/10/2017 8:20	Campus @ Escondido	1	0
11/10/2017 8:24	Tresidder West	0	4
11/10/2017 8:32	Via Ortega @ Y2E2	0	1
11/10/2017 8:45	PATC-University Circle	31	1
11/10/2017 8:50	PATC-University Circle	6	1
11/10/2017 8:56	Galvez @ Alumni Center	0	11
11/10/2017 8:57	Galvez @ Serra Mall	0	12
11/10/2017 8:58	Serra @ Encina Hall	0	9
11/10/2017 8:59	Serra @ Manzanita Field	0	2
11/10/2017 9:01	Campus @ Escondido	1	0
11/10/2017 9:03	Campus @ Munger	0	1
11/10/2017 9:07	Tresidder West	0	3
11/10/2017 9:11	Via Ortega S at Roble Garage	2	0
11/10/2017 9:12	Via Ortega @ Y2E2	1	2
11/10/2017 9:16	Medical Center @ Quarry	1	0

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DateTime	StopName	Boardings	Alightings
11/10/2017 9:30	PATC-University Circle	20	7
11/10/2017 9:37	Galvez @ Serra Mall	0	3
11/10/2017 9:40	Campus @ Escondido	0	1
11/10/2017 9:42	Campus @ Wilbur Field	1	4
11/10/2017 9:43	Campus @ Munger	0	3
11/10/2017 9:45	Tresidder West	3	2
11/10/2017 9:49	Tresidder West	1	2
11/10/2017 9:55	Quarry Ext @ Med School	1	0
11/10/2017 9:55	Quarry Ext @ Med School	0	1
11/10/2017 9:56	Quarry Ext @ Medical C	1	0
11/10/2017 9:57	Quarry @ Psychiatry Lot	0	0
11/10/2017 10:14	PATC-University Circle	13	7
11/10/2017 10:18	Galvez @ El Camino Real	1	0
11/10/2017 10:21	Galvez @ Alumni Center	0	3
11/10/2017 10:22	Galvez @ Serra Mall	0	1
11/10/2017 10:23	Serra @ Encina Hall	0	3
11/10/2017 10:25	Campus @ Escondido	1	0
11/10/2017 10:27	Campus @ Munger	0	3
11/10/2017 10:32	Tresidder West	0	3
11/10/2017 10:32	Tresidder West	1	0
11/10/2017 10:37	Via Ortega @ Y2E2	2	0
11/10/2017 10:39	Quarry Ext @ Med School	0	1
11/10/2017 10:54	PATC-University Circle	13	5
11/10/2017 10:59	Galvez @ El Camino Real	1	0
11/10/2017 11:01	Galvez @ Alumni Center	0	4
11/10/2017 11:02	Galvez @ Serra Mall	0	3
11/10/2017 11:03	Serra @ Encina Hall	0	5
11/10/2017 11:04	Serra @ Manzanita Field	0	1
11/10/2017 11:07	Campus @ Munger	1	0
11/10/2017 11:11	Tresidder West	3	0
11/10/2017 11:20	Medical Center @ Quarry	3	1
11/10/2017 11:38	Galvez @ El Camino Real	1	0
11/10/2017 11:41	Galvez @ Serra Mall	0	4
11/10/2017 11:41	Serra @ Encina Hall	0	2
11/10/2017 11:45	Campus @ Wilbur Lot	1	0
11/10/2017 11:45	Campus @ Wilbur Field	1	0
11/10/2017 11:51	Tresidder West	1	2
11/10/2017 11:59	Quarry Ext @ Med School	0	2
11/10/2017 12:02	Quarry @ Psychiatry Bld	0	4
11/10/2017 12:14	PATC-University Circle	31	9
11/10/2017 12:25	Campus @ Escondido	3	1
11/10/2017 12:39	Quarry Ext @ Med School	1	0
11/10/2017 12:40	Medical Center @ Quarry	2	0
11/10/2017 12:42	Quarry @ Psychiatry Bld	0	2
11/10/2017 12:54	PATC-University Circle	1	10
11/10/2017 12:54	PATC-University Circle	1	0
11/10/2017 13:05	Campus @ Wilbur Field	1	0
11/10/2017 13:06	Campus @ Munger	2	0
11/10/2017 13:06	Campus @ Mayfield N	1	0
11/10/2017 13:17	Via Ortega @ Y2E2	2	3
11/10/2017 13:20	Medical Center @ Quarry	2	1
11/10/2017 13:23	Quarry @ Psychiatry Bld	0	5
11/10/2017 13:34	PATC-University Circle	4	6
11/10/2017 13:35	PATC-University Circle	1	0
11/10/2017 13:40	Galvez @ El Camino Real	2	0
11/10/2017 13:43	Unknown	0	1
11/10/2017 13:46	Campus @ Escondido	0	1
11/10/2017 13:47	Campus @ Munger	1	0
11/10/2017 13:51	Tresidder West	5	1
11/10/2017 13:57	Via Ortega @ Y2E2	0	1
11/10/2017 14:01	Quarry Ext @ Medical C	1	0

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DateTime	StopName	Boardings	Alightings
11/10/2017 14:03	Quarry @ Psychiatry Lot	1	0
11/10/2017 14:04	Quarry @ Psychiatry Bld	0	3
11/10/2017 14:14	PATC-University Circle	9	10
11/10/2017 14:20	Unknown	0	8
11/10/2017 14:25	Campus @ Wilbur Field	2	0
11/10/2017 14:40	Roth @ Quarry Ext	1	0
11/10/2017 14:43	Quarry Ext @ Medical C	3	0
11/10/2017 14:45	Quarry @ Psychiatry Lot	6	3
11/10/2017 15:05	Unknown	1	2
11/10/2017 15:10	Campus @ Wilbur Lot	1	0
11/10/2017 15:11	Campus @ Munger	0	2
11/10/2017 15:15	Tresidder West	1	7
11/10/2017 15:21	Via Ortega @ Y2E2	4	0
11/10/2017 15:25	Quarry Ext @ Medical C	1	0
11/10/2017 15:27	Quarry @ Psychiatry Lot	11	0
11/10/2017 15:29	Quarry @ Psychiatry Bld	2	1
11/10/2017 15:38	PATC-University Circle	18	30
11/10/2017 15:50	El Camino @ PAMF NB	0	5
11/10/2017 15:53	Galvez @ El Camino Real	0	3
11/10/2017 15:58	Unknown	0	6
11/10/2017 16:00	Unknown	0	3
11/10/2017 16:01	Campus @ Escondido	0	1
11/10/2017 16:06	Tresidder West	7	1
11/10/2017 16:08	Santa Teresa @ Lomita	2	0
11/10/2017 16:10	Via Ortega S at Roble Garage	0	1
11/10/2017 16:11	Via Ortega @ Y2E2	1	0
11/10/2017 16:14	Quarry Ext @ Med School	6	1
11/10/2017 16:15	Medical Center @ Quarry	3	0
11/10/2017 16:16	Quarry @ Psychiatry Lot	3	0
11/10/2017 16:19	Quarry @ Psychiatry Bld	1	0
11/10/2017 16:39	PATC-University Circle	0	23
11/10/2017 16:42	PATC-University Circle	14	1
11/10/2017 16:58	El Camino @ PAMF NB	0	2
11/10/2017 17:07	Unknown	1	7
11/10/2017 17:10	Campus @ Escondido	0	2
11/10/2017 17:11	Campus @ Wilbur Field	1	0
11/10/2017 17:19	Tresidder West	7	0
11/10/2017 17:21	Santa Teresa @ Lomita	1	0
11/10/2017 17:28	Medical Center @ Quarry	2	0
11/10/2017 17:30	Quarry @ Psychiatry Lot	1	0
11/10/2017 17:31	Quarry @ Psychiatry Bld	0	3
11/10/2017 17:57	PATC-University Circle	34	13
11/10/2017 17:57	PATC-University Circle	2	0
11/10/2017 18:09	El Camino @ PAMF SB	0	15
11/10/2017 18:11	Galvez @ El Camino Real	1	0
11/10/2017 18:15	Unknown	0	4
11/10/2017 18:18	Unknown	2	4
11/10/2017 18:21	Campus @ Escondido	0	2
11/10/2017 18:22	Campus @ Wilbur Lot	1	0
11/10/2017 18:23	Campus @ Wilbur Field	0	2
11/10/2017 18:24	Campus @ Munger	0	4
11/10/2017 18:29	Tresidder West	4	4
11/10/2017 18:32	Santa Teresa @ Lomita	0	2
11/10/2017 18:33	Via Ortega S at Roble Garage	0	2
11/10/2017 18:36	Via Ortega S at Roble Garage	1	4
11/10/2017 18:42	Quarry Ext @ Med School	1	0
11/10/2017 18:56	Medical Center @ Quarry	13	17
11/10/2017 19:06	PATC-University Circle	9	6
11/10/2017 19:19	Galvez @ El Camino Real	2	2
11/10/2017 19:25	Unknown	0	3
11/10/2017 19:27	Campus @ Escondido	0	2

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DateTime	StopName	Boardings	Alightings
11/10/2017 19:28	Campus @ Wilbur Lot	1	1
11/10/2017 19:29	Campus @ Munger	1	2
11/10/2017 19:32	Tresidder West	0	2
11/10/2017 19:36	Via Ortega @ Y2E2	2	0
11/10/2017 19:38	Quarry Ext @ Med School	3	0
11/10/2017 19:44	PATC-University Circle	2	7
11/10/2017 19:54	Campus @ Escondido	0	2
11/10/2017 19:58	Tresidder West	0	0
11/10/2017 20:02	Via Ortega @ Y2E2	1	0
11/10/2017 20:05	Medical Center @ Quarry	1	0
11/10/2017 20:13	PATC-University Circle	1	3
11/10/2017 20:19	Galvez @ El Camino Real	0	0
11/10/2017 20:24	Campus @ Escondido	0	2
11/10/2017 20:32	Tresidder West	3	2
11/10/2017 20:36	Via Ortega @ Y2E2	1	0
11/10/2017 20:44	PATC-University Circle	0	2
11/10/2017 20:56	Unknown	1	1
11/10/2017 21:03	Unknown	1	1
11/10/2017 21:06	Unknown	1	1
11/10/2017 21:11	Unknown	1	1
11/10/2017 21:17	Unknown	1	1
11/11/2017 13:53	Unknown	4	3
11/11/2017 13:54	Unknown	1	1
11/13/2017 5:57	Unknown	2	2
11/13/2017 6:40	Quarry Ext @ Medical C	0	1
11/13/2017 6:48	PATC-University Circle	3	2
11/13/2017 6:54	Galvez @ El Camino Real	2	0
11/13/2017 6:57	Galvez @ Serra Mall	0	1
11/13/2017 6:58	Serra @ Manzanita Field	0	4
11/13/2017 7:04	Tresidder West	0	0
11/13/2017 7:06	Tresidder West	0	0
11/13/2017 7:14	Medical Center @ Quarry	0	0
11/13/2017 7:25	PATC-University Circle	35	3
11/13/2017 7:26	PATC-University Circle	1	0
11/13/2017 7:26	PATC-University Circle	1	0
11/13/2017 7:32	Galvez @ El Camino Real	1	0
11/13/2017 7:35	Galvez @ Alumni Center	0	12
11/13/2017 7:36	Galvez @ Serra Mall	0	13
11/13/2017 7:37	Serra @ Encina Hall	0	7
11/13/2017 7:38	Serra @ Manzanita Field	0	3
11/13/2017 7:40	Campus @ Wilbur Lot	1	0
11/13/2017 7:40	Campus @ Wilbur Field	0	2
11/13/2017 7:41	Campus @ Munger	0	2
11/13/2017 7:42	Campus @ Mayfield N	0	3
11/13/2017 7:44	Tresidder West	0	0
11/13/2017 7:46	Santa Teresa @ New Guinea	0	0
11/13/2017 7:48	Via Ortega S at Roble Garage	3	0
11/13/2017 7:53	Quarry Ext @ Medical C	1	1
11/13/2017 7:55	Quarry @ Psychiatry Bld	0	1
11/13/2017 8:10	PATC-University Circle	7	9
11/13/2017 8:17	Galvez @ Memorial	0	2
11/13/2017 8:18	Serra @ Encina Hall	0	1
11/13/2017 8:20	Campus @ Escondido	1	0
11/13/2017 8:22	Campus @ Wilbur Field	2	0
11/13/2017 8:23	Campus @ Mayfield N	0	1
11/13/2017 8:28	Tresidder West	4	2
11/13/2017 8:33	Via Ortega @ Y2E2	0	1
11/13/2017 8:50	PATC-University Circle	3	1
11/13/2017 8:55	Galvez @ El Camino Real	4	0
11/13/2017 8:59	Galvez @ Memorial	0	1
11/13/2017 8:59	Galvez @ Serra Mall	0	2

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DateTime	StopName	Boardings	Alightings
11/13/2017 9:04	Campus @ Escondido	6	0
11/13/2017 9:06	Campus @ Wilbur Field	1	1
11/13/2017 9:07	Campus @ Munger	1	2
11/13/2017 9:10	Tresidder West	1	4
11/13/2017 9:13	Tresidder West	1	1
11/13/2017 9:15	Santa Teresa @ Lomita	0	4
11/13/2017 9:17	Via Ortega S at Roble Garage	2	0
11/13/2017 9:18	Via Ortega @ Y2E2	2	5
11/13/2017 9:20	Roth @ Quarry Ext	0	1
11/13/2017 9:25	Quarry @ Crate/Barrel	0	1
11/13/2017 9:29	PATC-University Circle	19	0
11/13/2017 9:30	PATC-University Circle	3	1
11/13/2017 9:36	El Camino @ PAMF SB	0	1
11/13/2017 9:39	Galvez @ Memorial	0	3
11/13/2017 9:40	Galvez @ Serra Mall	0	8
11/13/2017 9:41	Serra @ Encina Hall	0	5
11/13/2017 9:43	Campus @ Escondido	1	0
11/13/2017 9:45	Campus @ Munger	1	0
11/13/2017 9:46	Campus @ Mayfield N	0	1
11/13/2017 9:48	Tresidder West	0	2
11/13/2017 9:52	Via Ortega @ Y2E2	0	1
11/13/2017 9:54	Roth @ Quarry Ext	0	1
11/13/2017 10:14	PATC-University Circle	17	5
11/13/2017 10:18	Galvez @ El Camino Real	0	0
11/13/2017 10:21	Galvez @ Serra Mall	0	4
11/13/2017 10:23	Serra @ Manzanita Field	2	7
11/13/2017 10:24	Campus @ Escondido	3	0
11/13/2017 10:25	Campus @ Wilbur Lot	1	1
11/13/2017 10:27	Campus @ Mayfield N	0	1
11/13/2017 10:31	Tresidder West	1	4
11/13/2017 10:35	Via Ortega @ Y2E2	1	3
11/13/2017 10:38	Medical Center @ Quarry	0	1
11/13/2017 10:41	Quarry @ Crate/Barrel	0	2
11/13/2017 10:54	PATC-University Circle	18	2
11/13/2017 10:58	Galvez @ El Camino Real	3	0
11/13/2017 11:00	Galvez @ Memorial	0	3
11/13/2017 11:01	Galvez @ Serra Mall	0	1
11/13/2017 11:02	Serra @ Encina Hall	1	3
11/13/2017 11:04	Campus @ Escondido	1	2
11/13/2017 11:11	Tresidder West	2	9
11/13/2017 11:15	Via Ortega S at Roble Garage	2	1
11/13/2017 11:16	Via Ortega @ Y2E2	0	1
11/13/2017 11:18	Roth @ Quarry Ext	0	2
11/13/2017 11:19	Quarry Ext @ Med School	2	0
11/13/2017 11:20	Medical Center @ Quarry	4	1
11/13/2017 11:33	PATC-University Circle	5	10
11/13/2017 11:38	Galvez @ El Camino Real	1	0
11/13/2017 11:41	Galvez @ Serra Mall	0	3
11/13/2017 11:43	Campus @ Escondido	0	1
11/13/2017 11:52	Tresidder West	0	0
11/13/2017 11:54	Via Ortega S at Roble Garage	1	0
11/13/2017 11:58	Quarry Ext @ Med School	0	1
11/13/2017 12:13	PATC-University Circle	14	3
11/13/2017 12:17	Galvez @ El Camino Real	1	0
11/13/2017 12:20	Galvez @ Alumni Center	0	3
11/13/2017 12:21	Galvez @ Serra Mall	0	0
11/13/2017 12:21	Serra @ Encina Hall	0	2
11/13/2017 12:24	Campus @ Escondido	2	1
11/13/2017 12:26	Campus @ Munger	0	1
11/13/2017 12:27	Campus @ Mayfield N	0	2
11/13/2017 12:31	Tresidder West	2	0

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DateTime	StopName	Boardings	Alightings
11/13/2017 12:34	Via Ortega S at Roble Garage	0	1
11/13/2017 12:36	Via Ortega @ Y2E2	0	3
11/13/2017 12:38	Quarry Ext @ Med School	3	2
11/13/2017 12:54	PATC-University Circle	8	8
11/13/2017 12:59	Galvez @ El Camino Real	3	0
11/13/2017 13:01	Quarry Ext Middle	3	1
11/13/2017 13:01	Quarry Ext @ Medical C	1	0
11/13/2017 13:01	Galvez @ Alumni Center	0	2
11/13/2017 13:03	Serra @ Encina Hall	0	1
11/13/2017 13:06	Campus @ Wilbur Lot	0	1
11/13/2017 13:07	Campus @ Munger	0	1
11/13/2017 13:12	Tresidder West	6	1
11/13/2017 13:14	Santa Teresa @ New Guinea	1	0
11/13/2017 13:16	PATC-University Circle	4	4
11/13/2017 13:18	Roth @ Quarry Ext	1	3
11/13/2017 13:19	Quarry Ext @ Med School	1	0
11/13/2017 13:20	Quarry Ext @ Medical C	4	0
11/13/2017 13:21	Galvez @ El Camino Real	1	0
11/13/2017 13:23	Quarry @ Psychiatry Bld	0	1
11/13/2017 13:23	Galvez @ Serra Mall	0	3
11/13/2017 13:24	Serra @ Encina Hall	1	1
11/13/2017 13:29	Campus @ Munger	2	0
11/13/2017 13:32	Tresidder West	1	2
11/13/2017 13:34	PATC-University Circle	2	9
11/13/2017 13:35	Via Ortega S at Roble Garage	1	0
11/13/2017 13:37	Via Ortega @ Y2E2	6	0
11/13/2017 13:38	El Camino @ PAMF SB	0	0
11/13/2017 13:39	Galvez @ El Camino Real	3	0
11/13/2017 13:39	Quarry Ext @ Med School	1	1
11/13/2017 13:40	Quarry Ext @ Medical C	1	0
11/13/2017 13:41	Galvez @ Alumni Center	0	1
11/13/2017 13:43	Galvez @ Serra Mall	0	1
11/13/2017 13:43	Quarry @ Psychiatry Bld	0	2
11/13/2017 13:50	Tresidder West	1	0
11/13/2017 13:53	PATC-University Circle	5	9
11/13/2017 13:56	Via Ortega @ Y2E2	1	0
11/13/2017 13:57	El Camino @ PAMF SB	2	0
11/13/2017 14:02	Quarry @ Psychiatry Bld	2	0
11/13/2017 14:03	Campus @ Escondido	0	1
11/13/2017 14:04	Campus @ Wilbur Field	1	0
11/13/2017 14:12	Tresidder West	1	5
11/13/2017 14:14	PATC-University Circle	6	6
11/13/2017 14:14	Via Ortega S at Roble Garage	1	0
11/13/2017 14:16	Via Ortega @ Y2E2	0	1
11/13/2017 14:18	Roth @ Quarry Ext	5	2
11/13/2017 14:19	Galvez @ El Camino Real	3	1
11/13/2017 14:19	Medical Center @ Quarry	8	0
11/13/2017 14:21	Galvez @ Alumni Center	0	1
11/13/2017 14:21	Quarry @ Psychiatry Lot	2	1
11/13/2017 14:22	Galvez @ Memorial	0	1
11/13/2017 14:27	Campus @ Wilbur Lot	0	3
11/13/2017 14:32	Tresidder West	1	0
11/13/2017 14:34	PATC-University Circle	1	12
11/13/2017 14:34	Santa Teresa @ Lomita	0	0
11/13/2017 14:37	Via Ortega S at Roble Garage	1	3
11/13/2017 14:38	Via Ortega @ Y2E2	1	1
11/13/2017 14:39	Galvez @ Alumni Center	1	0
11/13/2017 14:41	Roth @ Quarry Ext	1	0
11/13/2017 14:42	Quarry Ext @ Med School	3	0
11/13/2017 14:43	Campus @ Escondido	0	1
11/13/2017 14:43	Quarry Ext @ Medical C	7	0

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DateTime	StopName	Boardings	Alightings
11/13/2017 14:45	Quarry @ Psychiatry Lot	1	0
11/13/2017 14:52	Tresidder West	2	0
11/13/2017 14:54	PATC-University Circle	2	17
11/13/2017 14:56	Via Ortega @ Y2E2	2	0
11/13/2017 14:58	Roth @ Quarry Ext	0	0
11/13/2017 14:59	Quarry Ext @ Med School	2	0
11/13/2017 14:59	Galvez @ El Camino Real	3	0
11/13/2017 15:00	Medical Center @ Quarry	2	0
11/13/2017 15:01	Galvez @ Alumni Center	0	1
11/13/2017 15:02	Galvez @ Serra Mall	1	0
11/13/2017 15:03	Serra @ Encina Hall	1	1
11/13/2017 15:05	Serra @ Manzanita Field	1	1
11/13/2017 15:06	Campus @ Escondido	0	4
11/13/2017 15:08	Campus @ Wilbur Field	0	2
11/13/2017 15:08	Campus @ Munger	1	0
11/13/2017 15:09	Campus @ Mayfield N	0	1
11/13/2017 15:12	Tresidder West	1	0
11/13/2017 15:14	PATC-University Circle	5	8
11/13/2017 15:14	Santa Teresa @ Lomita	1	0
11/13/2017 15:16	Via Ortega S at Roble Garage	1	0
11/13/2017 15:18	Via Ortega @ Y2E2	4	2
11/13/2017 15:19	El Camino @ PAMF SB	0	2
11/13/2017 15:20	Galvez @ El Camino Real	1	0
11/13/2017 15:21	Roth @ Quarry Ext	0	0
11/13/2017 15:22	Quarry Ext @ Med School	3	0
11/13/2017 15:23	Quarry Ext @ Medical C	1	0
11/13/2017 15:24	Serra @ Manzanita Field	0	2
11/13/2017 15:24	Quarry @ Psychiatry Lot	6	0
11/13/2017 15:26	Campus @ Escondido	2	1
11/13/2017 15:26	Quarry @ Psychiatry Bld	0	5
11/13/2017 15:28	Campus @ Mayfield N	0	3
11/13/2017 15:32	Tresidder West	5	1
11/13/2017 15:33	PATC-University Circle	5	15
11/13/2017 15:36	Via Ortega S at Roble Garage	1	1
11/13/2017 15:36	Via Ortega S at Roble Garage	1	0
11/13/2017 15:37	Via Ortega @ Y2E2	3	0
11/13/2017 15:39	Roth @ Quarry Ext	0	2
11/13/2017 15:40	Quarry Ext @ Med School	4	1
11/13/2017 15:41	Medical Center @ Quarry	5	0
11/13/2017 15:41	Medical Center @ Quarry	1	0
11/13/2017 15:41	Galvez @ Serra Mall	0	1
11/13/2017 15:41	Galvez @ Serra Mall	0	1
11/13/2017 15:42	Serra @ Encina Hall	1	3
11/13/2017 15:42	Quarry @ Psychiatry Lot	0	0
11/13/2017 15:44	Quarry @ Psychiatry Bld	0	0
11/13/2017 15:44	Campus @ Escondido	1	0
11/13/2017 15:47	Campus @ Mayfield N	1	1
11/13/2017 15:48	PATC-University Circle	0	14
11/13/2017 15:52	Tresidder West	1	0
11/13/2017 15:54	PATC-University Circle	5	4
11/13/2017 15:54	Santa Teresa @ Lomita	1	0
11/13/2017 15:55	Via Ortega S at Roble Garage	0	1
11/13/2017 15:57	Via Ortega @ Y2E2	6	3
11/13/2017 15:59	El Camino @ PAMF SB	2	0
11/13/2017 15:59	Roth @ Quarry Ext	2	1
11/13/2017 16:00	Quarry Ext @ Med School	4	0
11/13/2017 16:01	Medical Center @ Quarry	8	0
11/13/2017 16:02	Galvez @ Memorial	0	1
11/13/2017 16:02	Quarry @ Psychiatry Lot	2	0
11/13/2017 16:03	Quarry @ Psychiatry Bld	0	1
11/13/2017 16:06	Campus @ Escondido	0	1

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DateTime	StopName	Boardings	Alightings
11/13/2017 16:07	Campus @ Wilbur Field	0	1
11/13/2017 16:12	Tresidder West	2	3
11/13/2017 16:14	PATC-University Circle	2	25
11/13/2017 16:14	Santa Teresa @ Lomita	1	0
11/13/2017 16:17	Via Ortega @ Y2E2	7	0
11/13/2017 16:20	Quarry Ext @ Med School	2	0
11/13/2017 16:20	Galvez @ Alumni Center	0	1
11/13/2017 16:20	Medical Center @ Quarry	4	0
11/13/2017 16:21	Galvez @ Memorial	1	0
11/13/2017 16:22	Quarry @ Psychiatry Lot	2	1
11/13/2017 16:23	Quarry @ Psychiatry Bld	0	2
11/13/2017 16:24	Campus @ Escondido	0	1
11/13/2017 16:25	Campus @ Wilbur Lot	1	0
11/13/2017 16:26	PATC-University Circle	0	14
11/13/2017 16:31	Tresidder West	0	0
11/13/2017 16:34	Santa Teresa @ Lomita	1	1
11/13/2017 16:34	PATC-University Circle	11	6
11/13/2017 16:36	Via Ortega @ Y2E2	4	0
11/13/2017 16:39	Roth @ Quarry Ext	1	0
11/13/2017 16:39	Quarry Ext @ Med School	4	0
11/13/2017 16:40	Medical Center @ Quarry	1	0
11/13/2017 16:40	Galvez @ El Camino Real	0	3
11/13/2017 16:41	Quarry @ Psychiatry Lot	1	0
11/13/2017 16:42	Galvez @ Alumni Center	1	1
11/13/2017 16:43	Quarry @ Psychiatry Bld	0	1
11/13/2017 16:43	Galvez @ Serra Mall	0	1
11/13/2017 16:44	Serra @ Encina Hall	0	1
11/13/2017 16:46	Campus @ Escondido	1	0
11/13/2017 16:52	Tresidder West	0	2
11/13/2017 16:54	PATC-University Circle	4	13
11/13/2017 16:54	Santa Teresa @ Lomita	0	1
11/13/2017 16:57	Via Ortega @ Y2E2	8	0
11/13/2017 17:00	Quarry Ext @ Med School	12	0
11/13/2017 17:01	Medical Center @ Quarry	8	0
11/13/2017 17:01	Medical Center @ Quarry	3	0
11/13/2017 17:03	Galvez @ El Camino Real	3	0
11/13/2017 17:03	Quarry @ Psychiatry Lot	8	0
11/13/2017 17:04	Quarry @ Psychiatry Bld	0	1
11/13/2017 17:05	Galvez @ Alumni Center	0	1
11/13/2017 17:07	Serra @ Manzanita Field	0	1
11/13/2017 17:08	PATC-University Circle	0	35
11/13/2017 17:09	Campus @ Escondido	1	2
11/13/2017 17:09	PATC-University Circle	2	0
11/13/2017 17:11	Campus @ Munger	0	1
11/13/2017 17:14	PATC-University Circle	2	2
11/13/2017 17:14	Tresidder West	2	0
11/13/2017 17:16	Santa Teresa @ Lomita	2	0
11/13/2017 17:18	Via Ortega S at Roble Garage	0	1
11/13/2017 17:19	Via Ortega @ Y2E2	4	0
11/13/2017 17:20	Galvez @ El Camino Real	0	0
11/13/2017 17:22	Galvez @ Alumni Center	0	1
11/13/2017 17:22	Quarry Ext @ Med School	9	0
11/13/2017 17:23	Medical Center @ Quarry	4	0
11/13/2017 17:23	Galvez @ Serra Mall	3	3
11/13/2017 17:25	Quarry @ Psychiatry Lot	7	0
11/13/2017 17:25	Serra @ Manzanita Field	2	0
11/13/2017 17:27	Quarry @ Psychiatry Bld	2	0
11/13/2017 17:27	Campus @ Escondido	0	1
11/13/2017 17:28	Campus @ Wilbur Lot	0	1
11/13/2017 17:29	Campus @ Munger	0	1
11/13/2017 17:32	Tresidder West	0	0

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DateTime	StopName	Boardings	Alightings
11/13/2017 17:33	PATC-University Circle	3	29
11/13/2017 17:34	Santa Teresa @ Lomita	3	0
11/13/2017 17:34	PATC-University Circle	0	0
11/13/2017 17:36	Via Ortega S at Roble Garage	1	1
11/13/2017 17:38	Via Ortega @ Y2E2	17	1
11/13/2017 17:38	Via Ortega @ Y2E2	1	0
11/13/2017 17:40	Galvez @ El Camino Real	1	0
11/13/2017 17:41	Quarry Ext @ Med School	2	0
11/13/2017 17:44	Serra @ Manzanita Field	0	2
11/13/2017 17:45	Quarry @ Psychiatry Bld	2	6
11/13/2017 17:48	Campus @ Munger	0	1
11/13/2017 17:52	Tresidder West	1	0
11/13/2017 17:54	PATC-University Circle	5	21
11/13/2017 17:54	Santa Teresa @ Lomita	1	0
11/13/2017 17:57	Via Ortega @ Y2E2	5	0
11/13/2017 17:59	Roth @ Quarry Ext	0	2
11/13/2017 18:00	Quarry Ext @ Med School	5	0
11/13/2017 18:01	Medical Center @ Quarry	0	0
11/13/2017 18:01	Medical Center @ Quarry	1	0
11/13/2017 18:01	Galvez @ El Camino Real	3	0
11/13/2017 18:02	Quarry @ Psychiatry Lot	1	0
11/13/2017 18:04	Galvez @ Alumni Center	1	0
11/13/2017 18:06	Serra @ Encina Hall	0	2
11/13/2017 18:07	Serra @ Manzanita Field	1	0
11/13/2017 18:09	Campus @ Escondido	0	4
11/13/2017 18:10	Campus @ Wilbur Field	1	0
11/13/2017 18:14	Tresidder West	0	2
11/13/2017 18:14	PATC-University Circle	3	15
11/13/2017 18:17	Via Ortega S at Roble Garage	0	1
11/13/2017 18:18	Via Ortega @ Y2E2	8	1
11/13/2017 18:19	Galvez @ El Camino Real	1	0
11/13/2017 18:21	Roth @ Quarry Ext	4	0
11/13/2017 18:22	Quarry Ext @ Med School	14	1
11/13/2017 18:22	Serra @ Encina Hall	0	2
11/13/2017 18:23	Quarry Ext @ Medical C	7	1
11/13/2017 18:25	Quarry @ Psychiatry Lot	4	0
11/13/2017 18:25	Campus @ Escondido	1	3
11/13/2017 18:32	Tresidder West	2	1
11/13/2017 18:34	Santa Teresa @ Lomita	4	1
11/13/2017 18:35	PATC-University Circle	5	28
11/13/2017 18:35	Via Ortega S at Roble Garage	1	1
11/13/2017 18:37	Via Ortega @ Y2E2	2	0
11/13/2017 18:39	Roth @ Quarry Ext	2	0
11/13/2017 18:40	Quarry Ext @ Med School	11	0
11/13/2017 18:41	Medical Center @ Quarry	1	0
11/13/2017 18:41	Galvez @ Serra Mall	0	1
11/13/2017 18:43	Quarry @ Psychiatry Lot	2	0
11/13/2017 18:43	Serra @ Manzanita Field	0	1
11/13/2017 18:43	Quarry @ Psychiatry Bld	0	1
11/13/2017 18:45	Campus @ Wilbur Lot	1	0
11/13/2017 18:52	Tresidder West	2	1
11/13/2017 18:54	PATC-University Circle	6	21
11/13/2017 18:54	Santa Teresa @ Lomita	0	1
11/13/2017 18:55	Via Ortega S at Roble Garage	1	0
11/13/2017 18:57	Via Ortega @ Y2E2	4	0
11/13/2017 18:59	Galvez @ El Camino Real	1	0
11/13/2017 19:00	Quarry Ext @ Med School	2	1
11/13/2017 19:00	Quarry Ext @ Medical C	1	0
11/13/2017 19:01	Quarry Ext @ Medical C	1	0
11/13/2017 19:03	Serra @ Encina Hall	0	1
11/13/2017 19:05	Campus @ Escondido	1	5

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DateTime	StopName	Boardings	Alightings
11/13/2017 19:11	Tresidder West	1	3
11/13/2017 19:15	PATC-University Circle	2	9
11/13/2017 19:15	Via Ortega S at Roble Garage	1	0
11/13/2017 19:16	Via Ortega @ Y2E2	6	0
11/13/2017 19:19	Quarry Ext @ Med School	7	0
11/13/2017 19:20	Medical Center @ Quarry	8	0
11/13/2017 19:22	Quarry @ Psychiatry Lot	2	0
11/13/2017 19:23	Quarry @ Psychiatry Bld	0	1
11/13/2017 19:24	Campus @ Escondido	0	1
11/13/2017 19:32	Tresidder West	1	0
11/13/2017 19:35	PATC-University Circle	3	25
11/13/2017 19:36	Via Ortega @ Y2E2	1	0
11/13/2017 19:39	Medical Center @ Quarry	1	0
11/13/2017 19:39	Medical Center @ Quarry	1	0
11/13/2017 19:41	Quarry @ Psychiatry Lot	2	0
11/13/2017 19:46	Campus @ Munger	1	2
11/13/2017 19:49	Tresidder West	1	0
11/13/2017 19:50	Tresidder West	2	0
11/13/2017 19:51	Tresidder West	1	0
11/13/2017 19:54	PATC-University Circle	6	8
11/13/2017 19:56	Via Ortega @ Y2E2	1	0
11/13/2017 19:58	Quarry Ext @ Med School	3	0
11/13/2017 19:59	Quarry Ext @ Medical C	2	0
11/13/2017 19:59	Galvez @ Serra Mall	0	1
11/13/2017 20:00	Serra @ Encina Hall	0	1
11/13/2017 20:01	Quarry @ Psychiatry Lot	0	0
11/13/2017 20:02	Campus @ Escondido	0	3
11/13/2017 20:12	Tresidder West	1	0
11/13/2017 20:13	PATC-University Circle	6	13
11/13/2017 20:15	Via Ortega S at Roble Garage	0	1
11/13/2017 20:16	Via Ortega @ Y2E2	1	0
11/13/2017 20:19	Quarry Ext @ Med School	2	0
11/13/2017 20:19	Galvez @ El Camino Real	2	0
11/13/2017 20:19	Medical Center @ Quarry	1	0
11/13/2017 20:24	Campus @ Escondido	0	1
11/13/2017 20:25	Campus @ Munger	0	4
11/13/2017 20:28	Tresidder West	0	2
11/13/2017 20:32	Tresidder West	1	0
11/13/2017 20:34	PATC-University Circle	2	3
11/13/2017 20:39	Medical Center @ Quarry	1	0
11/13/2017 20:40	Galvez @ Alumni Center	0	1
11/13/2017 20:42	Serra @ Encina Hall	0	1
11/13/2017 20:44	PATC-University Circle	0	1
11/13/2017 20:47	Unknown	0	0
11/13/2017 20:52	Tresidder West	2	0
11/13/2017 20:55	Via Ortega S at Roble Garage	1	0
11/13/2017 20:56	Via Ortega @ Y2E2	3	0
11/13/2017 20:59	Quarry Ext @ Med School	1	0
11/13/2017 20:59	Medical Center @ Quarry	1	0
11/13/2017 21:05	PATC-University Circle	0	8
11/15/2017 6:17	Stock Farm Garage E	1	0
11/15/2017 6:30	PATC-University Circle	17	0
11/15/2017 6:38	Galvez @ Alumni Center	0	1
11/15/2017 6:39	Serra @ Encina Hall	0	1
11/15/2017 6:40	Serra @ Manzanita Field	0	8
11/15/2017 6:43	Campus @ Munger	0	2
11/15/2017 6:48	Tresidder West	2	8
11/15/2017 6:51	Tresidder West	1	1
11/15/2017 6:55	Via Ortega S at Roble Garage	1	0
11/15/2017 6:59	Quarry Ext @ Med School	0	1
11/15/2017 7:07	PATC-University Circle	1	1

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DateTime	StopName	Boardings	Alightings
11/15/2017 7:25	Tresidder West	0	0
11/15/2017 7:34	Quarry Ext @ Medical C	2	0
11/15/2017 7:39	PATC-University Circle	15	2
11/15/2017 7:42	PATC-University Circle	13	0
11/15/2017 7:49	Galvez @ El Camino Real	1	0
11/15/2017 7:51	Galvez @ Alumni Center	1	11
11/15/2017 7:52	Galvez @ Serra Mall	0	4
11/15/2017 7:53	Serra @ Encina Hall	0	0
11/15/2017 7:54	Serra @ Manzanita Field	1	2
11/15/2017 7:57	Campus @ Munger	0	2
11/15/2017 7:58	Campus @ Mayfield N	1	1
11/15/2017 8:01	Tresidder West	1	2
11/15/2017 8:07	Quarry Ext @ Med School	0	2
11/15/2017 8:24	Quarry @ Crate/Barrel	0	0
11/15/2017 8:29	PATC-University Circle	3	0
11/15/2017 8:32	PATC-University Circle	42	0
11/15/2017 8:33	PATC-University Circle	1	1
11/15/2017 8:39	Galvez @ El Camino Real	0	1
11/15/2017 8:41	Galvez @ Alumni Center	0	6
11/15/2017 8:42	Galvez @ Memorial	0	4
11/15/2017 8:43	Galvez @ Serra Mall	0	9
11/15/2017 8:43	Serra @ Encina Hall	0	11
11/15/2017 8:45	Campus @ Escondido	1	1
11/15/2017 8:46	Campus @ Wilbur Lot	1	0
11/15/2017 8:47	Campus @ Munger	0	4
11/15/2017 8:48	Campus @ Mayfield N	0	1
11/15/2017 8:50	Tresidder West	0	7
11/15/2017 8:53	Via Ortega S Across from Roble	0	0
11/15/2017 8:54	Via Ortega @ Y2E2	1	0
11/15/2017 8:57	Roth @ Quarry Ext	0	1
11/15/2017 9:01	Quarry Ext Middle	1	1
11/15/2017 9:10	PATC-University Circle	2	1
11/15/2017 9:16	Serra @ Encina Hall	0	2
11/15/2017 9:19	Campus @ Escondido	1	0
11/15/2017 9:21	Campus @ Munger	2	0
11/15/2017 9:27	Tresidder West	0	0
11/15/2017 9:30	Santa Teresa @ West Res	0	1
11/15/2017 9:31	Via Ortega @ Y2E2	0	1
11/15/2017 9:34	Roth @ Quarry Ext	0	1
11/15/2017 9:35	Quarry @ Psychiatry Lot	1	0
11/15/2017 9:36	Quarry @ Crate/Barrel	0	1
11/15/2017 9:51	PATC-University Circle	18	4
11/15/2017 9:52	PATC-University Circle	1	0
11/15/2017 9:57	Galvez @ El Camino Real	2	0
11/15/2017 9:59	Galvez @ Alumni Center	1	3
11/15/2017 9:59	Galvez @ Memorial	0	1
11/15/2017 10:00	Galvez @ Serra Mall	0	2
11/15/2017 10:01	Serra @ Encina Hall	0	2
11/15/2017 10:03	Campus @ Escondido	6	0
11/15/2017 10:04	Campus @ Wilbur Lot	1	0
11/15/2017 10:05	Campus @ Wilbur Field	1	0
11/15/2017 10:05	Campus @ Munger	0	3
11/15/2017 10:06	Campus @ Mayfield N	0	1
11/15/2017 10:08	Tresidder West	0	4
11/15/2017 10:11	Via Ortega S at Roble Garage	0	1
11/15/2017 10:12	Via Ortega @ Y2E2	0	3
11/15/2017 10:14	Roth @ Quarry Ext	0	2
11/15/2017 10:15	Medical Center @ Quarry	1	0
11/15/2017 10:18	Quarry @ Crate/Barrel	0	1
11/15/2017 10:34	PATC-University Circle	7	2
11/15/2017 10:41	Galvez @ Memorial	1	0

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DateTime	StopName	Boardings	Alightings
11/15/2017 10:42	Galvez @ Serra Mall	0	1
11/15/2017 10:42	Serra @ Encina Hall	0	1
11/15/2017 10:46	Campus @ Munger	0	1
11/15/2017 10:52	Tresidder West	0	3
11/15/2017 10:55	Via Ortega S at Roble Garage	0	1
11/15/2017 10:57	Via Ortega @ Y2E2	2	0
11/15/2017 11:01	Medical Center @ Quarry	2	0
11/15/2017 11:03	Quarry @ Psychiatry Lot	3	0
11/15/2017 11:13	PATC-University Circle	9	10
11/15/2017 11:19	Galvez @ El Camino Real	1	0
11/15/2017 11:22	Galvez @ Serra Mall	0	1
11/15/2017 11:23	Serra @ Encina Hall	0	1
11/15/2017 11:24	Serra @ Manzanita Field	1	0
11/15/2017 11:28	Campus @ Mayfield N	0	2
11/15/2017 11:31	Tresidder West	2	3
11/15/2017 11:34	Santa Teresa @ Lomita	1	0
11/15/2017 11:36	Via Ortega S at Roble Garage	1	0
11/15/2017 11:37	Via Ortega @ Y2E2	1	3
11/15/2017 11:41	Quarry Ext @ Med School	2	0
11/15/2017 11:42	Quarry Ext @ Medical C	3	1
11/15/2017 11:52	PATC-University Circle	9	9
11/15/2017 11:53	PATC-University Circle	0	0
11/15/2017 11:54	PATC-University Circle	1	0
11/15/2017 11:59	Galvez @ El Camino Real	2	0
11/15/2017 12:01	Galvez @ Memorial	0	2
11/15/2017 12:02	Galvez @ Serra Mall	0	2
11/15/2017 12:02	Serra @ Encina Hall	0	2
11/15/2017 12:04	Campus @ Escondido	1	4
11/15/2017 12:06	Campus @ Wilbur Field	1	0
11/15/2017 12:07	Campus @ Mayfield N	0	1
11/15/2017 12:12	Tresidder West	5	1
11/15/2017 12:15	Via Ortega S at Roble Garage	0	2
11/15/2017 12:20	Medical Center @ Quarry	3	1
11/15/2017 12:22	Quarry @ Psychiatry Bld	0	2
11/15/2017 12:35	PATC-University Circle	3	5
11/15/2017 12:41	Galvez @ El Camino Real	1	0
11/15/2017 12:43	Galvez @ Serra Mall	1	1
11/15/2017 12:45	Serra @ Manzanita Field	0	1
11/15/2017 12:46	Campus @ Escondido	0	1
11/15/2017 12:47	Campus @ Wilbur Lot	1	0
11/15/2017 12:48	Campus @ Wilbur Field	1	1
11/15/2017 12:52	Tresidder West	0	0
11/15/2017 12:56	Via Ortega @ Y2E2	1	2
11/15/2017 12:59	Roth @ Quarry Ext	1	0
11/15/2017 13:01	Medical Center @ Quarry	3	0
11/15/2017 13:03	Quarry @ Psychiatry Bld	0	1
11/15/2017 13:14	PATC-University Circle	9	8
11/15/2017 13:20	Galvez @ Alumni Center	0	1
11/15/2017 13:21	Galvez @ Serra Mall	0	1
11/15/2017 13:21	Serra @ Encina Hall	0	2
11/15/2017 13:23	Serra @ Manzanita Field	1	0
11/15/2017 13:24	Campus @ Escondido	0	2
11/15/2017 13:26	Campus @ Munger	1	0
11/15/2017 13:32	Tresidder West	2	3
11/15/2017 13:34	Santa Teresa @ Lomita	1	0
11/15/2017 13:36	Via Ortega @ Y2E2	3	1
11/15/2017 13:39	Roth @ Quarry Ext	0	2
11/15/2017 13:40	Quarry Ext @ Med School	2	0
11/15/2017 13:41	Quarry Ext @ Medical C	3	0
11/15/2017 13:42	Quarry @ Psychiatry Bld	0	2
11/15/2017 13:54	PATC-University Circle	5	10

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DateTime	StopName	Boardings	Alightings
11/15/2017 13:58	Galvez @ El Camino Real	2	1
11/15/2017 14:01	Galvez @ Serra Mall	0	2
11/15/2017 14:04	Campus @ Escondido	0	1
11/15/2017 14:06	Campus @ Munger	0	1
11/15/2017 14:12	Tresidder West	0	0
11/15/2017 14:16	Via Ortega @ Y2E2	3	0
11/15/2017 14:17	Roth @ Quarry Ext	1	0
11/15/2017 14:18	Quarry Ext @ Med School	5	0
11/15/2017 14:19	Medical Center @ Quarry	9	2
11/15/2017 14:20	Quarry @ Psychiatry Lot	1	0
11/15/2017 14:22	Quarry @ Psychiatry Bld	0	1
11/15/2017 14:34	PATC-University Circle	3	16
11/15/2017 14:40	Galvez @ El Camino Real	1	0
11/15/2017 14:42	Galvez @ Serra Mall	0	1
11/15/2017 14:43	Serra @ Encina Hall	1	1
11/15/2017 14:44	Serra @ Manzanita Field	0	1
11/15/2017 14:46	Campus @ Escondido	1	0
11/15/2017 14:52	Tresidder West	1	2
11/15/2017 14:54	PATC-University Circle	8	5
11/15/2017 14:56	Via Ortega @ Y2E2	1	0
11/15/2017 14:58	Roth @ Quarry Ext	0	1
11/15/2017 14:59	Quarry Ext @ Med School	3	0
11/15/2017 15:00	Medical Center @ Quarry	3	0
11/15/2017 15:01	Quarry @ Psychiatry Lot	2	0
11/15/2017 15:02	Galvez @ Serra Mall	0	2
11/15/2017 15:06	Campus @ Wilbur Field	0	1
11/15/2017 15:07	Campus @ Munger	0	1
11/15/2017 15:12	Tresidder West	8	1
11/15/2017 15:14	PATC-University Circle	3	9
11/15/2017 15:17	Via Ortega @ Y2E2	3	1
11/15/2017 15:20	Roth @ Quarry Ext	2	0
11/15/2017 15:21	Quarry Ext @ Med School	3	2
11/15/2017 15:22	Quarry Ext @ Medical C	4	0
11/15/2017 15:23	Serra @ Encina Hall	0	1
11/15/2017 15:24	Quarry @ Psychiatry Lot	6	1
11/15/2017 15:25	Quarry @ Psychiatry Bld	0	4
11/15/2017 15:32	Tresidder West	6	4
11/15/2017 15:34	Santa Teresa @ Lomita	1	0
11/15/2017 15:34	PATC-University Circle	3	22
11/15/2017 15:35	Via Ortega S at Roble Garage	0	1
11/15/2017 15:36	Via Ortega @ Y2E2	4	0
11/15/2017 15:39	Quarry Ext @ Med School	6	0
11/15/2017 15:39	Galvez @ El Camino Real	2	0
11/15/2017 15:40	Medical Center @ Quarry	13	0
11/15/2017 15:42	Quarry @ Psychiatry Lot	1	1
11/15/2017 15:43	Quarry @ Psychiatry Bld	0	3
11/15/2017 15:43	Serra @ Encina Hall	0	1
11/15/2017 15:45	Campus @ Escondido	0	1
11/15/2017 15:52	Tresidder West	3	1
11/15/2017 15:54	PATC-University Circle	6	18
11/15/2017 15:54	Santa Teresa @ Lomita	1	0
11/15/2017 15:54	Santa Teresa @ Lomita	0	1
11/15/2017 15:55	Via Ortega S at Roble Garage	1	0
11/15/2017 15:57	Via Ortega @ Y2E2	4	1
11/15/2017 15:59	Roth @ Quarry Ext	3	0
11/15/2017 16:00	Galvez @ El Camino Real	1	0
11/15/2017 16:00	Quarry Ext @ Med School	5	0
11/15/2017 16:01	Medical Center @ Quarry	0	0
11/15/2017 16:02	Galvez @ Alumni Center	1	1
11/15/2017 16:03	Galvez @ Memorial	1	0
11/15/2017 16:04	Quarry @ Psychiatry Bld	0	3

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DateTime	StopName	Boardings	Alightings
11/15/2017 16:06	Campus @ Escondido	0	2
11/15/2017 16:07	Campus @ Wilbur Lot	0	1
11/15/2017 16:09	Campus @ Mayfield N	0	1
11/15/2017 16:09	PATC-University Circle	1	22
11/15/2017 16:12	Tresidder West	2	2
11/15/2017 16:14	Santa Teresa @ Lomita	1	0
11/15/2017 16:14	PATC-University Circle	0	0
11/15/2017 16:14	Santa Teresa @ Lomita	1	0
11/15/2017 16:15	Via Ortega S at Roble Garage	1	0
11/15/2017 16:17	Via Ortega @ Y2E2	8	0
11/15/2017 16:19	Quarry Ext @ Med School	2	0
11/15/2017 16:20	Medical Center @ Quarry	7	1
11/15/2017 16:22	Quarry @ Psychiatry Lot	4	0
11/15/2017 16:23	Quarry @ Psychiatry Bld	1	3
11/15/2017 16:25	Campus @ Escondido	0	2
11/15/2017 16:26	Campus @ Wilbur Field	1	0
11/15/2017 16:27	PATC-University Circle	0	23
11/15/2017 16:32	Tresidder West	0	0
11/15/2017 16:34	Santa Teresa @ Lomita	1	0
11/15/2017 16:35	PATC-University Circle	5	2
11/15/2017 16:36	Via Ortega @ Y2E2	1	0
11/15/2017 16:39	El Camino @ PAMF SB	0	2
11/15/2017 16:39	Quarry Ext @ Med School	11	0
11/15/2017 16:42	Galvez @ Alumni Center	1	0
11/15/2017 16:42	Quarry @ Psychiatry Lot	5	0
11/15/2017 16:43	Galvez @ Serra Mall	0	1
11/15/2017 16:47	Campus @ Munger	1	0
11/15/2017 16:51	Tresidder West	1	2
11/15/2017 16:53	Santa Teresa @ Lomita	1	0
11/15/2017 16:54	PATC-University Circle	6	23
11/15/2017 16:54	Via Ortega S at Roble Garage	0	1
11/15/2017 16:56	Via Ortega @ Y2E2	7	0
11/15/2017 16:59	Roth @ Quarry Ext	1	0
11/15/2017 16:59	Galvez @ El Camino Real	4	0
11/15/2017 16:59	Galvez @ El Camino Real	0	0
11/15/2017 17:00	Quarry Ext @ Med School	16	0
11/15/2017 17:01	Medical Center @ Quarry	5	0
11/15/2017 17:02	Quarry @ Psychiatry Lot	8	0
11/15/2017 17:05	Serra @ Manzanita Field	4	1
11/15/2017 17:05	Serra @ Manzanita Field	0	0
11/15/2017 17:05	Serra @ Manzanita Field	0	0
11/15/2017 17:07	Campus @ Escondido	1	2
11/15/2017 17:07	Campus @ Escondido	0	0
11/15/2017 17:12	Tresidder West	11	8
11/15/2017 17:12	Tresidder West	1	0
11/15/2017 17:14	PATC-University Circle	1	35
11/15/2017 17:14	Santa Teresa @ Lomita	1	0
11/15/2017 17:16	Via Ortega S at Roble Garage	5	0
11/15/2017 17:17	Via Ortega @ Y2E2	6	1
11/15/2017 17:18	El Camino @ PAMF SB	1	0
11/15/2017 17:20	Galvez @ El Camino Real	1	0
11/15/2017 17:20	Roth @ Quarry Ext	0	0
11/15/2017 17:21	Roth @ Quarry Ext	0	0
11/15/2017 17:21	Quarry Ext @ Med School	5	0
11/15/2017 17:22	Galvez @ Alumni Center	1	0
11/15/2017 17:22	Quarry Ext @ Medical C	5	0
11/15/2017 17:24	Quarry @ Psychiatry Lot	5	0
11/15/2017 17:27	Campus @ Wilbur Lot	0	1
11/15/2017 17:27	Quarry @ Psychiatry Bld	1	3
11/15/2017 17:29	Campus @ Mayfield N	0	1
11/15/2017 17:35	Tresidder West	3	1

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DateTime	StopName	Boardings	Alightings
11/15/2017 17:36	PATC-University Circle	1	33
11/15/2017 17:38	Via Ortega S at Roble Garage	1	0
11/15/2017 17:40	Via Ortega @ Y2E2	3	0
11/15/2017 17:43	Quarry Ext @ Med School	5	2
11/15/2017 17:44	Medical Center @ Quarry	4	1
11/15/2017 17:45	Serra @ Encina Hall	3	0
11/15/2017 17:46	Quarry @ Psychiatry Lot	1	0
11/15/2017 17:47	Quarry @ Psychiatry Bld	1	0
11/15/2017 17:47	Campus @ Escondido	1	3
11/15/2017 17:48	Campus @ Escondido	0	0
11/15/2017 17:52	Tresidder West	1	2
11/15/2017 17:52	Tresidder West	0	0
11/15/2017 17:54	Santa Teresa @ Lomita	1	0
11/15/2017 17:55	PATC-University Circle	6	19
11/15/2017 17:56	Via Ortega S at Roble Garage	3	0
11/15/2017 17:57	Via Ortega @ Y2E2	0	0
11/15/2017 18:01	Quarry Ext @ Med School	4	0
11/15/2017 18:02	Medical Center @ Quarry	1	0
11/15/2017 18:03	Quarry @ Psychiatry Lot	1	0
11/15/2017 18:04	Quarry @ Psychiatry Bld	1	2
11/15/2017 18:05	Serra @ Manzanita Field	0	2
11/15/2017 18:08	Campus @ Wilbur Field	1	1
11/15/2017 18:09	PATC-University Circle	1	9
11/15/2017 18:12	Tresidder West	5	4
11/15/2017 18:14	PATC-University Circle	0	0
11/15/2017 18:16	Via Ortega S at Roble Garage	1	1
11/15/2017 18:17	Via Ortega @ Y2E2	1	0
11/15/2017 18:20	Medical Center @ Quarry	3	0
11/15/2017 18:20	Medical Center @ Quarry	1	0
11/15/2017 18:22	Quarry @ Psychiatry Lot	3	0
11/15/2017 18:22	Galvez @ El Camino Real	4	0
11/15/2017 18:23	Quarry @ Crate/Barrel	0	1
11/15/2017 18:26	Serra @ Encina Hall	2	0
11/15/2017 18:27	Serra @ Manzanita Field	0	2
11/15/2017 18:29	Campus @ Escondido	0	4
11/15/2017 18:30	Campus @ Wilbur Lot	0	1
11/15/2017 18:32	Campus @ Mayfield N	0	1
11/15/2017 18:34	PATC-University Circle	1	13
11/15/2017 18:35	Tresidder West	5	0
11/15/2017 18:38	Via Ortega S at Roble Garage	1	0
11/15/2017 18:39	Galvez @ El Camino Real	4	0
11/15/2017 18:42	Quarry Ext @ Med School	1	0
11/15/2017 18:42	Galvez @ Memorial	0	3
11/15/2017 18:44	Quarry @ Psychiatry Lot	2	0
11/15/2017 18:48	PATC-University Circle	2	10
11/15/2017 18:48	PATC-University Circle	0	0
11/15/2017 18:53	Tresidder West	4	1
11/15/2017 18:54	PATC-University Circle	7	1
11/15/2017 18:54	PATC-University Circle	0	0
11/15/2017 18:58	Via Ortega @ Y2E2	4	0
11/15/2017 18:59	Galvez @ El Camino Real	1	0
11/15/2017 19:02	Galvez @ Alumni Center	0	1
11/15/2017 19:02	Galvez @ Alumni Center	0	0
11/15/2017 19:03	Quarry @ Psychiatry Bld	0	2
11/15/2017 19:03	Galvez @ Serra Mall	0	1
11/15/2017 19:06	Campus @ Escondido	0	1
11/15/2017 19:06	Campus @ Escondido	0	0
11/15/2017 19:08	Campus @ Munger	0	1
11/15/2017 19:09	PATC-University Circle	0	4
11/15/2017 19:12	Tresidder West	2	2
11/15/2017 19:12	Tresidder West	0	0

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DateTime	StopName	Boardings	Alightings
11/15/2017 19:15	PATC-University Circle	6	1
11/15/2017 19:16	Via Ortega S at Roble Garage	5	0
11/15/2017 19:19	Galvez @ El Camino Real	1	0
11/15/2017 19:19	Roth @ Quarry Ext	2	0
11/15/2017 19:20	Quarry Ext @ Med School	10	0
11/15/2017 19:20	Quarry Ext @ Med School	1	0
11/15/2017 19:21	Medical Center @ Quarry	7	0
11/15/2017 19:22	Serra @ Encina Hall	0	2
11/15/2017 19:23	Quarry @ Psychiatry Lot	1	0
11/15/2017 19:23	Quarry @ Psychiatry Lot	0	0
11/15/2017 19:24	Campus @ Escondido	0	3
11/15/2017 19:29	PATC-University Circle	3	28
11/15/2017 19:29	PATC-University Circle	0	0
11/15/2017 19:31	Tresidder West	4	2
11/15/2017 19:34	PATC-University Circle	1	3
11/15/2017 19:34	PATC-University Circle	0	0
11/15/2017 19:35	Via Ortega @ Y2E2	0	0
11/15/2017 19:37	Quarry Ext @ Med School	1	0
11/15/2017 19:38	Medical Center @ Quarry	0	0
11/15/2017 19:41	Galvez @ Alumni Center	0	2
11/15/2017 19:42	Galvez @ Alumni Center	0	0
11/15/2017 19:45	Serra @ Manzanita Field	1	0
11/15/2017 19:47	Campus @ Escondido	0	2
11/15/2017 19:48	Campus @ Munger	1	0
11/15/2017 19:51	Tresidder West	1	0
11/15/2017 19:52	Tresidder West	0	0
11/15/2017 19:53	PATC-University Circle	4	3
11/15/2017 19:55	Via Ortega S at Roble Garage	0	1
11/15/2017 19:55	Via Ortega S at Roble Garage	0	0
11/15/2017 19:56	Via Ortega @ Y2E2	2	0
11/15/2017 19:57	Via Ortega @ Y2E2	2	0
11/15/2017 19:59	Galvez @ El Camino Real	1	0
11/15/2017 19:59	Quarry Ext @ Med School	1	0
11/15/2017 20:00	Quarry Ext @ Medical C	5	0
11/15/2017 20:01	Quarry @ Psychiatry Lot	2	0
11/15/2017 20:02	Galvez @ Serra Mall	0	1
11/15/2017 20:02	Quarry @ Crate/Barrel	0	1
11/15/2017 20:04	Serra @ Manzanita Field	0	1
11/15/2017 20:05	Campus @ Escondido	0	1
11/15/2017 20:12	Tresidder West	1	1
11/15/2017 20:14	PATC-University Circle	1	15
11/15/2017 20:14	PATC-University Circle	0	0
11/15/2017 20:14	Santa Teresa @ Lomita	1	0
11/15/2017 20:15	Via Ortega S at Roble Garage	2	0
11/15/2017 20:17	Via Ortega @ Y2E2	2	0
11/15/2017 20:18	Galvez @ El Camino Real	1	0
11/15/2017 20:19	Quarry Ext @ Med School	2	0
11/15/2017 20:21	Galvez @ Serra Mall	1	0
11/15/2017 20:22	Quarry @ Psychiatry Bld	0	1
11/15/2017 20:31	Tresidder West	1	2
11/15/2017 20:31	Tresidder West	0	0
11/15/2017 20:33	PATC-University Circle	5	10
11/15/2017 20:34	Santa Teresa @ Lomita	0	1
11/15/2017 20:38	El Camino @ PAMF SB	0	1
11/15/2017 20:39	Galvez @ El Camino Real	3	0
11/15/2017 20:46	Campus @ Escondido	0	2
11/15/2017 20:47	Campus @ Munger	0	1
11/15/2017 20:52	Tresidder West	0	1
11/15/2017 20:55	Via Ortega S at Roble Garage	1	0
11/15/2017 20:56	Via Ortega @ Y2E2	2	0
11/15/2017 20:59	Quarry Ext @ Med School	3	0

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DateTime	StopName	Boardings	Alightings
11/15/2017 21:00	Quarry Ext @ Medical C	4	0
11/15/2017 21:06	PATC-University Circle	0	12
11/16/2017 6:12	PATC-University Circle	11	0
11/16/2017 6:15	Unknown	0	0
11/16/2017 6:20	Galvez @ Memorial	1	1
11/16/2017 6:20	Unknown	0	0
11/16/2017 6:21	Galvez @ Serra Mall	0	2
11/16/2017 6:22	Serra @ Encina Hall	0	5
11/16/2017 6:26	Campus @ Munger	0	2
11/16/2017 6:31	PATC-University Circle	22	1
11/16/2017 6:31	Tresidder West	0	1
11/16/2017 6:33	Santa Teresa @ Lomita	0	1
11/16/2017 6:35	Via Ortega S at Roble Garage	0	1
11/16/2017 6:36	Galvez @ Alumni Center	0	2
11/16/2017 6:37	Galvez @ Serra Mall	0	2
11/16/2017 6:38	Serra @ Encina Hall	0	4
11/16/2017 6:39	Serra @ Manzanita Field	0	8
11/16/2017 6:42	Campus @ Munger	0	2
11/16/2017 6:48	PATC-University Circle	0	0
11/16/2017 6:52	Tresidder West	2	6
11/16/2017 6:52	Galvez @ El Camino Real	2	0
11/16/2017 6:54	Galvez @ Memorial	1	0
11/16/2017 6:55	Via Ortega S at Roble Garage	2	0
11/16/2017 6:55	Galvez @ Serra Mall	0	1
11/16/2017 7:06	Tresidder West	1	1
11/16/2017 7:06	Tresidder West	0	0
11/16/2017 7:08	PATC-University Circle	0	1
11/16/2017 7:14	Quarry Ext @ Medical C	1	1
11/16/2017 7:20	Campus @ Munger	2	0
11/16/2017 7:24	Tresidder West	0	0
11/16/2017 7:25	PATC-University Circle	32	5
11/16/2017 7:30	Quarry Ext @ Med School	0	1
11/16/2017 7:33	Galvez @ Alumni Center	0	8
11/16/2017 7:33	Quarry @ Psychiatry Lot	2	1
11/16/2017 7:33	Galvez @ Alumni Center	0	0
11/16/2017 7:34	Galvez @ Memorial	0	1
11/16/2017 7:35	Galvez @ Serra Mall	0	13
11/16/2017 7:36	Serra @ Encina Hall	0	8
11/16/2017 7:37	Serra @ Manzanita Field	0	2
11/16/2017 7:40	Campus @ Munger	1	0
11/16/2017 7:41	Campus @ Mayfield N	0	1
11/16/2017 7:43	PATC-University Circle	46	11
11/16/2017 7:44	Tresidder West	0	1
11/16/2017 7:49	Galvez @ El Camino Real	1	0
11/16/2017 7:49	Via Ortega @ Y2E2	0	1
11/16/2017 7:51	Galvez @ Alumni Center	1	11
11/16/2017 7:51	Galvez @ Memorial	0	2
11/16/2017 7:52	Quarry Ext @ Med School	1	0
11/16/2017 7:52	Galvez @ Serra Mall	0	10
11/16/2017 7:52	Quarry Ext @ Medical C	1	0
11/16/2017 7:53	Serra @ Encina Hall	0	9
11/16/2017 7:54	Quarry @ Psychiatry Lot	1	0
11/16/2017 7:55	Serra @ Manzanita Field	0	2
11/16/2017 7:58	Campus @ Mayfield N	1	0
11/16/2017 8:01	Tresidder West	2	5
11/16/2017 8:07	Quarry Ext @ Med School	0	2
11/16/2017 8:08	Medical Center @ Quarry	2	0
11/16/2017 8:11	PATC-University Circle	16	9
11/16/2017 8:11	Quarry @ Crate/Barrel	0	0
11/16/2017 8:15	El Camino @ PAMF SB	0	1
11/16/2017 8:16	Caltrain Platform South	0	5

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DateTime	StopName	Boardings	Alightings
11/16/2017 8:18	Galvez @ El Camino Real	2	0
11/16/2017 8:19	Caltrain Platform South	1	2
11/16/2017 8:20	Caltrain Platform South	0	1
11/16/2017 8:20	Galvez @ Alumni Center	0	3
11/16/2017 8:21	Galvez @ Memorial	0	2
11/16/2017 8:22	Galvez @ Serra Mall	0	3
11/16/2017 8:23	Serra @ Encina Hall	0	0
11/16/2017 8:26	Campus @ Wilbur Lot	1	0
11/16/2017 8:27	Campus @ Munger	5	0
11/16/2017 8:30	Tresidder West	1	4
11/16/2017 8:33	PATC-University Circle	31	7
11/16/2017 8:34	Via Ortega S at Roble Garage	1	1
11/16/2017 8:37	Via Ortega @ Y2E2	2	6
11/16/2017 8:38	El Camino @ Town/Cntry	0	1
11/16/2017 8:40	Quarry Ext @ Medical C	3	0
11/16/2017 8:41	Galvez @ Alumni Center	1	6
11/16/2017 8:42	Galvez @ Memorial	0	1
11/16/2017 8:43	Galvez @ Serra Mall	0	4
11/16/2017 8:43	Serra @ Encina Hall	0	3
11/16/2017 8:46	Campus @ Escondido	1	0
11/16/2017 8:46	PATC-University Circle	16	3
11/16/2017 8:47	Campus @ Wilbur Lot	0	1
11/16/2017 8:47	Campus @ Wilbur Field	0	1
11/16/2017 8:48	Campus @ Munger	0	2
11/16/2017 8:49	Campus @ Mayfield N	1	5
11/16/2017 8:50	PATC-University Circle	16	1
11/16/2017 8:51	Tresidder West	3	6
11/16/2017 8:57	Galvez @ El Camino Real	4	0
11/16/2017 8:58	Roth @ Quarry Ext	0	5
11/16/2017 9:00	Galvez @ Alumni Center	1	9
11/16/2017 9:00	Quarry @ Psychiatry Lot	1	0
11/16/2017 9:01	Galvez @ Memorial	0	4
11/16/2017 9:01	Galvez @ Memorial	2	2
11/16/2017 9:02	Galvez @ Serra Mall	0	6
11/16/2017 9:03	Serra @ Encina Hall	0	15
11/16/2017 9:04	Serra @ Manzanita Field	0	2
11/16/2017 9:06	Campus @ Escondido	3	0
11/16/2017 9:07	Campus @ Wilbur Field	0	1
11/16/2017 9:08	Campus @ Munger	1	5
11/16/2017 9:09	Campus @ Mayfield N	1	0
11/16/2017 9:10	PATC-University Circle	4	2
11/16/2017 9:13	Tresidder East	1	5
11/16/2017 9:15	Santa Teresa @ Lomita	2	6
11/16/2017 9:17	Galvez @ Memorial	0	1
11/16/2017 9:18	Via Ortega @ Y2E2	0	2
11/16/2017 9:18	Serra @ Encina Hall	0	2
11/16/2017 9:20	Roth @ Quarry Ext	0	2
11/16/2017 9:20	Campus @ Escondido	3	0
11/16/2017 9:21	Quarry Ext @ Medical C	4	0
11/16/2017 9:22	Campus @ Munger	2	1
11/16/2017 9:25	Tresidder West	3	2
11/16/2017 9:29	PATC-University Circle	15	8
11/16/2017 9:30	PATC-University Circle	1	0
11/16/2017 9:30	Via Ortega @ Cypress Lot	0	3
11/16/2017 9:34	Quarry Ext @ Med School	1	1
11/16/2017 9:36	Galvez @ Alumni Center	2	3
11/16/2017 9:37	Galvez @ Serra Mall	0	5
11/16/2017 9:38	Quarry Ext Middle	1	1
11/16/2017 9:40	Quarry @ Psychiatry Lot	1	0
11/16/2017 9:40	Campus @ Escondido	1	0
11/16/2017 9:41	Campus @ Wilbur Field	0	3

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DateTime	StopName	Boardings	Alightings
11/16/2017 9:42	Campus @ Munger	0	1
11/16/2017 9:43	Campus @ Mayfield N	1	0
11/16/2017 9:49	Tresidder West	5	6
11/16/2017 9:52	Via Ortega S at Roble Garage	1	2
11/16/2017 9:53	PATC-University Circle	4	3
11/16/2017 9:54	Via Ortega @ Y2E2	1	1
11/16/2017 9:58	Quarry @ Psychiatry Lot	0	1
11/16/2017 9:59	Galvez @ El Camino Real	4	0
11/16/2017 10:02	Galvez @ Memorial	0	0
11/16/2017 10:03	Galvez @ Serra Mall	1	6
11/16/2017 10:04	Serra @ Encina Hall	0	3
11/16/2017 10:05	Serra @ Manzanita Field	1	1
11/16/2017 10:07	Campus @ Wilbur Lot	2	0
11/16/2017 10:09	Campus @ Mayfield N	0	1
11/16/2017 10:13	Via Ortega S at Roble Garage	1	0
11/16/2017 10:13	PATC-University Circle	10	2
11/16/2017 10:15	Via Ortega @ Y2E2	0	3
11/16/2017 10:17	Roth @ Quarry Ext	0	2
11/16/2017 10:17	El Camino @ PAMF SB	0	0
11/16/2017 10:18	Medical Center @ Quarry	1	0
11/16/2017 10:19	Quarry @ Psychiatry Lot	1	0
11/16/2017 10:19	Galvez @ El Camino Real	0	1
11/16/2017 10:20	Quarry @ Crate/Barrel	0	2
11/16/2017 10:22	Galvez @ Serra Mall	0	1
11/16/2017 10:23	Serra @ Encina Hall	0	3
11/16/2017 10:25	Campus @ Escondido	2	0
11/16/2017 10:27	Campus @ Wilbur Field	0	1
11/16/2017 10:28	Campus @ Munger	0	2
11/16/2017 10:32	Tresidder West	3	1
11/16/2017 10:35	PATC-University Circle	6	4
11/16/2017 10:37	Via Ortega @ Y2E2	0	3
11/16/2017 10:37	PATC-University Circle	18	4
11/16/2017 10:40	Quarry Ext @ Med School	0	2
11/16/2017 10:46	Galvez @ Alumni Center	0	2
11/16/2017 10:47	Galvez @ Serra Mall	0	5
11/16/2017 10:48	Serra @ Encina Hall	0	1
11/16/2017 10:51	Campus @ Escondido	1	0
11/16/2017 10:52	Campus @ Wilbur Field	2	0
11/16/2017 10:53	Campus @ Munger	0	2
11/16/2017 10:54	Campus @ Mayfield N	0	1
11/16/2017 10:54	PATC-University Circle	0	0
11/16/2017 10:56	Tresidder West	2	6
11/16/2017 10:59	Via Ortega S at Roble Garage	0	1
11/16/2017 10:59	Galvez @ Alumni Center	0	1
11/16/2017 11:00	Galvez @ Memorial	0	1
11/16/2017 11:01	Galvez @ Serra Mall	0	2
11/16/2017 11:01	Via Ortega @ Y2E2	0	3
11/16/2017 11:01	Serra @ Encina Hall	0	2
11/16/2017 11:02	Serra @ Manzanita Field	2	1
11/16/2017 11:03	Roth @ Quarry Ext	0	1
11/16/2017 11:04	Campus @ Escondido	4	0
11/16/2017 11:04	Medical Center @ Quarry	1	0
11/16/2017 11:05	Campus @ Wilbur Field	0	1
11/16/2017 11:06	Campus @ Munger	0	1
11/16/2017 11:07	Quarry @ Psychiatry Bld	0	1
11/16/2017 11:12	Tresidder West	5	4
11/16/2017 11:14	PATC-University Circle	15	0
11/16/2017 11:14	Santa Teresa @ Lomita	1	0
11/16/2017 11:15	Via Ortega S at Roble Garage	1	2
11/16/2017 11:17	Via Ortega @ Y2E2	1	3
11/16/2017 11:19	Roth @ Quarry Ext	0	3

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11/16/2017 11:20	Roth @ Quarry Ext	2	1
11/16/2017 11:21	Quarry Ext @ Med School	1	0
11/16/2017 11:21	Galvez @ Memorial	0	3
11/16/2017 11:21	Medical Center @ Quarry	0	1
11/16/2017 11:22	Galvez @ Serra Mall	0	6
11/16/2017 11:24	Serra @ Manzanita Field	0	1
11/16/2017 11:24	Quarry @ Psychiatry Bld	0	1
11/16/2017 11:26	Campus @ Escondido	3	1
11/16/2017 11:27	Campus @ Munger	0	3
11/16/2017 11:28	Campus @ Mayfield N	0	1
11/16/2017 11:32	Tresidder West	1	2
11/16/2017 11:32	PATC-University Circle	10	5
11/16/2017 11:33	PATC-University Circle	1	0
11/16/2017 11:36	Via Ortega S at Roble Garage	2	0
11/16/2017 11:37	Via Ortega @ Y2E2	0	2
11/16/2017 11:38	El Camino @ PAMF NB	0	0
11/16/2017 11:40	Quarry Ext @ Medical C	4	0
11/16/2017 11:43	Galvez @ Serra Mall	0	2
11/16/2017 11:43	Quarry @ Psychiatry Bld	0	5
11/16/2017 11:43	Serra @ Encina Hall	0	5
11/16/2017 11:46	Campus @ Wilbur Lot	1	0
11/16/2017 11:47	Campus @ Munger	1	0
11/16/2017 11:51	Tresidder West	3	5
11/16/2017 11:52	Tresidder West	1	0
11/16/2017 11:56	Via Ortega @ Y2E2	4	0
11/16/2017 11:59	Quarry Ext @ Med School	0	1
11/16/2017 11:59	Medical Center @ Quarry	0	1
11/16/2017 12:01	Quarry @ Psychiatry Lot	1	2
11/16/2017 12:03	Unknown	0	0
11/16/2017 12:09	PATC-University Circle	4	6
11/16/2017 12:13	PATC-University Circle	6	8
11/16/2017 12:13	PATC-University Circle	14	14
11/16/2017 12:13	Tresidder West	3	2
11/16/2017 12:14	PATC-University Circle	2	0
11/16/2017 12:16	Santa Teresa @ Lomita	0	0
11/16/2017 12:17	El Camino @ PAMF SB	1	0
11/16/2017 12:18	Via Ortega @ Y2E2	2	0
11/16/2017 12:20	Galvez @ Alumni Center	2	3
11/16/2017 12:20	Galvez @ Memorial	2	0
11/16/2017 12:21	Galvez @ Serra Mall	0	5
11/16/2017 12:21	Roth @ Quarry Ext	0	1
11/16/2017 12:22	Quarry Ext @ Medical C	8	0
11/16/2017 12:22	Serra @ Manzanita Field	0	1
11/16/2017 12:23	Quarry Ext @ Medical C	1	0
11/16/2017 12:25	Campus @ Escondido	7	1
11/16/2017 12:25	Campus @ Wilbur Lot	0	0
11/16/2017 12:26	Quarry @ Psychiatry Bld	0	4
11/16/2017 12:26	Campus @ Wilbur Field	3	0
11/16/2017 12:27	Campus @ Munger	1	0
11/16/2017 12:31	Tresidder West	4	5
11/16/2017 12:32	Tresidder West	1	0
11/16/2017 12:33	PATC-University Circle	1	10
11/16/2017 12:33	PATC-University Circle	7	8
11/16/2017 12:34	Via Ortega S at Roble Garage	0	2
11/16/2017 12:35	Via Ortega S at Roble Garage	1	0
11/16/2017 12:36	Via Ortega @ Y2E2	0	7
11/16/2017 12:38	Roth @ Quarry Ext	2	2
11/16/2017 12:41	Galvez @ Serra Mall	3	4
11/16/2017 12:41	Serra @ Encina Hall	1	0
11/16/2017 12:42	Quarry @ Psychiatry Bld	0	3
11/16/2017 12:45	Campus @ Munger	2	0

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DateTime	StopName	Boardings	Alightings
11/16/2017 12:46	Campus @ Mayfield N	0	1
11/16/2017 12:51	Tresidder West	4	7
11/16/2017 12:53	PATC-University Circle	9	11
11/16/2017 12:55	Via Ortega S at Roble Garage	1	2
11/16/2017 12:58	Roth @ Quarry Ext	0	3
11/16/2017 12:59	Galvez @ El Camino Real	1	0
11/16/2017 13:00	Quarry Ext @ Medical C	1	0
11/16/2017 13:01	Galvez @ Alumni Center	0	3
11/16/2017 13:01	Galvez @ Memorial	0	1
11/16/2017 13:02	Galvez @ Serra Mall	0	2
11/16/2017 13:03	Serra @ Encina Hall	0	1
11/16/2017 13:05	Campus @ Escondido	1	2
11/16/2017 13:07	Campus @ Munger	0	2
11/16/2017 13:11	Tresidder West	3	4
11/16/2017 13:14	PATC-University Circle	9	1
11/16/2017 13:15	Via Ortega S at Roble Garage	1	0
11/16/2017 13:17	Via Ortega @ Y2E2	4	0
11/16/2017 13:19	Roth @ Quarry Ext	1	0
11/16/2017 13:20	Quarry Ext @ Med School	4	0
11/16/2017 13:20	Quarry Ext @ Med School	1	0
11/16/2017 13:20	Galvez @ El Camino Real	3	0
11/16/2017 13:21	Quarry Ext @ Medical C	4	0
11/16/2017 13:22	Galvez @ Alumni Center	1	3
11/16/2017 13:23	Galvez @ Serra Mall	0	2
11/16/2017 13:24	Serra @ Encina Hall	0	5
11/16/2017 13:26	Campus @ Escondido	2	2
11/16/2017 13:28	Campus @ Munger	3	2
11/16/2017 13:32	Tresidder West	1	2
11/16/2017 13:33	PATC-University Circle	4	17
11/16/2017 13:34	Santa Teresa @ New Guinea	0	2
11/16/2017 13:35	Via Ortega S at Roble Garage	1	0
11/16/2017 13:36	Via Ortega @ Y2E2	2	0
11/16/2017 13:39	Roth @ Quarry Ext	0	1
11/16/2017 13:39	Quarry Ext @ Med School	7	0
11/16/2017 13:40	Quarry Ext @ Medical C	1	0
11/16/2017 13:45	Serra @ Manzanita Field	1	0
11/16/2017 13:51	Tresidder West	1	0
11/16/2017 13:53	PATC-University Circle	2	18
11/16/2017 13:55	Santa Teresa @ Lomita	3	0
11/16/2017 13:57	Via Ortega @ Y2E2	0	2
11/16/2017 14:00	Galvez @ El Camino Real	2	0
11/16/2017 14:00	Quarry Ext @ Med School	1	0
11/16/2017 14:01	Quarry Ext @ Med School	1	0
11/16/2017 14:02	Galvez @ Serra Mall	0	1
11/16/2017 14:03	Serra @ Encina Hall	0	1
11/16/2017 14:05	Quarry Ext @ Medical C	5	1
11/16/2017 14:07	Campus @ Alvarado Row	1	0
11/16/2017 14:07	Quarry @ Psychiatry Lot	2	0
11/16/2017 14:08	Quarry @ Psychiatry Bld	0	2
11/16/2017 14:11	Tresidder West	3	0
11/16/2017 14:15	PATC-University Circle	8	12
11/16/2017 14:15	PATC-University Circle	1	0
11/16/2017 14:16	Via Ortega @ Y2E2	1	0
11/16/2017 14:18	Roth @ Quarry Ext	2	0
11/16/2017 14:19	Quarry Ext @ Med School	3	1
11/16/2017 14:19	Quarry Ext @ Medical C	4	0
11/16/2017 14:21	Quarry @ Psychiatry Lot	0	0
11/16/2017 14:21	Galvez @ El Camino Real	2	0
11/16/2017 14:22	Quarry @ Psychiatry Bld	0	2
11/16/2017 14:23	Galvez @ Alumni Center	0	1
11/16/2017 14:27	Campus @ Escondido	2	1

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DateTime	StopName	Boardings	Alightings
11/16/2017 14:32	Tresidder West	0	3
11/16/2017 14:34	PATC-University Circle	5	16
11/16/2017 14:36	Via Ortega @ Y2E2	4	1
11/16/2017 14:39	Roth @ Quarry Ext	0	1
11/16/2017 14:40	Quarry Ext @ Med School	4	0
11/16/2017 14:41	Quarry Ext @ Medical C	6	0
11/16/2017 14:42	Serra @ Manzanita Field	3	0
11/16/2017 14:43	Quarry @ Psychiatry Lot	2	0
11/16/2017 14:44	Campus @ Escondido	1	0
11/16/2017 14:45	Quarry @ Psychiatry Bld	0	2
11/16/2017 14:46	Campus @ Munger	0	1
11/16/2017 14:52	Tresidder West	2	2
11/16/2017 14:54	PATC-University Circle	6	13
11/16/2017 14:57	Via Ortega @ Y2E2	3	1
11/16/2017 14:59	Galvez @ El Camino Real	2	0
11/16/2017 14:59	Roth @ Quarry Ext	1	1
11/16/2017 15:00	Roth @ Quarry Ext	2	0
11/16/2017 15:01	Quarry Ext @ Medical C	5	0
11/16/2017 15:01	Galvez @ Memorial	0	2
11/16/2017 15:02	Galvez @ Serra Mall	0	1
11/16/2017 15:04	Serra @ Manzanita Field	2	0
11/16/2017 15:04	Quarry @ Psychiatry Bld	0	2
11/16/2017 15:05	Campus @ Escondido	0	2
11/16/2017 15:06	Campus @ Wilbur Lot	0	1
11/16/2017 15:12	Tresidder West	0	2
11/16/2017 15:14	PATC-University Circle	5	13
11/16/2017 15:15	Via Ortega S at Roble Garage	1	0
11/16/2017 15:17	Via Ortega @ Y2E2	7	0
11/16/2017 15:18	El Camino @ PAMF SB	0	0
11/16/2017 15:20	Roth @ Quarry Ext	0	1
11/16/2017 15:20	Quarry Ext @ Med School	2	0
11/16/2017 15:22	Medical Center @ Quarry	2	0
11/16/2017 15:23	Serra @ Encina Hall	1	2
11/16/2017 15:24	Quarry @ Psychiatry Lot	10	0
11/16/2017 15:25	Quarry @ Psychiatry Bld	3	1
11/16/2017 15:25	Campus @ Escondido	0	1
11/16/2017 15:26	Campus @ Wilbur Field	0	1
11/16/2017 15:27	Campus @ Munger	1	0
11/16/2017 15:32	Tresidder West	4	1
11/16/2017 15:33	PATC-University Circle	12	34
11/16/2017 15:34	Santa Teresa @ Lomita	1	0
11/16/2017 15:35	Via Ortega S at Roble Garage	0	2
11/16/2017 15:37	Via Ortega @ Y2E2	8	2
11/16/2017 15:39	Galvez @ El Camino Real	1	0
11/16/2017 15:40	Quarry Ext @ Med School	5	2
11/16/2017 15:41	Medical Center @ Quarry	6	0
11/16/2017 15:41	Galvez @ Alumni Center	0	3
11/16/2017 15:42	Quarry @ Psychiatry Lot	0	0
11/16/2017 15:43	Serra @ Encina Hall	0	1
11/16/2017 15:44	Serra @ Manzanita Field	0	0
11/16/2017 15:46	Campus @ Wilbur Lot	0	2
11/16/2017 15:47	Campus @ Munger	0	1
11/16/2017 15:48	PATC-University Circle	0	21
11/16/2017 15:51	Tresidder West	2	1
11/16/2017 15:54	PATC-University Circle	3	0
11/16/2017 15:56	Via Ortega @ Y2E2	7	0
11/16/2017 15:58	Roth @ Quarry Ext	0	1
11/16/2017 15:59	Galvez @ El Camino Real	3	0
11/16/2017 16:00	Quarry Ext @ Med School	6	1
11/16/2017 16:01	Medical Center @ Quarry	11	1
11/16/2017 16:02	Galvez @ Memorial	0	2

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DateTime	StopName	Boardings	Alightings
11/16/2017 16:02	Galvez @ Serra Mall	1	0
11/16/2017 16:04	Serra @ Campus Dr	1	1
11/16/2017 16:06	Campus @ Escondido	1	2
11/16/2017 16:07	Campus @ Wilbur Lot	0	2
11/16/2017 16:08	Campus @ Munger	1	0
11/16/2017 16:12	Tresidder West	1	3
11/16/2017 16:14	PATC-University Circle	7	30
11/16/2017 16:14	Santa Teresa @ Lomita	0	1
11/16/2017 16:16	Via Ortega S at Roble Garage	1	0
11/16/2017 16:17	Via Ortega @ Y2E2	5	0
11/16/2017 16:20	Quarry Ext @ Med School	8	2
11/16/2017 16:21	Quarry Ext @ Medical C	4	0
11/16/2017 16:22	Galvez @ Serra Mall	0	2
11/16/2017 16:23	Serra @ Encina Hall	1	1
11/16/2017 16:23	Quarry @ Psychiatry Lot	2	0
11/16/2017 16:24	Quarry @ Psychiatry Bld	0	1
11/16/2017 16:25	Campus @ Escondido	2	0
11/16/2017 16:26	Campus @ Wilbur Lot	1	0
11/16/2017 16:32	Tresidder West	4	3
11/16/2017 16:33	PATC-University Circle	10	27
11/16/2017 16:35	Via Ortega S at Roble Garage	0	2
11/16/2017 16:37	Via Ortega @ Y2E2	9	0
11/16/2017 16:39	Galvez @ El Camino Real	0	1
11/16/2017 16:40	Roth @ Quarry Ext	3	0
11/16/2017 16:41	Medical Center @ Quarry	6	0
11/16/2017 16:43	Quarry @ Psychiatry Lot	5	0
11/16/2017 16:45	Quarry @ Psychiatry Bld	0	2
11/16/2017 16:46	Campus @ Wilbur Field	0	2
11/16/2017 16:47	Campus @ Mayfield N	0	1
11/16/2017 16:49	PATC-University Circle	1	30
11/16/2017 16:51	Tresidder East	6	6
11/16/2017 16:53	Santa Teresa @ Lomita	2	0
11/16/2017 16:54	PATC-University Circle	4	2
11/16/2017 16:56	Via Ortega @ Y2E2	15	1
11/16/2017 16:58	Roth @ Quarry Ext	1	0
11/16/2017 16:59	Quarry Ext @ Med School	10	0
11/16/2017 17:00	Quarry Ext @ Medical C	7	0
11/16/2017 17:00	Galvez @ El Camino Real	1	0
11/16/2017 17:01	Quarry @ Psychiatry Lot	8	0
11/16/2017 17:06	Campus @ Escondido	0	2
11/16/2017 17:07	PATC-University Circle	6	45
11/16/2017 17:09	Campus @ Mayfield S	0	2
11/16/2017 17:13	Tresidder West	2	2
11/16/2017 17:14	PATC-University Circle	2	2
11/16/2017 17:16	Santa Teresa @ Lomita	3	0
11/16/2017 17:19	Via Ortega @ Y2E2	3	0
11/16/2017 17:21	Galvez @ El Camino Real	1	0
11/16/2017 17:22	Roth @ Quarry Ext	3	0
11/16/2017 17:23	Quarry Ext @ Med School	13	0
11/16/2017 17:24	Galvez @ Alumni Center	2	0
11/16/2017 17:24	Medical Center @ Quarry	8	0
11/16/2017 17:24	Medical Center @ Quarry	2	0
11/16/2017 17:26	Quarry @ Psychiatry Lot	7	0
11/16/2017 17:26	Serra @ Encina Hall	2	4
11/16/2017 17:28	Campus @ Escondido	0	4
11/16/2017 17:31	Campus @ Mayfield S	0	2
11/16/2017 17:33	PATC-University Circle	1	39
11/16/2017 17:34	PATC-University Circle	0	0
11/16/2017 17:38	Tresidder West	2	3
11/16/2017 17:42	Via Ortega S at Roble Garage	2	0
11/16/2017 17:43	Via Ortega @ Y2E2	5	0

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DateTime	StopName	Boardings	Alightings
11/16/2017 17:47	Quarry Ext @ Med School	2	0
11/16/2017 17:47	Quarry Ext @ Med School	2	0
11/16/2017 17:49	Campus @ Escondido	3	0
11/16/2017 17:49	Quarry @ Crate/Barrel	0	1
11/16/2017 17:50	Quarry @ Crate/Barrel	1	0
11/16/2017 17:52	Campus @ Mayfield N	0	3
11/16/2017 17:54	Tresidder West	0	1
11/16/2017 17:57	Santa Teresa @ Lomita	1	1
11/16/2017 17:58	PATC-University Circle	6	16
11/16/2017 17:58	Via Ortega S at Roble Garage	1	0
11/16/2017 17:58	PATC-University Circle	0	0
11/16/2017 18:00	Via Ortega @ Y2E2	3	0
11/16/2017 18:02	Roth @ Quarry Ext	1	0
11/16/2017 18:03	Quarry Ext @ Med School	12	0
11/16/2017 18:04	Medical Center @ Quarry	11	0
11/16/2017 18:04	Medical Center @ Quarry	2	0
11/16/2017 18:06	Quarry @ Psychiatry Lot	5	0
11/16/2017 18:08	Quarry @ Psychiatry Bld	1	0
11/16/2017 18:09	Galvez @ Memorial	2	0
11/16/2017 18:11	Serra @ Encina Hall	0	1
11/16/2017 18:13	Campus @ Escondido	0	0
11/16/2017 18:14	PATC-University Circle	4	37
11/16/2017 18:15	Campus @ Munger	0	1
11/16/2017 18:20	Tresidder West	9	3
11/16/2017 18:21	Galvez @ Serra Mall	1	1
11/16/2017 18:22	Serra @ Encina Hall	1	0
11/16/2017 18:22	Santa Teresa @ Lomita	1	0
11/16/2017 18:24	Via Ortega S at Roble Garage	5	1
11/16/2017 18:25	Campus @ Escondido	0	3
11/16/2017 18:25	Via Ortega @ Y2E2	3	0
11/16/2017 18:28	Quarry Ext @ Med School	2	1
11/16/2017 18:28	Medical Center @ Quarry	1	2
11/16/2017 18:31	Quarry @ Crate/Barrel	0	1
11/16/2017 18:32	Tresidder West	1	1
11/16/2017 18:34	Santa Teresa @ Lomita	1	0
11/16/2017 18:36	Via Ortega S at Roble Garage	3	0
11/16/2017 18:37	PATC-University Circle	2	14
11/16/2017 18:41	Galvez @ El Camino Real	1	0
11/16/2017 18:41	Quarry Ext @ Med School	3	0
11/16/2017 18:42	Medical Center @ Quarry	2	0
11/16/2017 18:44	Quarry @ Psychiatry Lot	0	0
11/16/2017 18:46	Serra @ Manzanita Field	1	0
11/16/2017 18:48	Campus @ Escondido	0	3
11/16/2017 18:49	PATC-University Circle	4	9
11/16/2017 18:56	PATC-University Circle	10	14
11/16/2017 18:56	PATC-University Circle	11	2
11/16/2017 18:56	Tresidder West	2	2
11/16/2017 18:59	Via Ortega S at Roble Garage	1	0
11/16/2017 19:00	Via Ortega @ Cypress Lot	1	0
11/16/2017 19:01	El Camino @ PAMF SB	0	2
11/16/2017 19:03	Quarry Ext @ Med School	0	1
11/16/2017 19:04	Quarry Ext @ Medical C	1	0
11/16/2017 19:04	Galvez @ Serra Mall	0	1
11/16/2017 19:05	Serra @ Encina Hall	1	0
11/16/2017 19:05	Quarry @ Psychiatry Lot	1	0
11/16/2017 19:06	Serra @ Manzanita Field	0	2
11/16/2017 19:07	Unknown	0	0
11/16/2017 19:08	Campus @ Escondido	4	5
11/16/2017 19:10	Campus @ Munger	0	2
11/16/2017 19:12	Tresidder West	3	1
11/16/2017 19:14	PATC-University Circle	1	5

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DateTime	StopName	Boardings	Alightings
11/16/2017 19:15	Via Ortega S at Roble Garage	1	2
11/16/2017 19:17	Via Ortega @ Y2E2	6	2
11/16/2017 19:19	Roth @ Quarry Ext	0	1
11/16/2017 19:20	Quarry Ext @ Med School	7	0
11/16/2017 19:21	Medical Center @ Quarry	12	0
11/16/2017 19:23	Quarry @ Psychiatry Lot	4	0
11/16/2017 19:23	Campus @ Escondido	3	0
11/16/2017 19:24	Quarry @ Psychiatry Bld	0	1
11/16/2017 19:33	Tresidder West	0	0
11/16/2017 19:34	PATC-University Circle	4	35
11/16/2017 19:35	Santa Teresa @ New Guinea	3	0
11/16/2017 19:37	Via Ortega @ Y2E2	2	2
11/16/2017 19:39	Quarry Ext @ Med School	6	0
11/16/2017 19:41	Quarry @ Psychiatry Lot	1	0
11/16/2017 19:42	Serra @ Encina Hall	2	0
11/16/2017 19:44	Campus @ Escondido	2	0
11/16/2017 19:46	Campus @ Munger	1	0
11/16/2017 19:51	Tresidder West	2	4
11/16/2017 19:54	Via Ortega S at Roble Garage	0	1
11/16/2017 19:55	PATC-University Circle	11	15
11/16/2017 19:58	Roth @ Quarry Ext	1	1
11/16/2017 19:58	Quarry Ext @ Med School	1	0
11/16/2017 19:59	Quarry Ext @ Medical C	1	0
11/16/2017 20:00	Galvez @ El Camino Real	2	0
11/16/2017 20:02	Galvez @ Alumni Center	0	2
11/16/2017 20:03	Galvez @ Serra Mall	0	1
11/16/2017 20:04	Serra @ Encina Hall	1	3
11/16/2017 20:05	Serra @ Manzanita Field	0	3
11/16/2017 20:07	Campus @ Escondido	0	2
11/16/2017 20:08	Campus @ Wilbur Lot	0	1
11/16/2017 20:13	Tresidder West	2	0
11/16/2017 20:14	PATC-University Circle	11	12
11/16/2017 20:16	Santa Teresa @ Lomita	1	0
11/16/2017 20:18	Via Ortega @ Y2E2	1	0
11/16/2017 20:21	Quarry Ext @ Med School	0	0
11/16/2017 20:21	Quarry Ext @ Medical C	1	0
11/16/2017 20:23	Quarry @ Psychiatry Lot	1	0
11/16/2017 20:24	Campus @ Escondido	0	2
11/16/2017 20:25	Campus @ Wilbur Field	0	1
11/16/2017 20:27	Campus @ Mayfield N	0	3
11/16/2017 20:31	Tresidder West	0	2
11/16/2017 20:34	PATC-University Circle	5	9
11/16/2017 20:39	Galvez @ El Camino Real	2	0
11/16/2017 20:42	Galvez @ Serra Mall	0	1
11/16/2017 20:45	Campus @ Escondido	0	1
11/16/2017 20:47	Campus @ Munger	0	2
11/16/2017 20:49	Unknown	0	0
11/16/2017 20:52	Tresidder West	0	1
11/16/2017 20:55	Via Ortega S at Roble Garage	2	0
11/16/2017 20:57	Via Ortega @ Y2E2	4	0
11/16/2017 21:00	Quarry Ext @ Med School	5	0
11/16/2017 21:00	Quarry Ext @ Medical C	1	0
11/16/2017 21:02	Quarry @ Psychiatry Lot	1	0
11/16/2017 21:08	PATC-University Circle	1	11
11/17/2017 5:39	Unknown	2	3
11/17/2017 5:52	Unknown	2	1
11/17/2017 5:53	Unknown	2	2
11/17/2017 5:56	Unknown	0	0
11/17/2017 6:08	PATC-University Circle	5	0
11/17/2017 6:09	PATC-University Circle	1	0
11/17/2017 6:18	Galvez @ Alumni Center	1	0

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DateTime	StopName	Boardings	Alightings
11/17/2017 6:19	Galvez @ Serra Mall	0	2
11/17/2017 6:20	Serra @ Encina Hall	0	1
11/17/2017 6:21	Serra @ Manzanita Field	0	1
11/17/2017 6:24	Campus @ Munger	0	3
11/17/2017 6:27	Tresidder West	1	0
11/17/2017 6:34	Via Ortega S at Roble Garage	0	2
11/17/2017 6:35	Via Ortega @ Y2E2	1	0
11/17/2017 6:45	PATC-University Circle	0	2
11/17/2017 6:51	Galvez @ El Camino Real	1	0
11/17/2017 6:53	Galvez @ Serra Mall	0	1
11/17/2017 6:58	Campus @ Mayfield N	1	0
11/17/2017 7:06	Tresidder West	2	1
11/17/2017 7:10	Via Ortega @ Y2E2	3	1
11/17/2017 7:13	Quarry Ext @ Med School	0	1
11/17/2017 7:24	PATC-University Circle	0	0
11/17/2017 7:25	PATC-University Circle	1	0
11/17/2017 7:30	Galvez @ Alumni Center	0	5
11/17/2017 7:31	Galvez @ Serra Mall	0	9
11/17/2017 7:32	Serra @ Encina Hall	0	4
11/17/2017 7:34	Campus @ Escondido	0	1
11/17/2017 7:35	Campus @ Wilbur Lot	1	0
11/17/2017 7:36	Campus @ Wilbur Field	0	2
11/17/2017 7:37	Campus @ Mayfield N	0	1
11/17/2017 7:39	Tresidder West	0	2
11/17/2017 7:40	Tresidder West	0	2
11/17/2017 7:43	Tresidder West	2	0
11/17/2017 7:51	Quarry Ext @ Med School	1	0
11/17/2017 7:52	Quarry Ext @ Medical C	1	0
11/17/2017 7:59	PATC-University Circle	0	2
11/17/2017 8:09	PATC-University Circle	4	2
11/17/2017 8:14	Galvez @ El Camino Real	3	0
11/17/2017 8:16	Galvez @ Alumni Center	0	2
11/17/2017 8:17	Galvez @ Serra Mall	0	3
11/17/2017 8:26	Tresidder West	2	2
11/17/2017 8:29	Tresidder West	1	0
11/17/2017 8:33	Via Ortega @ Y2E2	0	2
11/17/2017 8:37	Medical Center @ Quarry	0	0
11/17/2017 8:45	PATC-University Circle	14	3
11/17/2017 8:49	PATC-University Circle	1	0
11/17/2017 8:54	Galvez @ El Camino Real	4	0
11/17/2017 8:57	Galvez @ Alumni Center	0	1
11/17/2017 8:58	Galvez @ Memorial	0	2
11/17/2017 8:58	Galvez @ Serra Mall	0	3
11/17/2017 8:59	Serra @ Encina Hall	0	7
11/17/2017 9:00	Serra @ Manzanita Field	0	2
11/17/2017 9:02	Campus @ Escondido	3	0
11/17/2017 9:03	Campus @ Wilbur Field	0	1
11/17/2017 9:04	Campus @ Munger	0	1
11/17/2017 9:05	Campus @ Mayfield N	1	0
11/17/2017 9:08	Tresidder West	0	1
11/17/2017 9:10	Santa Teresa @ Lomita	0	1
11/17/2017 9:11	Via Ortega S at Roble Garage	1	0
11/17/2017 9:13	Via Ortega @ Y2E2	0	2
11/17/2017 9:16	Quarry Ext @ Med School	0	1
11/17/2017 9:24	PATC-University Circle	12	2
11/17/2017 9:29	PATC-University Circle	1	3
11/17/2017 9:34	Galvez @ El Camino Real	1	0
11/17/2017 9:36	Galvez @ Alumni Center	0	3
11/17/2017 9:37	Galvez @ Serra Mall	0	1
11/17/2017 9:38	Serra @ Encina Hall	0	4
11/17/2017 9:41	Campus @ Munger	0	1

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DateTime	StopName	Boardings	Alightings
11/17/2017 9:47	Tresidder West	0	2
11/17/2017 9:52	Via Ortega @ Y2E2	1	1
11/17/2017 9:55	Medical Center @ Quarry	1	0
11/17/2017 10:14	PATC-University Circle	11	5
11/17/2017 10:20	Galvez @ Alumni Center	0	1
11/17/2017 10:22	Serra @ Manzanita Field	0	1
11/17/2017 10:24	Campus @ Escondido	3	0
11/17/2017 10:25	Campus @ Wilbur Field	1	0
11/17/2017 10:26	Campus @ Munger	0	2
11/17/2017 10:32	Tresidder West	4	7
11/17/2017 10:35	Via Ortega S at Roble Garage	1	0
11/17/2017 10:36	Via Ortega @ Y2E2	0	3
11/17/2017 10:39	Roth @ Quarry Ext	1	2
11/17/2017 10:40	Quarry Ext @ Med School	1	0
11/17/2017 10:53	PATC-University Circle	7	5
11/17/2017 10:58	Galvez @ El Camino Real	3	0
11/17/2017 11:00	Galvez @ Memorial	0	1
11/17/2017 11:01	Galvez @ Serra Mall	1	3
11/17/2017 11:02	Serra @ Encina Hall	0	1
11/17/2017 11:04	Campus @ Escondido	6	3
11/17/2017 11:06	Campus @ Wilbur Field	0	2
11/17/2017 11:11	Tresidder West	1	4
11/17/2017 11:14	Santa Teresa @ Lomita	0	1
11/17/2017 11:15	Via Ortega S at Roble Garage	1	0
11/17/2017 11:17	Via Ortega @ Y2E2	1	2
11/17/2017 11:19	Roth @ Quarry Ext	0	1
11/17/2017 11:20	Medical Center @ Quarry	2	0
11/17/2017 11:23	Quarry @ Psychiatry Bld	0	1
11/17/2017 11:33	PATC-University Circle	5	3
11/17/2017 11:33	Tresidder West	5	1
11/17/2017 11:40	Galvez @ El Camino Real	3	0
11/17/2017 11:42	Galvez @ Alumni Center	1	1
11/17/2017 11:43	Galvez @ Serra Mall	0	4
11/17/2017 11:50	Campus @ Mayfield N	1	1
11/17/2017 11:52	Tresidder West	1	1
11/17/2017 11:54	PATC-University Circle	6	9
11/17/2017 11:55	Via Ortega S at Roble Garage	3	0
11/17/2017 11:57	Via Ortega @ Y2E2	1	0
11/17/2017 11:59	Roth @ Quarry Ext	0	2
11/17/2017 12:00	Medical Center @ Quarry	3	0
11/17/2017 12:02	Quarry @ Psychiatry Bld	0	2
11/17/2017 12:03	Galvez @ Serra Mall	0	2
11/17/2017 12:07	Campus @ Wilbur Field	1	0
11/17/2017 12:08	Campus @ Munger	0	1
11/17/2017 12:19	Quarry Ext @ Med School	11	0
11/17/2017 12:20	Quarry Ext @ Medical C	3	0
11/17/2017 12:23	Galvez @ Serra Mall	0	3
11/17/2017 12:23	Serra @ Encina Hall	0	1
11/17/2017 12:26	Campus @ Escondido	1	0
11/17/2017 12:35	PATC-University Circle	3	19
11/17/2017 12:35	Via Ortega S at Roble Garage	0	1
11/17/2017 12:36	Via Ortega @ Y2E2	3	0
11/17/2017 12:42	Serra @ Encina Hall	0	1
11/17/2017 12:53	Tresidder West	3	2
11/17/2017 12:59	Galvez @ El Camino Real	3	0
11/17/2017 13:03	Serra @ Encina Hall	2	0
11/17/2017 13:13	Tresidder West	3	0
11/17/2017 13:15	Via Ortega S at Roble Garage	1	0
11/17/2017 13:16	PATC-University Circle	8	8
11/17/2017 13:17	Via Ortega @ Y2E2	3	1
11/17/2017 13:19	Roth @ Quarry Ext	1	5

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DateTime	StopName	Boardings	Alightings
11/17/2017 13:21	Galvez @ El Camino Real	3	0
11/17/2017 13:21	Quarry Ext @ Medical C	2	0
11/17/2017 13:23	Quarry @ Psychiatry Lot	1	0
11/17/2017 13:24	Galvez @ Serra Mall	3	1
11/17/2017 13:24	Quarry @ Psychiatry Bld	1	0
11/17/2017 13:25	Serra @ Manzanita Field	1	1
11/17/2017 13:28	Campus @ Wilbur Field	1	0
11/17/2017 13:34	PATC-University Circle	3	12
11/17/2017 13:41	Quarry Ext @ Medical C	3	2
11/17/2017 13:48	Campus @ Wilbur Lot	0	2
11/17/2017 13:49	Campus @ Munger	1	0
11/17/2017 13:51	PATC-University Circle	2	11
11/17/2017 13:53	Tresidder West	3	5
11/17/2017 13:54	PATC-University Circle	1	1
11/17/2017 13:54	PATC-University Circle	1	0
11/17/2017 14:01	Galvez @ El Camino Real	3	0
11/17/2017 14:01	Quarry Ext @ Med School	1	0
11/17/2017 14:04	Quarry @ Psychiatry Lot	3	0
11/17/2017 14:04	Serra @ Encina Hall	1	0
11/17/2017 14:06	Campus @ Escondido	2	2
11/17/2017 14:08	Campus @ Munger	0	1
11/17/2017 14:12	Tresidder West	5	3
11/17/2017 14:14	Santa Teresa @ Lomita	1	0
11/17/2017 14:18	Roth @ Quarry Ext	1	0
11/17/2017 14:19	Quarry Ext @ Med School	1	2
11/17/2017 14:20	Medical Center @ Quarry	8	0
11/17/2017 14:28	Campus @ Wilbur Lot	0	1
11/17/2017 14:32	Tresidder West	10	4
11/17/2017 14:32	Tresidder West	1	0
11/17/2017 14:59	Galvez @ El Camino Real	1	1
11/17/2017 15:00	Roth @ Quarry Ext	0	0
11/17/2017 15:08	Campus @ Munger	0	1
11/17/2017 15:12	Tresidder West	5	2
11/17/2017 15:14	PATC-University Circle	6	10
11/17/2017 15:20	Roth @ Quarry Ext	0	3
11/17/2017 15:21	Quarry Ext @ Med School	4	0
11/17/2017 15:22	Galvez @ Alumni Center	0	2
11/17/2017 15:22	Quarry Ext @ Medical C	8	0
11/17/2017 15:24	Quarry @ Psychiatry Lot	8	0
11/17/2017 15:32	Tresidder West	3	2
11/17/2017 15:35	PATC-University Circle	9	26
11/17/2017 15:35	Via Ortega S at Roble Garage	4	0
11/17/2017 15:35	PATC-University Circle	1	0
11/17/2017 15:37	Via Ortega @ Y2E2	4	0
11/17/2017 15:42	Galvez @ Alumni Center	2	3
11/17/2017 15:44	Serra @ Manzanita Field	0	2
11/17/2017 15:46	Campus @ Escondido	1	1
11/17/2017 15:52	Tresidder West	3	4
11/17/2017 15:54	PATC-University Circle	2	1
11/17/2017 15:56	Via Ortega @ Y2E2	6	2
11/17/2017 15:59	Roth @ Quarry Ext	6	0
11/17/2017 15:59	Galvez @ El Camino Real	4	0
11/17/2017 16:00	Medical Center @ Quarry	3	0
11/17/2017 16:01	Quarry @ Psychiatry Lot	3	0
11/17/2017 16:02	Serra @ Encina Hall	0	1
11/17/2017 16:03	Quarry @ Psychiatry Bld	0	1
11/17/2017 16:04	Serra @ Manzanita Field	0	1
11/17/2017 16:05	Campus @ Escondido	0	2
11/17/2017 16:12	Tresidder West	4	0
11/17/2017 16:14	PATC-University Circle	9	21
11/17/2017 16:14	Santa Teresa @ Lomita	1	0

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DateTime	StopName	Boardings	Alightings
11/17/2017 16:15	Via Ortega S Across from Roble	2	1
11/17/2017 16:16	Via Ortega @ Y2E2	2	0
11/17/2017 16:18	El Camino @ PAMF SB	0	1
11/17/2017 16:19	Quarry Ext @ Med School	2	0
11/17/2017 16:20	Medical Center @ Quarry	2	0
11/17/2017 16:20	Galvez @ El Camino Real	3	0
11/17/2017 16:20	Medical Center @ Quarry	0	0
11/17/2017 16:21	Quarry @ Psychiatry Lot	1	0
11/17/2017 16:22	Galvez @ Serra Mall	0	2
11/17/2017 16:23	Quarry @ Psychiatry Bld	0	3
11/17/2017 16:23	Serra @ Encina Hall	0	3
11/17/2017 16:25	Serra @ Manzanita Field	0	1
11/17/2017 16:26	Campus @ Escondido	1	0
11/17/2017 16:27	Campus @ Wilbur Lot	0	1
11/17/2017 16:28	Campus @ Wilbur Field	0	1
11/17/2017 16:32	Tresidder West	0	1
11/17/2017 16:34	Santa Teresa @ Lomita	2	0
11/17/2017 16:34	Santa Teresa @ Lomita	2	0
11/17/2017 16:35	PATC-University Circle	5	14
11/17/2017 16:35	PATC-University Circle	0	0
11/17/2017 16:37	Via Ortega @ Cypress Lot	0	1
11/17/2017 16:40	Roth @ Quarry Ext	0	1
11/17/2017 16:40	Galvez @ El Camino Real	1	1
11/17/2017 16:40	Quarry Ext @ Med School	2	0
11/17/2017 16:41	Medical Center @ Quarry	2	0
11/17/2017 16:42	Galvez @ Alumni Center	1	0
11/17/2017 16:44	Quarry @ Psychiatry Bld	0	1
11/17/2017 16:45	Campus @ Escondido	0	1
11/17/2017 16:47	Campus @ Mayfield N	1	1
11/17/2017 16:48	PATC-University Circle	0	8
11/17/2017 16:50	Tresidder West	2	4
11/17/2017 16:50	Tresidder West	0	0
11/17/2017 16:50	Tresidder West	1	0
11/17/2017 16:50	Tresidder West	0	0
11/17/2017 16:53	Santa Teresa @ Lomita	1	0
11/17/2017 16:54	PATC-University Circle	4	1
11/17/2017 16:56	Via Ortega @ Y2E2	0	1
11/17/2017 16:59	Quarry Ext Middle	3	1
11/17/2017 17:00	Quarry Ext Middle	1	0
11/17/2017 17:00	Medical Center @ Quarry	3	0
11/17/2017 17:02	Quarry @ Psychiatry Lot	3	0
11/17/2017 17:04	Serra @ Manzanita Field	2	0
11/17/2017 17:07	Campus @ Escondido	0	1
11/17/2017 17:08	PATC-University Circle	0	15
11/17/2017 17:09	Campus @ Munger	0	3
11/17/2017 17:13	Campus @ Mayfield S	0	1
11/17/2017 17:14	PATC-University Circle	3	1
11/17/2017 17:15	Tresidder West	1	1
11/17/2017 17:17	Santa Teresa @ Lomita	2	0
11/17/2017 17:18	Via Ortega S at Roble Garage	1	1
11/17/2017 17:20	Via Ortega @ Y2E2	4	0
11/17/2017 17:20	Galvez @ El Camino Real	4	0
11/17/2017 17:23	Roth @ Quarry Ext	1	0
11/17/2017 17:23	Galvez @ Serra Mall	0	1
11/17/2017 17:24	Quarry Ext @ Med School	16	0
11/17/2017 17:24	Serra @ Encina Hall	0	2
11/17/2017 17:25	Medical Center @ Quarry	10	0
11/17/2017 17:25	Serra @ Manzanita Field	1	0
11/17/2017 17:26	Quarry @ Psychiatry Lot	8	0
11/17/2017 17:26	Campus @ Escondido	0	1
11/17/2017 17:28	Quarry @ Psychiatry Bld	1	4

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DateTime	StopName	Boardings	Alightings
11/17/2017 17:28	Campus @ Munger	0	1
11/17/2017 17:33	PATC-University Circle	0	42
11/17/2017 17:35	PATC-University Circle	0	42
11/17/2017 17:37	Tresidder West	7	8
11/17/2017 17:37	Tresidder West	1	0
11/17/2017 17:41	Via Ortega S Across from Roble	0	1
11/17/2017 17:43	Via Ortega @ Y2E2	3	0
11/17/2017 17:43	Via Ortega @ Y2E2	0	0
11/17/2017 17:43	Galvez @ El Camino Real	1	0
11/17/2017 17:46	Quarry Ext @ Med School	7	1
11/17/2017 17:46	Quarry Ext @ Med School	0	0
11/17/2017 17:47	Medical Center @ Quarry	2	0
11/17/2017 17:47	Medical Center @ Quarry	0	0
11/17/2017 17:49	Quarry @ Psychiatry Lot	1	0
11/17/2017 17:49	Quarry @ Psychiatry Lot	0	0
11/17/2017 17:50	Quarry @ Psychiatry Bld	1	3
11/17/2017 17:50	Quarry @ Psychiatry Bld	0	0
11/17/2017 17:50	Campus @ Escondido	0	1
11/17/2017 17:53	Campus @ Munger	1	0
11/17/2017 17:56	PATC-University Circle	1	15
11/17/2017 17:56	PATC-University Circle	0	0
11/17/2017 17:57	PATC-University Circle	7	0
11/17/2017 17:57	Tresidder West	0	0
11/17/2017 17:57	PATC-University Circle	0	0
11/17/2017 18:00	Via Ortega S at Roble Garage	5	0
11/17/2017 18:02	Via Ortega @ Y2E2	1	0
11/17/2017 18:05	Quarry Ext @ Med School	3	0
11/17/2017 18:05	Galvez @ El Camino Real	0	2
11/17/2017 18:05	Galvez @ El Camino Real	0	0
11/17/2017 18:05	Medical Center @ Quarry	4	0
11/17/2017 18:07	Quarry @ Psychiatry Lot	1	0
11/17/2017 18:07	Galvez @ Alumni Center	0	1
11/17/2017 18:07	Galvez @ Alumni Center	0	0
11/17/2017 18:08	Quarry @ Psychiatry Bld	1	0
11/17/2017 18:08	Galvez @ Memorial	1	0
11/17/2017 18:09	Galvez @ Serra Mall	0	2
11/17/2017 18:10	Serra @ Encina Hall	0	2
11/17/2017 18:14	Campus @ Wilbur Field	0	1
11/17/2017 18:15	PATC-University Circle	7	17
11/17/2017 18:18	Tresidder West	5	1
11/17/2017 18:18	Tresidder West	0	0
11/17/2017 18:20	Santa Teresa @ Lomita	2	0
11/17/2017 18:20	Santa Teresa @ Lomita	0	0
11/17/2017 18:22	Via Ortega S at Roble Garage	2	0
11/17/2017 18:23	Galvez @ El Camino Real	1	0
11/17/2017 18:25	Galvez @ Alumni Center	0	1
11/17/2017 18:26	Quarry Ext Middle	0	5
11/17/2017 18:27	Medical Center @ Quarry	2	0
11/17/2017 18:27	Serra @ Encina Hall	0	2
11/17/2017 18:28	Serra @ Manzanita Field	0	1
11/17/2017 18:30	Campus @ Escondido	0	4
11/17/2017 18:33	Campus @ Mayfield N	2	0
11/17/2017 18:34	PATC-University Circle	1	5
11/17/2017 18:34	PATC-University Circle	0	0
11/17/2017 18:36	Tresidder West	1	0
11/17/2017 18:38	Santa Teresa @ Lomita	0	2
11/17/2017 18:38	Galvez @ El Camino Real	2	0
11/17/2017 18:40	Galvez @ Alumni Center	0	1
11/17/2017 18:41	Via Ortega @ Y2E2	1	0
11/17/2017 18:43	Quarry Ext @ Med School	1	0
11/17/2017 18:45	Campus @ Escondido	0	2

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DateTime	StopName	Boardings	Alightings
11/17/2017 18:46	Quarry @ Psychiatry Bld	0	0
11/17/2017 18:52	Tresidder West	2	1
11/17/2017 18:52	Tresidder West	0	0
11/17/2017 18:54	PATC-University Circle	10	5
11/17/2017 18:55	Via Ortega S at Roble Garage	2	1
11/17/2017 18:56	Via Ortega @ Y2E2	1	0
11/17/2017 18:58	El Camino @ PAMF SB	0	0
11/17/2017 18:58	El Camino @ PAMF SB	0	0
11/17/2017 18:58	Roth @ Quarry Ext	1	0
11/17/2017 18:59	Quarry Ext @ Med School	4	0
11/17/2017 18:59	Quarry Ext @ Med School	4	0
11/17/2017 19:01	Galvez @ El Camino Real	4	12
11/17/2017 19:01	Quarry @ Psychiatry Lot	1	0
11/17/2017 19:01	Quarry @ Psychiatry Lot	0	0
11/17/2017 19:01	Galvez @ El Camino Real	9	1
11/17/2017 19:04	Galvez @ Alumni Center	0	2
11/17/2017 19:06	Galvez @ Serra Mall	0	1
11/17/2017 19:08	Campus @ Escondido	0	3
11/17/2017 19:09	Campus @ Wilbur Lot	2	0
11/17/2017 19:09	PATC-University Circle	3	12
11/17/2017 19:09	PATC-University Circle	1	0
11/17/2017 19:10	PATC-University Circle	0	0
11/17/2017 19:10	Campus @ Wilbur Field	0	1
11/17/2017 19:10	PATC-University Circle	0	0
11/17/2017 19:11	Campus @ Mayfield N	1	0
11/17/2017 19:13	Tresidder West	2	1
11/17/2017 19:14	PATC-University Circle	4	0
11/17/2017 19:15	Santa Teresa @ Lomita	4	3
11/17/2017 19:16	Via Ortega S Across from Roble	0	3
11/17/2017 19:19	Roth @ Quarry Ext	0	1
11/17/2017 19:19	Quarry Ext @ Med School	5	0
11/17/2017 19:20	Galvez @ Alumni Center	0	0
11/17/2017 19:20	Medical Center @ Quarry	5	0
11/17/2017 19:24	Campus @ Wilbur Lot	0	5
11/17/2017 19:34	PATC-University Circle	4	15
11/17/2017 19:35	PATC-University Circle	1	1
11/17/2017 19:37	Tresidder West	2	1
11/17/2017 19:37	Tresidder West	0	0
11/17/2017 19:41	Via Ortega @ Y2E2	3	0
11/17/2017 19:41	Via Ortega @ Y2E2	0	0
11/17/2017 19:44	Campus @ Escondido	0	1
11/17/2017 19:44	Medical Center @ Quarry	2	0
11/17/2017 19:45	Quarry @ Psychiatry Lot	0	0
11/17/2017 19:49	Tresidder West	0	1
11/17/2017 19:52	Tresidder West	1	0
11/17/2017 19:53	Unknown	2	3
11/17/2017 19:53	PATC-University Circle	3	7
11/17/2017 19:53	PATC-University Circle	0	0
11/17/2017 19:53	Unknown	0	0
11/17/2017 19:54	Santa Teresa @ Lomita	1	0
11/17/2017 19:54	PATC-University Circle	0	1
11/17/2017 19:55	PATC-University Circle	0	0
11/17/2017 19:57	Via Ortega @ Y2E2	1	0
11/17/2017 19:59	Quarry Ext @ Med School	3	0
11/17/2017 19:59	Galvez @ El Camino Real	3	0
11/17/2017 20:00	Galvez @ El Camino Real	0	0
11/17/2017 20:00	Quarry Ext @ Medical C	2	0
11/17/2017 20:02	Quarry @ Psychiatry Lot	2	0
11/17/2017 20:03	Quarry @ Psychiatry Bld	0	1
11/17/2017 20:05	Campus @ Escondido	2	3
11/17/2017 20:05	Campus @ Escondido	0	0

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11/17/2017 20:08	Campus @ Munger	0	1
11/17/2017 20:12	Tresidder West	0	0
11/17/2017 20:12	Tresidder West	0	0
11/17/2017 20:14	PATC-University Circle	1	10
11/17/2017 20:16	Via Ortega @ Y2E2	2	0
11/17/2017 20:16	Via Ortega @ Y2E2	0	0
11/17/2017 20:19	Quarry Ext @ Med School	1	0
11/17/2017 20:19	Quarry Ext @ Med School	0	0
11/17/2017 20:23	Unknown	1	1
11/17/2017 20:23	Serra @ Manzanita Field	2	0
11/17/2017 20:34	PATC-University Circle	3	6
11/17/2017 20:34	PATC-University Circle	0	0
11/17/2017 20:35	Via Ortega S at Roble Garage	0	2
11/17/2017 20:38	Quarry Ext @ Med School	1	2
11/17/2017 20:38	El Camino @ PAMF SB	0	1
11/17/2017 20:38	El Camino @ PAMF SB	0	0
11/17/2017 20:40	Galvez @ El Camino Real	4	0
11/17/2017 20:40	Galvez @ El Camino Real	0	0
11/17/2017 20:41	Unknown	1	1
11/17/2017 20:45	PATC-University Circle	0	1
11/17/2017 20:51	Unknown	1	1
11/17/2017 20:51	Tresidder West	0	2
11/17/2017 20:51	Tresidder West	0	0
11/17/2017 20:56	Via Ortega @ Y2E2	3	0
11/17/2017 20:56	Via Ortega @ Y2E2	0	0
11/17/2017 20:56	Unknown	1	1
11/17/2017 20:58	Unknown	1	1
11/17/2017 20:59	Quarry Ext @ Med School	2	0
11/17/2017 20:59	Quarry Ext @ Med School	0	0
11/17/2017 21:00	Medical Center @ Quarry	1	0
11/17/2017 21:00	Medical Center @ Quarry	0	0
11/17/2017 21:01	Quarry @ Psychiatry Lot	1	0
11/17/2017 21:01	Quarry @ Psychiatry Lot	0	0
11/17/2017 21:02	Unknown	1	1
11/17/2017 21:02	Quarry @ Psychiatry Bld	0	1
11/17/2017 21:02	Quarry @ Psychiatry Bld	0	0
11/17/2017 21:05	Unknown	4	2
11/17/2017 21:07	PATC-University Circle	0	5
11/17/2017 21:07	PATC-University Circle	0	0
11/17/2017 21:09	Unknown	1	1
11/17/2017 21:10	Unknown	1	1
11/17/2017 21:19	Unknown	1	1
11/17/2017 21:19	Unknown	0	0
11/17/2017 21:43	Unknown	1	1
11/17/2017 21:44	Unknown	0	0
11/17/2017 21:48	Unknown	1	1
11/17/2017 21:48	Unknown	0	0
11/17/2017 21:53	Unknown	1	1
11/17/2017 21:55	Unknown	1	1
11/17/2017 21:56	Unknown	1	1
11/18/2017 10:13	Unknown	0	0
11/18/2017 10:13	Unknown	0	0
11/20/2017 6:13	PATC-University Circle	5	0
11/20/2017 6:19	Galvez @ Memorial	0	1
11/20/2017 6:20	Serra @ Encina Hall	0	2
11/20/2017 6:22	Serra @ Manzanita Field	0	1
11/20/2017 6:31	PATC-University Circle	15	1
11/20/2017 6:31	Tresidder West	1	1
11/20/2017 6:34	Galvez @ El Camino Real	0	1
11/20/2017 6:37	Serra @ Encina Hall	0	2
11/20/2017 6:38	Roth @ Quarry Ext	0	1

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DateTime	StopName	Boardings	Alightings
11/20/2017 6:38	Serra @ Manzanita Field	0	7
11/20/2017 6:41	Campus @ Munger	0	2
11/20/2017 6:48	PATC-University Circle	1	0
11/20/2017 6:54	Unknown	0	0
11/20/2017 6:54	Galvez @ El Camino Real	2	0
11/20/2017 6:56	Via Ortega @ Y2E2	1	0
11/20/2017 6:57	Galvez @ Serra Mall	0	3
11/20/2017 7:06	Tresidder West	0	0
11/20/2017 7:07	PATC-University Circle	4	2
11/20/2017 7:13	Galvez @ Alumni Center	0	1
11/20/2017 7:14	Galvez @ Serra Mall	0	1
11/20/2017 7:14	Serra @ Encina Hall	0	1
11/20/2017 7:25	PATC-University Circle	12	0
11/20/2017 7:31	Galvez @ Alumni Center	0	5
11/20/2017 7:32	Galvez @ Serra Mall	0	6
11/20/2017 7:33	Roth @ Quarry Ext	2	0
11/20/2017 7:33	Serra @ Encina Hall	0	2
11/20/2017 7:34	Serra @ Manzanita Field	0	1
11/20/2017 7:36	Campus @ Escondido	0	1
11/20/2017 7:44	Tresidder West	1	1
11/20/2017 7:45	PATC-University Circle	29	4
11/20/2017 7:49	Galvez @ El Camino Real	1	0
11/20/2017 7:49	Via Ortega @ Y2E2	2	0
11/20/2017 7:51	Galvez @ Alumni Center	0	8
11/20/2017 7:52	Galvez @ Memorial	0	4
11/20/2017 7:52	Galvez @ Serra Mall	0	6
11/20/2017 7:53	Serra @ Encina Hall	0	6
11/20/2017 7:53	Quarry Ext @ Medical C	3	0
11/20/2017 7:54	Serra @ Manzanita Field	0	1
11/20/2017 7:55	Quarry @ Psychiatry Lot	1	0
11/20/2017 7:57	Campus @ Munger	0	1
11/20/2017 7:58	Campus @ Mayfield N	0	2
11/20/2017 8:04	Tresidder West	1	0
11/20/2017 8:07	Via Ortega S at Roble Garage	0	1
11/20/2017 8:09	PATC-University Circle	2	7
11/20/2017 8:10	PATC-University Circle	0	0
11/20/2017 8:14	Galvez @ El Camino Real	1	0
11/20/2017 8:16	Galvez @ Alumni Center	0	2
11/20/2017 8:17	Galvez @ Memorial	0	1
11/20/2017 8:18	Serra @ Encina Hall	0	1
11/20/2017 8:20	Campus @ Wilbur Lot	1	0
11/20/2017 8:22	Campus @ Mayfield N	0	1
11/20/2017 8:22	Quarry @ Crate/Barrel	2	2
11/20/2017 8:28	Tresidder West	2	1
11/20/2017 8:33	Via Ortega @ Y2E2	0	0
11/20/2017 8:33	PATC-University Circle	14	1
11/20/2017 8:35	PATC-University Circle	11	0
11/20/2017 8:36	PATC-University Circle	1	0
11/20/2017 8:36	Medical Center @ Quarry	1	0
11/20/2017 8:37	Quarry @ Psychiatry Lot	0	0
11/20/2017 8:41	El Camino @ Town/Cntry	0	1
11/20/2017 8:44	Galvez @ Alumni Center	1	5
11/20/2017 8:45	Galvez @ Memorial	0	1
11/20/2017 8:46	Galvez @ Serra Mall	0	5
11/20/2017 8:46	Serra @ Encina Hall	0	9
11/20/2017 8:47	PATC-University Circle	23	2
11/20/2017 8:47	Serra @ Manzanita Field	0	1
11/20/2017 8:49	Campus @ Escondido	0	1
11/20/2017 8:49	PATC-University Circle	0	0
11/20/2017 8:51	Campus @ Munger	0	2
11/20/2017 8:54	Galvez @ El Camino Real	2	0

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DateTime	StopName	Boardings	Alightings
11/20/2017 8:56	Galvez @ Alumni Center	0	7
11/20/2017 8:57	Tresidder West	0	1
11/20/2017 8:57	Galvez @ Memorial	0	1
11/20/2017 8:58	Galvez @ Serra Mall	0	9
11/20/2017 8:59	Serra @ Encina Hall	0	6
11/20/2017 9:00	Serra @ Manzanita Field	0	1
11/20/2017 9:01	Campus @ Escondido	1	0
11/20/2017 9:03	Campus @ Munger	0	1
11/20/2017 9:08	Tresidder West	1	2
11/20/2017 9:10	PATC-University Circle	2	2
11/20/2017 9:13	Via Ortega @ Y2E2	0	1
11/20/2017 9:18	Quarry @ Psychiatry Lot	1	0
11/20/2017 9:18	Galvez @ Serra Mall	0	1
11/20/2017 9:20	Serra @ Manzanita Field	3	0
11/20/2017 9:21	Campus @ Escondido	1	0
11/20/2017 9:23	Campus @ Munger	1	0
11/20/2017 9:25	Tresidder West	0	1
11/20/2017 9:26	PATC-University Circle	9	2
11/20/2017 9:29	PATC-University Circle	1	1
11/20/2017 9:30	Via Ortega @ Y2E2	0	2
11/20/2017 9:36	Quarry Ext Middle	1	2
11/20/2017 9:36	Galvez @ Alumni Center	0	1
11/20/2017 9:40	Campus @ Wilbur Lot	0	1
11/20/2017 9:41	Campus @ Munger	0	3
11/20/2017 9:42	Campus @ Mayfield N	1	0
11/20/2017 9:47	Tresidder West	1	2
11/20/2017 9:52	PATC-University Circle	7	1
11/20/2017 9:53	PATC-University Circle	0	0
11/20/2017 9:54	Quarry Ext @ Med School	0	1
11/20/2017 9:58	Galvez @ Alumni Center	0	1
11/20/2017 9:59	Galvez @ Serra Mall	0	1
11/20/2017 10:01	Campus @ Escondido	1	1
11/20/2017 10:05	Tresidder West	0	3
11/20/2017 10:14	PATC-University Circle	9	5
11/20/2017 10:14	Quarry Ext Middle	1	3
11/20/2017 10:15	Unknown	0	0
11/20/2017 10:20	Galvez @ Alumni Center	0	2
11/20/2017 10:22	Galvez @ Serra Mall	0	3
11/20/2017 10:22	Serra @ Encina Hall	0	1
11/20/2017 10:24	Campus @ Escondido	1	0
11/20/2017 10:26	Campus @ Wilbur Field	0	1
11/20/2017 10:32	Tresidder West	2	1
11/20/2017 10:35	PATC-University Circle	11	4
11/20/2017 10:35	PATC-University Circle	0	0
11/20/2017 10:38	El Camino @ PAMF SB	0	1
11/20/2017 10:42	Galvez @ Memorial	0	1
11/20/2017 10:43	Galvez @ Serra Mall	0	0
11/20/2017 10:43	Serra @ Encina Hall	0	2
11/20/2017 10:45	Campus @ Escondido	1	0
11/20/2017 10:52	Tresidder West	0	0
11/20/2017 10:52	Tresidder West	1	0
11/20/2017 10:53	PATC-University Circle	13	4
11/20/2017 10:55	Via Ortega S at Roble Garage	0	1
11/20/2017 10:57	Via Ortega @ Y2E2	4	1
11/20/2017 10:59	Galvez @ Alumni Center	0	2
11/20/2017 11:00	Galvez @ Memorial	0	2
11/20/2017 11:00	Galvez @ Serra Mall	0	1
11/20/2017 11:01	Serra @ Encina Hall	0	2
11/20/2017 11:04	Campus @ Wilbur Lot	1	2
11/20/2017 11:10	Tresidder West	4	1
11/20/2017 11:13	PATC-University Circle	13	6

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DateTime	StopName	Boardings	Alightings
11/20/2017 11:14	Via Ortega S at Roble Garage	5	1
11/20/2017 11:15	Via Ortega @ Y2E2	2	0
11/20/2017 11:18	Roth @ Quarry Ext	0	2
11/20/2017 11:18	Medical Center @ Quarry	1	0
11/20/2017 11:19	Galvez @ El Camino Real	2	0
11/20/2017 11:22	Galvez @ Serra Mall	0	8
11/20/2017 11:23	Serra @ Encina Hall	1	0
11/20/2017 11:24	Serra @ Manzanita Field	0	0
11/20/2017 11:26	Campus @ Wilbur Lot	1	0
11/20/2017 11:28	Campus @ Munger	0	2
11/20/2017 11:32	Tresidder West	0	3
11/20/2017 11:32	Tresidder West	1	0
11/20/2017 11:34	PATC-University Circle	3	9
11/20/2017 11:38	Roth @ Quarry Ext	0	3
11/20/2017 11:39	Galvez @ Alumni Center	0	1
11/20/2017 11:39	Quarry Ext @ Medical C	1	0
11/20/2017 11:41	Serra @ Encina Hall	0	1
11/20/2017 11:52	Tresidder West	1	0
11/20/2017 11:53	PATC-University Circle	9	4
11/20/2017 11:54	PATC-University Circle	0	0
11/20/2017 11:55	Via Ortega S at Roble Garage	1	0
11/20/2017 11:58	Roth @ Quarry Ext	0	1
11/20/2017 12:00	Quarry @ Psychiatry Lot	1	0
11/20/2017 12:02	Galvez @ Serra Mall	0	2
11/20/2017 12:02	Serra @ Encina Hall	1	0
11/20/2017 12:05	Campus @ Escondido	0	1
11/20/2017 12:07	Campus @ Munger	0	1
11/20/2017 12:12	Tresidder West	0	3
11/20/2017 12:13	PATC-University Circle	0	2
11/20/2017 12:14	Santa Teresa @ Lomita	1	0
11/20/2017 12:15	Via Ortega S at Roble Garage	1	0
11/20/2017 12:17	Galvez @ El Camino Real	4	0
11/20/2017 12:20	Quarry Ext @ Medical C	5	0
11/20/2017 12:20	Galvez @ Serra Mall	0	1
11/20/2017 12:23	Campus @ Escondido	1	2
11/20/2017 12:31	Tresidder West	2	0
11/20/2017 12:35	PATC-University Circle	5	4
11/20/2017 12:35	Via Ortega @ Y2E2	2	1
11/20/2017 12:36	PATC-University Circle	1	0
11/20/2017 12:38	Roth @ Quarry Ext	2	0
11/20/2017 12:39	Medical Center @ Quarry	4	0
11/20/2017 12:41	Quarry @ Psychiatry Bld	0	3
11/20/2017 12:41	Galvez @ El Camino Real	0	2
11/20/2017 12:44	Galvez @ Serra Mall	0	4
11/20/2017 12:47	Campus @ Escondido	2	0
11/20/2017 12:49	Campus @ Munger	0	1
11/20/2017 12:51	Tresidder West	1	1
11/20/2017 12:52	Tresidder West	2	0
11/20/2017 12:55	PATC-University Circle	5	8
11/20/2017 12:56	Via Ortega @ Y2E2	0	2
11/20/2017 12:58	Roth @ Quarry Ext	0	1
11/20/2017 12:59	Galvez @ El Camino Real	2	0
11/20/2017 13:01	Galvez @ Alumni Center	0	2
11/20/2017 13:04	Campus @ Escondido	1	1
11/20/2017 13:08	PATC-University Circle	6	3
11/20/2017 13:11	Tresidder West	6	5
11/20/2017 13:14	PATC-University Circle	5	4
11/20/2017 13:18	Roth @ Quarry Ext	7	7
11/20/2017 13:19	Galvez @ El Camino Real	4	0
11/20/2017 13:19	Quarry Ext @ Medical C	2	0
11/20/2017 13:21	Galvez @ Memorial	0	2

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DateTime	StopName	Boardings	Alightings
11/20/2017 13:22	Quarry @ Psychiatry Bld	0	3
11/20/2017 13:22	Serra @ Encina Hall	0	2
11/20/2017 13:25	Campus @ Escondido	1	1
11/20/2017 13:27	Campus @ Mayfield N	0	1
11/20/2017 13:31	Tresidder West	1	1
11/20/2017 13:33	PATC-University Circle	5	9
11/20/2017 13:35	Via Ortega @ Y2E2	1	0
11/20/2017 13:38	Quarry Ext @ Med School	3	0
11/20/2017 13:39	Quarry Ext @ Medical C	1	0
11/20/2017 13:39	Galvez @ El Camino Real	1	0
11/20/2017 13:41	Quarry @ Psychiatry Bld	0	3
11/20/2017 13:41	Galvez @ Serra Mall	0	2
11/20/2017 13:42	Serra @ Encina Hall	1	0
11/20/2017 13:45	Campus @ Escondido	0	1
11/20/2017 13:51	Tresidder West	0	1
11/20/2017 13:55	PATC-University Circle	5	6
11/20/2017 13:55	Via Ortega S at Roble Garage	3	0
11/20/2017 14:02	Galvez @ Alumni Center	0	1
11/20/2017 14:04	Serra @ Encina Hall	0	2
11/20/2017 14:07	Campus @ Munger	1	0
11/20/2017 14:11	Tresidder West	5	0
11/20/2017 14:14	PATC-University Circle	4	7
11/20/2017 14:15	Via Ortega @ Y2E2	1	0
11/20/2017 14:17	Roth @ Quarry Ext	2	0
11/20/2017 14:18	El Camino @ PAMF SB	0	0
11/20/2017 14:18	Quarry Ext @ Med School	2	0
11/20/2017 14:19	Quarry Ext @ Medical C	6	0
11/20/2017 14:19	Galvez @ El Camino Real	2	0
11/20/2017 14:21	Quarry @ Psychiatry Lot	1	0
11/20/2017 14:22	Galvez @ Alumni Center	0	2
11/20/2017 14:22	Quarry @ Psychiatry Bld	0	3
11/20/2017 14:27	Campus @ Wilbur Field	1	0
11/20/2017 14:32	Tresidder West	2	0
11/20/2017 14:34	PATC-University Circle	3	18
11/20/2017 14:34	Santa Teresa @ Lomita	1	0
11/20/2017 14:37	Via Ortega @ Y2E2	1	0
11/20/2017 14:39	Roth @ Quarry Ext	0	0
11/20/2017 14:40	Quarry Ext @ Med School	1	0
11/20/2017 14:41	Quarry Ext @ Medical C	4	1
11/20/2017 14:42	Galvez @ Memorial	0	1
11/20/2017 14:43	Quarry @ Psychiatry Lot	0	2
11/20/2017 14:45	Quarry @ Psychiatry Bld	2	4
11/20/2017 14:46	Campus @ Wilbur Field	1	0
11/20/2017 14:52	Tresidder West	3	0
11/20/2017 14:54	PATC-University Circle	5	7
11/20/2017 14:55	Via Ortega S at Roble Garage	0	1
11/20/2017 14:56	Via Ortega @ Y2E2	1	0
11/20/2017 14:58	Galvez @ El Camino Real	3	0
11/20/2017 14:59	Roth @ Quarry Ext	0	3
11/20/2017 14:59	Roth @ Quarry Ext	1	0
11/20/2017 15:00	Quarry Ext @ Med School	4	0
11/20/2017 15:01	Galvez @ Memorial	0	2
11/20/2017 15:01	Quarry Ext @ Medical C	5	0
11/20/2017 15:01	Galvez @ Serra Mall	0	1
11/20/2017 15:03	Quarry @ Psychiatry Lot	3	0
11/20/2017 15:04	Quarry @ Psychiatry Bld	1	0
11/20/2017 15:05	Campus @ Escondido	0	2
11/20/2017 15:06	Campus @ Wilbur Field	0	1
11/20/2017 15:12	Tresidder West	1	1
11/20/2017 15:14	PATC-University Circle	10	12
11/20/2017 15:15	Via Ortega S at Roble Garage	0	1

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DateTime	StopName	Boardings	Alightings
11/20/2017 15:16	Via Ortega @ Y2E2	1	0
11/20/2017 15:19	Quarry Ext @ Med School	2	0
11/20/2017 15:20	Galvez @ El Camino Real	2	0
11/20/2017 15:21	Quarry Ext @ Medical C	7	0
11/20/2017 15:21	Quarry Ext @ Medical C	1	0
11/20/2017 15:22	Galvez @ Alumni Center	0	1
11/20/2017 15:22	Quarry @ Psychiatry Lot	5	0
11/20/2017 15:23	Galvez @ Serra Mall	0	1
11/20/2017 15:24	Quarry @ Psychiatry Bld	0	4
11/20/2017 15:26	Campus @ Escondido	0	5
11/20/2017 15:26	Campus @ Wilbur Lot	0	1
11/20/2017 15:28	Campus @ Mayfield N	1	0
11/20/2017 15:32	Tresidder West	2	1
11/20/2017 15:34	PATC-University Circle	2	14
11/20/2017 15:35	Via Ortega S at Roble Garage	0	3
11/20/2017 15:36	Via Ortega @ Y2E2	7	0
11/20/2017 15:38	El Camino @ PAMF SB	2	0
11/20/2017 15:39	Quarry Ext @ Med School	2	2
11/20/2017 15:40	Medical Center @ Quarry	2	0
11/20/2017 15:41	Quarry @ Psychiatry Lot	0	0
11/20/2017 15:42	Quarry @ Crate/Barrel	0	1
11/20/2017 15:44	Campus @ Escondido	0	1
11/20/2017 15:52	Tresidder West	0	3
11/20/2017 15:54	PATC-University Circle	6	13
11/20/2017 15:55	Via Ortega S at Roble Garage	1	0
11/20/2017 15:59	Galvez @ El Camino Real	1	0
11/20/2017 16:00	Quarry Ext @ Med School	2	0
11/20/2017 16:01	Medical Center @ Quarry	7	0
11/20/2017 16:01	Medical Center @ Quarry	2	0
11/20/2017 16:02	Medical Center @ Quarry	2	0
11/20/2017 16:03	Serra @ Manzanita Field	0	1
11/20/2017 16:04	Quarry @ Psychiatry Lot	0	0
11/20/2017 16:05	Campus @ Wilbur Lot	0	1
11/20/2017 16:06	Campus @ Wilbur Field	1	1
11/20/2017 16:09	PATC-University Circle	0	15
11/20/2017 16:12	Tresidder West	5	3
11/20/2017 16:14	PATC-University Circle	0	0
11/20/2017 16:16	Via Ortega @ Y2E2	5	0
11/20/2017 16:18	Roth @ Quarry Ext	0	3
11/20/2017 16:19	Quarry Ext @ Med School	4	0
11/20/2017 16:20	Medical Center @ Quarry	3	0
11/20/2017 16:20	Galvez @ El Camino Real	2	0
11/20/2017 16:22	Quarry @ Psychiatry Bld	0	1
11/20/2017 16:24	Serra @ Manzanita Field	1	0
11/20/2017 16:27	Campus @ Wilbur Field	1	0
11/20/2017 16:28	Campus @ Mayfield N	1	0
11/20/2017 16:32	Tresidder West	6	2
11/20/2017 16:34	PATC-University Circle	5	15
11/20/2017 16:34	Santa Teresa @ Lomita	1	1
11/20/2017 16:36	Via Ortega S at Roble Garage	0	2
11/20/2017 16:37	Via Ortega @ Y2E2	0	0
11/20/2017 16:39	Galvez @ El Camino Real	2	0
11/20/2017 16:40	Roth @ Quarry Ext	3	0
11/20/2017 16:41	Galvez @ Memorial	0	2
11/20/2017 16:41	Quarry Ext @ Med School	2	0
11/20/2017 16:42	Medical Center @ Quarry	2	0
11/20/2017 16:44	Campus @ Escondido	0	1
11/20/2017 16:44	Quarry @ Psychiatry Lot	2	0
11/20/2017 16:45	Campus @ Munger	0	2
11/20/2017 16:51	Tresidder West	3	1
11/20/2017 16:51	PATC-University Circle	2	17

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DateTime	StopName	Boardings	Alightings
11/20/2017 16:53	Via Ortega S at Roble Garage	1	0
11/20/2017 16:54	PATC-University Circle	2	1
11/20/2017 16:55	Via Ortega @ Y2E2	7	0
11/20/2017 16:57	Roth @ Quarry Ext	1	0
11/20/2017 16:58	Quarry Ext @ Med School	19	0
11/20/2017 16:59	Medical Center @ Quarry	9	0
11/20/2017 17:00	Galvez @ El Camino Real	1	1
11/20/2017 17:00	Quarry @ Psychiatry Lot	1	0
11/20/2017 17:02	Quarry @ Psychiatry Bld	2	0
11/20/2017 17:04	Serra @ Encina Hall	1	0
11/20/2017 17:05	Serra @ Manzanita Field	0	1
11/20/2017 17:06	Campus @ Escondido	3	2
11/20/2017 17:12	Tresidder West	2	5
11/20/2017 17:14	PATC-University Circle	2	39
11/20/2017 17:16	Via Ortega @ Y2E2	5	0
11/20/2017 17:19	Roth @ Quarry Ext	1	0
11/20/2017 17:19	Galvez @ El Camino Real	1	0
11/20/2017 17:19	Quarry Ext @ Med School	6	0
11/20/2017 17:20	Medical Center @ Quarry	5	0
11/20/2017 17:22	Serra @ Encina Hall	1	0
11/20/2017 17:22	Quarry @ Psychiatry Lot	3	0
11/20/2017 17:23	Quarry @ Psychiatry Bld	0	3
11/20/2017 17:24	Campus @ Escondido	0	1
11/20/2017 17:27	PATC-University Circle	1	20
11/20/2017 17:30	Tresidder West	0	0
11/20/2017 17:32	Santa Teresa @ Lomita	0	1
11/20/2017 17:34	PATC-University Circle	3	0
11/20/2017 17:35	Via Ortega @ Y2E2	10	0
11/20/2017 17:37	Roth @ Quarry Ext	1	0
11/20/2017 17:38	Quarry Ext @ Med School	3	0
11/20/2017 17:39	Medical Center @ Quarry	5	0
11/20/2017 17:39	Medical Center @ Quarry	1	0
11/20/2017 17:40	Quarry @ Psychiatry Lot	1	0
11/20/2017 17:42	Serra @ Encina Hall	1	1
11/20/2017 17:45	PATC-University Circle	0	17
11/20/2017 17:47	Campus @ Mayfield N	0	2
11/20/2017 17:52	Tresidder West	3	0
11/20/2017 17:55	PATC-University Circle	2	1
11/20/2017 17:55	Via Ortega S at Roble Garage	1	0
11/20/2017 17:59	Galvez @ El Camino Real	1	0
11/20/2017 17:59	Quarry Ext @ Med School	1	0
11/20/2017 18:01	Galvez @ Serra Mall	1	0
11/20/2017 18:04	Campus @ Escondido	0	2
11/20/2017 18:07	PATC-University Circle	4	6
11/20/2017 18:12	Tresidder West	3	1
11/20/2017 18:14	PATC-University Circle	0	0
11/20/2017 18:16	Via Ortega @ Y2E2	3	1
11/20/2017 18:18	Quarry Ext @ Med School	1	0
11/20/2017 18:20	Medical Center @ Quarry	1	0
11/20/2017 18:20	Medical Center @ Quarry	1	0
11/20/2017 18:22	Quarry @ Psychiatry Lot	3	0
11/20/2017 18:23	Serra @ Manzanita Field	1	0
11/20/2017 18:25	Campus @ Escondido	0	3
11/20/2017 18:26	PATC-University Circle	2	12
11/20/2017 18:27	PATC-University Circle	1	0
11/20/2017 18:27	Campus @ Wilbur Field	0	3
11/20/2017 18:32	Tresidder West	1	0
11/20/2017 18:34	PATC-University Circle	4	2
11/20/2017 18:34	Santa Teresa @ Lomita	2	0
11/20/2017 18:34	PATC-University Circle	1	0
11/20/2017 18:37	Via Ortega @ Y2E2	4	0

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DateTime	StopName	Boardings	Alightings
11/20/2017 18:39	Galvez @ El Camino Real	1	0
11/20/2017 18:39	Roth @ Quarry Ext	0	1
11/20/2017 18:40	Quarry Ext @ Med School	9	0
11/20/2017 18:41	Medical Center @ Quarry	6	1
11/20/2017 18:42	Galvez @ Memorial	0	2
11/20/2017 18:42	Galvez @ Serra Mall	0	1
11/20/2017 18:42	Quarry @ Psychiatry Lot	3	0
11/20/2017 18:43	Serra @ Manzanita Field	0	1
11/20/2017 18:45	Campus @ Escondido	0	3
11/20/2017 18:55	Tresidder West	1	1
11/20/2017 18:55	PATC-University Circle	3	28
11/20/2017 18:59	Galvez @ El Camino Real	3	0
11/20/2017 19:00	Quarry Ext Middle	3	1
11/20/2017 19:01	Medical Center @ Quarry	0	0
11/20/2017 19:02	Galvez @ Alumni Center	0	2
11/20/2017 19:02	Quarry @ Psychiatry Lot	3	0
11/20/2017 19:04	Serra @ Encina Hall	0	1
11/20/2017 19:06	Campus @ Escondido	0	2
11/20/2017 19:07	Campus @ Wilbur Lot	1	0
11/20/2017 19:08	PATC-University Circle	1	6
11/20/2017 19:08	Campus @ Munger	0	1
11/20/2017 19:12	Tresidder West	2	1
11/20/2017 19:15	Via Ortega S at Roble Garage	1	0
11/20/2017 19:15	PATC-University Circle	11	4
11/20/2017 19:16	Via Ortega @ Y2E2	4	0
11/20/2017 19:19	Quarry Ext @ Med School	8	0
11/20/2017 19:19	Medical Center @ Quarry	5	0
11/20/2017 19:20	Galvez @ Alumni Center	1	0
11/20/2017 19:20	Medical Center @ Quarry	2	0
11/20/2017 19:21	Serra @ Encina Hall	1	0
11/20/2017 19:22	Quarry @ Psychiatry Bld	2	1
11/20/2017 19:23	Campus @ Escondido	0	6
11/20/2017 19:24	Campus @ Wilbur Lot	0	3
11/20/2017 19:26	Campus @ Munger	0	2
11/20/2017 19:33	PATC-University Circle	9	24
11/20/2017 19:34	Tresidder West	2	1
11/20/2017 19:40	Quarry Ext @ Med School	3	0
11/20/2017 19:40	Galvez @ Alumni Center	0	7
11/20/2017 19:41	Medical Center @ Quarry	4	0
11/20/2017 19:41	Medical Center @ Quarry	1	0
11/20/2017 19:42	Quarry near Falk Bld	1	0
11/20/2017 19:43	Quarry @ Psychiatry Lot	1	0
11/20/2017 19:44	Quarry @ Crate/Barrel	0	1
11/20/2017 19:45	Campus @ Escondido	1	5
11/20/2017 19:49	Tresidder West	0	1
11/20/2017 19:53	Tresidder West	1	0
11/20/2017 19:54	PATC-University Circle	3	11
11/20/2017 19:56	Via Ortega S at Roble Garage	2	0
11/20/2017 19:58	El Camino @ PAMF SB	1	0
11/20/2017 19:59	Quarry Ext @ Med School	2	0
11/20/2017 20:00	Galvez @ El Camino Real	2	0
11/20/2017 20:00	Medical Center @ Quarry	2	1
11/20/2017 20:01	Quarry @ Psychiatry Lot	3	0
11/20/2017 20:02	Galvez @ Alumni Center	0	1
11/20/2017 20:02	Quarry @ Psychiatry Bld	1	1
11/20/2017 20:03	Serra @ Encina Hall	0	1
11/20/2017 20:06	Campus @ Escondido	0	2
11/20/2017 20:12	Tresidder West	0	0
11/20/2017 20:16	PATC-University Circle	4	12
11/20/2017 20:16	Via Ortega @ Y2E2	1	0
11/20/2017 20:19	Quarry Ext @ Med School	1	0

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DateTime	StopName	Boardings	Alightings
11/20/2017 20:20	Medical Center @ Quarry	0	0
11/20/2017 20:21	Quarry @ Psychiatry Lot	2	0
11/20/2017 20:26	Campus @ Escondido	0	1
11/20/2017 20:27	Campus @ Wilbur Field	1	0
11/20/2017 20:31	Tresidder West	0	0
11/20/2017 20:34	PATC-University Circle	3	4
11/20/2017 20:34	Santa Teresa @ Lomita	1	0
11/20/2017 20:36	Via Ortega @ Y2E2	0	2
11/20/2017 20:41	Quarry @ Psychiatry Bld	0	1
11/20/2017 20:43	Serra @ Encina Hall	0	3
11/20/2017 20:52	Tresidder West	0	0
11/20/2017 20:55	Via Ortega S at Roble Garage	0	1
11/20/2017 20:56	Via Ortega @ Y2E2	2	0
11/20/2017 20:59	Quarry Ext @ Med School	1	0
11/20/2017 20:59	Medical Center @ Quarry	0	0
11/20/2017 21:05	PATC-University Circle	0	1
11/21/2017 4:38	Unknown	1	1
11/21/2017 5:40	Unknown	3	3
11/21/2017 5:42	Unknown	0	0
11/21/2017 5:42	Unknown	0	0
11/21/2017 5:52	Unknown	1	1
11/21/2017 6:14	PATC-University Circle	8	1
11/21/2017 6:19	Unknown	5	8
11/21/2017 6:20	Galvez @ Alumni Center	1	0
11/21/2017 6:21	Galvez @ Memorial	0	0
11/21/2017 6:22	Serra @ Encina Hall	0	2
11/21/2017 6:23	Serra @ Manzanita Field	0	0
11/21/2017 6:30	PATC-University Circle	15	4
11/21/2017 6:31	Tresidder West	1	1
11/21/2017 6:34	Via Ortega S at Roble Garage	0	1
11/21/2017 6:35	Via Ortega @ Y2E2	0	0
11/21/2017 6:36	Galvez @ Alumni Center	0	2
11/21/2017 6:37	Serra @ Encina Hall	0	1
11/21/2017 6:38	Serra @ Manzanita Field	0	7
11/21/2017 6:39	Quarry Ext @ Medical C	0	0
11/21/2017 6:41	Campus @ Munger	0	1
11/21/2017 6:47	PATC-University Circle	1	1
11/21/2017 6:50	Tresidder West	1	4
11/21/2017 6:52	Galvez @ El Camino Real	1	0
11/21/2017 6:55	Galvez @ Serra Mall	0	1
11/21/2017 7:06	Tresidder West	1	1
11/21/2017 7:08	PATC-University Circle	5	0
11/21/2017 7:11	Galvez @ El Camino Real	1	0
11/21/2017 7:14	Galvez @ Serra Mall	0	3
11/21/2017 7:17	Campus @ Munger	0	2
11/21/2017 7:18	Campus @ Mayfield N	1	0
11/21/2017 7:25	PATC-University Circle	20	0
11/21/2017 7:25	Tresidder West	0	1
11/21/2017 7:27	Santa Teresa @ Lomita	1	0
11/21/2017 7:31	Galvez @ Alumni Center	1	5
11/21/2017 7:32	Roth @ Quarry Ext	2	0
11/21/2017 7:32	Galvez @ Memorial	0	1
11/21/2017 7:32	Galvez @ Serra Mall	0	11
11/21/2017 7:33	Quarry Ext @ Medical C	1	1
11/21/2017 7:33	Serra @ Encina Hall	0	2
11/21/2017 7:34	Quarry @ Psychiatry Lot	0	1
11/21/2017 7:34	Serra @ Manzanita Field	0	1
11/21/2017 7:38	Campus @ Mayfield N	0	1
11/21/2017 7:42	PATC-University Circle	30	3
11/21/2017 7:43	PATC-University Circle	1	0
11/21/2017 7:44	Tresidder West	1	2

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DateTime	StopName	Boardings	Alightings
11/21/2017 7:49	Galvez @ Alumni Center	0	12
11/21/2017 7:49	Galvez @ Memorial	0	3
11/21/2017 7:50	Galvez @ Serra Mall	0	7
11/21/2017 7:51	Serra @ Encina Hall	0	5
11/21/2017 7:52	Serra @ Manzanita Field	1	1
11/21/2017 7:53	Quarry Ext @ Medical C	1	0
11/21/2017 7:54	Campus @ Wilbur Lot	1	0
11/21/2017 7:55	Campus @ Munger	0	2
11/21/2017 7:56	Campus @ Mayfield N	0	1
11/21/2017 8:02	Tresidder West	2	3
11/21/2017 8:03	Tresidder West	1	0
11/21/2017 8:06	Via Ortega @ Y2E2	1	0
11/21/2017 8:09	PATC-University Circle	7	3
11/21/2017 8:11	PATC-University Circle	1	0
11/21/2017 8:15	Caltrain Platform South	0	3
11/21/2017 8:18	Galvez @ Alumni Center	0	3
11/21/2017 8:19	Galvez @ Serra Mall	0	2
11/21/2017 8:20	Serra @ Encina Hall	0	1
11/21/2017 8:23	Campus @ Escondido	2	0
11/21/2017 8:24	Campus @ Wilbur Field	0	1
11/21/2017 8:26	Campus @ Mayfield N	1	0
11/21/2017 8:28	Tresidder West	1	2
11/21/2017 8:31	Via Ortega S at Roble Garage	0	2
11/21/2017 8:33	Via Ortega @ Y2E2	1	2
11/21/2017 8:33	PATC-University Circle	31	1
11/21/2017 8:34	PATC-University Circle	1	0
11/21/2017 8:37	Quarry Ext @ Medical C	1	1
11/21/2017 8:39	Galvez @ El Camino Real	1	0
11/21/2017 8:40	Quarry @ Psychiatry Bld	0	1
11/21/2017 8:41	Galvez @ Alumni Center	2	8
11/21/2017 8:41	Quarry @ Psychiatry Bld	1	1
11/21/2017 8:41	Galvez @ Memorial	0	4
11/21/2017 8:42	Galvez @ Serra Mall	0	10
11/21/2017 8:43	Serra @ Encina Hall	0	9
11/21/2017 8:45	Campus @ Escondido	2	0
11/21/2017 8:46	PATC-University Circle	7	1
11/21/2017 8:46	Campus @ Wilbur Field	0	0
11/21/2017 8:48	Campus @ Mayfield N	0	1
11/21/2017 8:49	PATC-University Circle	3	1
11/21/2017 8:50	PATC-University Circle	1	0
11/21/2017 8:50	Tresidder West	0	2
11/21/2017 8:54	Via Ortega @ Y2E2	0	1
11/21/2017 8:54	Galvez @ El Camino Real	1	0
11/21/2017 8:56	Roth @ Quarry Ext	0	2
11/21/2017 8:57	Medical Center @ Quarry	3	0
11/21/2017 8:57	Galvez @ Memorial	0	2
11/21/2017 8:58	Galvez @ Serra Mall	0	1
11/21/2017 8:58	Serra @ Encina Hall	0	5
11/21/2017 8:58	Quarry @ Psychiatry Lot	0	1
11/21/2017 9:00	Quarry @ Psychiatry Bld	0	1
11/21/2017 9:02	Campus @ Munger	0	3
11/21/2017 9:07	Tresidder West	2	3
11/21/2017 9:10	PATC-University Circle	4	2
11/21/2017 9:12	Via Ortega @ Y2E2	0	2
11/21/2017 9:14	Galvez @ El Camino Real	2	0
11/21/2017 9:16	Galvez @ Serra Mall	0	2
11/21/2017 9:17	Serra @ Manzanita Field	0	1
11/21/2017 9:22	PATC-University Circle	5	1
11/21/2017 9:29	PATC-University Circle	5	4
11/21/2017 9:30	Tresidder West	1	2
11/21/2017 9:30	Tresidder West	2	0

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DateTime	StopName	Boardings	Alightings
11/21/2017 9:31	Tresidder West	3	0
11/21/2017 9:33	Galvez @ El Camino Real	1	0
11/21/2017 9:35	Via Ortega @ Y2E2	0	2
11/21/2017 9:36	Galvez @ Alumni Center	0	3
11/21/2017 9:36	Roth @ Quarry Ext	1	0
11/21/2017 9:37	Galvez @ Serra Mall	0	1
11/21/2017 9:37	Quarry Ext @ Med School	2	0
11/21/2017 9:37	Serra @ Encina Hall	0	1
11/21/2017 9:38	Serra @ Manzanita Field	0	1
11/21/2017 9:40	Campus @ Escondido	2	0
11/21/2017 9:42	Campus @ Mayfield N	0	1
11/21/2017 9:47	Tresidder West	2	1
11/21/2017 9:51	Via Ortega @ Y2E2	1	3
11/21/2017 9:52	PATC-University Circle	8	8
11/21/2017 9:55	Medical Center @ Quarry	2	1
11/21/2017 9:57	Quarry @ Crate/Barrel	0	1
11/21/2017 9:57	Galvez @ Alumni Center	0	4
11/21/2017 9:59	Serra @ Encina Hall	0	2
11/21/2017 10:10	Tresidder West	0	1
11/21/2017 10:13	Via Ortega S at Roble Garage	4	0
11/21/2017 10:14	PATC-University Circle	14	4
11/21/2017 10:15	Roth Wy @ Campus Dr	0	0
11/21/2017 10:18	Quarry @ Psychiatry Lot	0	0
11/21/2017 10:20	Galvez @ Serra Mall	0	9
11/21/2017 10:21	Serra @ Encina Hall	0	1
11/21/2017 10:22	Serra @ Manzanita Field	1	0
11/21/2017 10:24	Campus @ Escondido	1	0
11/21/2017 10:25	Campus @ Wilbur Field	1	0
11/21/2017 10:26	Campus @ Munger	1	0
11/21/2017 10:32	Tresidder West	1	2
11/21/2017 10:36	Via Ortega @ Y2E2	0	3
11/21/2017 10:37	PATC-University Circle	20	6
11/21/2017 10:39	Roth @ Quarry Ext	1	3
11/21/2017 10:39	Quarry Ext @ Med School	1	0
11/21/2017 10:40	Medical Center @ Quarry	1	0
11/21/2017 10:42	Quarry @ Psychiatry Bld	0	2
11/21/2017 10:44	Galvez @ Memorial	0	15
11/21/2017 10:45	Galvez @ Serra Mall	0	3
11/21/2017 10:45	Serra @ Encina Hall	0	2
11/21/2017 10:52	Tresidder West	0	0
11/21/2017 10:53	PATC-University Circle	13	4
11/21/2017 10:56	Via Ortega @ Y2E2	1	0
11/21/2017 10:59	Roth @ Quarry Ext	1	0
11/21/2017 10:59	Galvez @ Alumni Center	0	4
11/21/2017 10:59	Quarry Ext @ Med School	2	0
11/21/2017 11:00	Quarry Ext @ Medical C	2	0
11/21/2017 11:00	Galvez @ Serra Mall	0	3
11/21/2017 11:01	Serra @ Encina Hall	0	2
11/21/2017 11:02	Serra @ Manzanita Field	0	2
11/21/2017 11:03	Quarry @ Psychiatry Bld	0	2
11/21/2017 11:11	Tresidder West	2	1
11/21/2017 11:14	PATC-University Circle	8	8
11/21/2017 11:14	Via Ortega S at Roble Garage	1	0
11/21/2017 11:15	Via Ortega @ Y2E2	1	0
11/21/2017 11:17	Roth @ Quarry Ext	0	1
11/21/2017 11:19	Medical Center @ Quarry	3	1
11/21/2017 11:20	Galvez @ Alumni Center	0	1
11/21/2017 11:22	Galvez @ Serra Mall	0	1
11/21/2017 11:22	Serra @ Encina Hall	0	1
11/21/2017 11:25	Campus @ Escondido	4	0
11/21/2017 11:26	Campus @ Wilbur Lot	1	0

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DateTime	StopName	Boardings	Alightings
11/21/2017 11:28	Campus @ Mayfield N	0	1
11/21/2017 11:31	Tresidder West	0	3
11/21/2017 11:34	PATC-University Circle	3	6
11/21/2017 11:36	Via Ortega @ Y2E2	2	2
11/21/2017 11:39	Medical Center @ Quarry	1	0
11/21/2017 11:43	Serra @ Encina Hall	4	7
11/21/2017 11:52	Tresidder West	0	0
11/21/2017 11:53	PATC-University Circle	6	4
11/21/2017 11:55	Via Ortega @ Y2E2	0	0
11/21/2017 11:58	Quarry Ext @ Med School	3	1
11/21/2017 12:00	Quarry @ Psychiatry Lot	1	0
11/21/2017 12:01	Galvez @ Serra Mall	0	1
11/21/2017 12:04	Campus @ Escondido	0	0
11/21/2017 12:05	Campus @ Wilbur Field	0	1
11/21/2017 12:12	Tresidder West	1	3
11/21/2017 12:13	PATC-University Circle	6	10
11/21/2017 12:15	Via Ortega @ Y2E2	1	0
11/21/2017 12:17	Galvez @ El Camino Real	9	0
11/21/2017 12:19	Medical Center @ Quarry	4	1
11/21/2017 12:20	Quarry @ Psychiatry Lot	2	0
11/21/2017 12:21	Serra @ Encina Hall	0	3
11/21/2017 12:21	Quarry @ Psychiatry Bld	0	3
11/21/2017 12:23	Campus @ Escondido	2	3
11/21/2017 12:24	Campus @ Wilbur Lot	1	0
11/21/2017 12:26	Campus @ Mayfield N	0	2
11/21/2017 12:31	Tresidder West	0	3
11/21/2017 12:34	PATC-University Circle	5	8
11/21/2017 12:36	Via Ortega @ Y2E2	0	0
11/21/2017 12:38	Roth @ Quarry Ext	0	1
11/21/2017 12:39	Galvez @ El Camino Real	5	0
11/21/2017 12:40	Quarry Ext @ Medical C	1	0
11/21/2017 12:42	Galvez @ Memorial	0	2
11/21/2017 12:42	Unknown	0	1
11/21/2017 12:42	Galvez @ Serra Mall	0	1
11/21/2017 12:43	Serra @ Encina Hall	1	4
11/21/2017 12:51	Tresidder West	8	2
11/21/2017 12:54	PATC-University Circle	3	2
11/21/2017 12:55	Via Ortega S at Roble Garage	1	0
11/21/2017 12:56	Via Ortega @ Y2E2	0	1
11/21/2017 12:59	Galvez @ El Camino Real	1	0
11/21/2017 12:59	Quarry Ext @ Medical C	4	3
11/21/2017 13:01	Galvez @ Memorial	0	1
11/21/2017 13:01	Quarry @ Psychiatry Bld	0	1
11/21/2017 13:05	Campus @ Escondido	0	1
11/21/2017 13:12	Tresidder West	7	0
11/21/2017 13:14	PATC-University Circle	9	14
11/21/2017 13:16	Via Ortega @ Y2E2	0	3
11/21/2017 13:18	Galvez @ El Camino Real	1	0
11/21/2017 13:19	Quarry Ext @ Med School	4	0
11/21/2017 13:20	Quarry Ext @ Medical C	1	0
11/21/2017 13:20	Galvez @ Memorial	0	2
11/21/2017 13:21	Serra @ Encina Hall	0	3
11/21/2017 13:22	Quarry @ Psychiatry Lot	2	0
11/21/2017 13:22	Serra @ Manzanita Field	1	0
11/21/2017 13:24	Campus @ Escondido	0	1
11/21/2017 13:26	Campus @ Mayfield N	1	0
11/21/2017 13:31	Tresidder West	0	0
11/21/2017 13:33	PATC-University Circle	4	13
11/21/2017 13:35	Via Ortega @ Y2E2	0	2
11/21/2017 13:37	Roth @ Quarry Ext	1	0
11/21/2017 13:38	Quarry Ext @ Med School	1	1

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DateTime	StopName	Boardings	Alightings
11/21/2017 13:39	Quarry Ext @ Medical C	0	0
11/21/2017 13:39	Galvez @ El Camino Real	1	0
11/21/2017 13:40	Quarry @ Psychiatry Lot	0	0
11/21/2017 13:41	Galvez @ Alumni Center	0	1
11/21/2017 13:46	Campus @ Escondido	0	1
11/21/2017 13:48	Campus @ Munger	0	1
11/21/2017 13:51	Tresidder West	0	0
11/21/2017 13:54	PATC-University Circle	10	13
11/21/2017 13:59	Roth @ Quarry Ext	2	0
11/21/2017 14:00	Quarry Ext @ Med School	1	0
11/21/2017 14:01	Quarry Ext @ Medical C	3	0
11/21/2017 14:03	Galvez @ Serra Mall	0	1
11/21/2017 14:06	Campus @ Escondido	1	1
11/21/2017 14:11	Tresidder West	4	0
11/21/2017 14:14	PATC-University Circle	10	8
11/21/2017 14:15	Via Ortega @ Y2E2	2	0
11/21/2017 14:18	Quarry Ext @ Med School	3	2
11/21/2017 14:19	Quarry Ext @ Medical C	8	0
11/21/2017 14:20	Quarry @ Psychiatry Lot	3	0
11/21/2017 14:21	Galvez @ Serra Mall	0	1
11/21/2017 14:22	Serra @ Manzanita Field	0	1
11/21/2017 14:22	Quarry @ Psychiatry Bld	0	1
11/21/2017 14:24	Campus @ Escondido	1	1
11/21/2017 14:25	Campus @ Wilbur Lot	0	1
11/21/2017 14:26	Campus @ Wilbur Field	1	0
11/21/2017 14:27	Campus @ Munger	0	0
11/21/2017 14:28	Campus @ Mayfield N	2	0
11/21/2017 14:32	Tresidder West	2	1
11/21/2017 14:34	PATC-University Circle	6	22
11/21/2017 14:35	Via Ortega S at Roble Garage	1	2
11/21/2017 14:37	Via Ortega @ Y2E2	4	0
11/21/2017 14:39	El Camino @ PAMF SB	0	1
11/21/2017 14:40	Roth @ Quarry Ext	2	1
11/21/2017 14:40	Galvez @ El Camino Real	2	0
11/21/2017 14:41	Quarry Ext @ Medical C	5	0
11/21/2017 14:42	Galvez @ Alumni Center	0	2
11/21/2017 14:43	Galvez @ Memorial	0	1
11/21/2017 14:43	Quarry @ Psychiatry Lot	1	0
11/21/2017 14:44	Serra @ Encina Hall	1	1
11/21/2017 14:44	Quarry @ Psychiatry Bld	0	3
11/21/2017 14:45	Serra @ Manzanita Field	0	1
11/21/2017 14:46	Campus @ Serra St	0	1
11/21/2017 14:52	Tresidder West	2	1
11/21/2017 14:54	PATC-University Circle	5	17
11/21/2017 14:55	Via Ortega S at Roble Garage	1	0
11/21/2017 14:57	Via Ortega @ Y2E2	1	0
11/21/2017 15:00	Roth @ Quarry Ext	1	2
11/21/2017 15:01	Quarry Ext @ Med School	3	0
11/21/2017 15:01	Quarry Ext @ Medical C	2	0
11/21/2017 15:03	Quarry @ Psychiatry Lot	3	0
11/21/2017 15:04	Campus @ Escondido	1	0
11/21/2017 15:12	Tresidder West	1	0
11/21/2017 15:14	PATC-University Circle	10	16
11/21/2017 15:15	Santa Teresa @ Lomita	1	1
11/21/2017 15:18	Via Ortega @ Y2E2	5	0
11/21/2017 15:19	Galvez @ El Camino Real	1	0
11/21/2017 15:21	Roth @ Quarry Ext	2	0
11/21/2017 15:22	Quarry Ext @ Med School	3	0
11/21/2017 15:22	Serra @ Encina Hall	0	2
11/21/2017 15:23	Quarry Ext @ Medical C	8	0
11/21/2017 15:24	Campus @ Escondido	1	3

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DateTime	StopName	Boardings	Alightings
11/21/2017 15:25	Quarry @ Psychiatry Lot	7	0
11/21/2017 15:26	Campus @ Munger	0	1
11/21/2017 15:26	Quarry @ Psychiatry Bld	0	1
11/21/2017 15:27	Campus @ Mayfield N	0	3
11/21/2017 15:32	Tresidder West	2	0
11/21/2017 15:32	PATC-University Circle	1	29
11/21/2017 15:34	PATC-University Circle	2	1
11/21/2017 15:36	Via Ortega @ Y2E2	5	1
11/21/2017 15:38	Roth @ Quarry Ext	1	1
11/21/2017 15:39	Quarry Ext @ Med School	4	0
11/21/2017 15:40	Medical Center @ Quarry	3	0
11/21/2017 15:41	Galvez @ Serra Mall	0	1
11/21/2017 15:41	Quarry @ Psychiatry Lot	0	0
11/21/2017 15:44	Campus @ Escondido	1	0
11/21/2017 15:52	Tresidder West	5	2
11/21/2017 15:54	PATC-University Circle	3	18
11/21/2017 15:56	Via Ortega @ Y2E2	2	1
11/21/2017 15:59	Roth @ Quarry Ext	1	0
11/21/2017 15:59	Quarry Ext @ Med School	1	0
11/21/2017 16:00	Medical Center @ Quarry	2	0
11/21/2017 16:02	Serra @ Encina Hall	0	1
11/21/2017 16:02	Quarry @ Psychiatry Bld	1	0
11/21/2017 16:06	Campus @ Munger	1	0
11/21/2017 16:12	Tresidder West	1	1
11/21/2017 16:14	Santa Teresa @ Lomita	2	1
11/21/2017 16:14	PATC-University Circle	4	12
11/21/2017 16:16	Via Ortega @ Y2E2	4	0
11/21/2017 16:19	Quarry Ext @ Med School	2	0
11/21/2017 16:20	Medical Center @ Quarry	1	0
11/21/2017 16:20	Medical Center @ Quarry	2	0
11/21/2017 16:22	Serra @ Manzanita Field	0	1
11/21/2017 16:23	Quarry @ Psychiatry Bld	2	3
11/21/2017 16:24	Campus @ Escondido	0	3
11/21/2017 16:32	Tresidder West	2	1
11/21/2017 16:34	Santa Teresa @ Lomita	3	0
11/21/2017 16:35	PATC-University Circle	8	13
11/21/2017 16:35	Via Ortega S at Roble Garage	0	1
11/21/2017 16:37	Via Ortega @ Y2E2	5	0
11/21/2017 16:40	Galvez @ El Camino Real	2	0
11/21/2017 16:41	Quarry @ Psychiatry Lot	6	0
11/21/2017 16:43	Galvez @ Serra Mall	0	2
11/21/2017 16:43	Serra @ Encina Hall	1	1
11/21/2017 16:45	Serra @ Manzanita Field	0	2
11/21/2017 16:50	Tresidder West	0	4
11/21/2017 16:52	Santa Teresa @ New Guinea	1	0
11/21/2017 16:53	Via Ortega S at Roble Garage	3	0
11/21/2017 16:53	PATC-University Circle	1	18
11/21/2017 16:55	Via Ortega @ Y2E2	9	1
11/21/2017 16:58	Quarry Ext @ Med School	6	0
11/21/2017 16:59	Medical Center @ Quarry	3	0
11/21/2017 17:00	Quarry @ Psychiatry Lot	2	0
11/21/2017 17:01	Quarry @ Crate/Barrel	0	1
11/21/2017 17:01	Galvez @ Serra Mall	1	0
11/21/2017 17:04	Campus @ Escondido	0	1
11/21/2017 17:12	Tresidder West	3	0
11/21/2017 17:14	PATC-University Circle	3	28
11/21/2017 17:16	Via Ortega @ Y2E2	3	0
11/21/2017 17:19	Galvez @ El Camino Real	2	0
11/21/2017 17:19	Quarry Ext @ Med School	2	0
11/21/2017 17:20	Medical Center @ Quarry	1	0
11/21/2017 17:21	Galvez @ Alumni Center	2	1

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DateTime	StopName	Boardings	Alightings
11/21/2017 17:21	Quarry @ Psychiatry Lot	2	0
11/21/2017 17:21	Galvez @ Memorial	0	2
11/21/2017 17:22	Quarry @ Psychiatry Bld	1	1
11/21/2017 17:22	Serra @ Encina Hall	2	0
11/21/2017 17:25	Campus @ Wilbur Field	1	0
11/21/2017 17:34	PATC-University Circle	2	11
11/21/2017 17:35	Tresidder West	3	3
11/21/2017 17:37	Santa Teresa @ Lomita	1	0
11/21/2017 17:38	Via Ortega S at Roble Garage	1	2
11/21/2017 17:40	Via Ortega @ Y2E2	3	2
11/21/2017 17:40	Via Ortega @ Y2E2	1	0
11/21/2017 17:42	Roth @ Quarry Ext	0	1
11/21/2017 17:43	Quarry Ext @ Med School	2	0
11/21/2017 17:43	Quarry Ext @ Med School	1	0
11/21/2017 17:45	Serra @ Manzanita Field	0	1
11/21/2017 17:45	Quarry Ext @ Medical C	2	0
11/21/2017 17:46	Quarry @ Psychiatry Lot	4	0
11/21/2017 17:47	Campus @ Wilbur Lot	0	1
11/21/2017 17:47	Quarry @ Psychiatry Bld	0	5
11/21/2017 17:52	Tresidder West	2	0
11/21/2017 17:54	PATC-University Circle	9	18
11/21/2017 17:56	Santa Teresa @ Lomita	3	1
11/21/2017 17:58	Via Ortega S at Roble Garage	1	0
11/21/2017 18:01	Galvez @ El Camino Real	1	1
11/21/2017 18:02	Medical Center @ Quarry	1	0
11/21/2017 18:02	Medical Center @ Quarry	1	0
11/21/2017 18:04	Quarry @ Psychiatry Lot	0	0
11/21/2017 18:05	Serra @ Manzanita Field	0	2
11/21/2017 18:05	Quarry @ Psychiatry Bld	0	1
11/21/2017 18:07	Campus @ Escondido	0	2
11/21/2017 18:08	Campus @ Munger	0	1
11/21/2017 18:12	Tresidder West	0	0
11/21/2017 18:14	PATC-University Circle	5	11
11/21/2017 18:14	Santa Teresa @ Lomita	1	0
11/21/2017 18:17	Via Ortega @ Y2E2	1	0
11/21/2017 18:20	Galvez @ El Camino Real	1	0
11/21/2017 18:20	Quarry Ext @ Med School	5	0
11/21/2017 18:21	Medical Center @ Quarry	2	0
11/21/2017 18:22	Quarry @ Psychiatry Lot	0	0
11/21/2017 18:25	Campus @ Escondido	0	2
11/21/2017 18:26	Campus @ Wilbur Lot	0	3
11/21/2017 18:28	PATC-University Circle	0	10
11/21/2017 18:32	Tresidder West	1	0
11/21/2017 18:34	PATC-University Circle	3	1
11/21/2017 18:35	Via Ortega S at Roble Garage	1	0
11/21/2017 18:36	Via Ortega @ Y2E2	4	1
11/21/2017 18:38	Roth @ Quarry Ext	1	0
11/21/2017 18:40	Quarry Ext @ Med School	4	0
11/21/2017 18:40	Medical Center @ Quarry	4	0
11/21/2017 18:45	Campus @ Escondido	0	1
11/21/2017 18:52	Tresidder West	0	0
11/21/2017 18:53	PATC-University Circle	4	17
11/21/2017 18:57	Via Ortega @ Y2E2	1	0
11/21/2017 18:59	Roth @ Quarry Ext	1	0
11/21/2017 19:00	Quarry Ext @ Med School	2	0
11/21/2017 19:01	Medical Center @ Quarry	6	0
11/21/2017 19:03	Campus @ Escondido	1	1
11/21/2017 19:04	Quarry @ Psychiatry Bld	1	2
11/21/2017 19:08	PATC-University Circle	0	11
11/21/2017 19:11	Tresidder West	5	1
11/21/2017 19:14	PATC-University Circle	3	0

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DateTime	StopName	Boardings	Alightings
11/21/2017 19:14	Via Ortega S at Roble Garage	1	3
11/21/2017 19:16	Via Ortega @ Y2E2	0	0
11/21/2017 19:19	Galvez @ El Camino Real	2	1
11/21/2017 19:19	Roth @ Quarry Ext	4	2
11/21/2017 19:20	Quarry Ext @ Med School	7	0
11/21/2017 19:21	Quarry Ext @ Medical C	8	0
11/21/2017 19:21	Galvez @ Memorial	0	1
11/21/2017 19:22	Quarry @ Psychiatry Lot	4	0
11/21/2017 19:23	Quarry @ Psychiatry Bld	3	0
11/21/2017 19:25	Campus @ Escondido	0	2
11/21/2017 19:26	Campus @ Munger	0	2
11/21/2017 19:27	PATC-University Circle	0	27
11/21/2017 19:32	Tresidder West	4	0
11/21/2017 19:33	PATC-University Circle	3	3
11/21/2017 19:37	Via Ortega @ Y2E2	0	0
11/21/2017 19:41	Roth @ Quarry Ext	0	4
11/21/2017 19:41	Campus @ Escondido	0	1
11/21/2017 19:42	Quarry Ext @ Med School	2	0
11/21/2017 19:43	Medical Center @ Quarry	0	0
11/21/2017 19:43	Medical Center @ Quarry	0	0
11/21/2017 19:44	Quarry @ Psychiatry Lot	2	0
11/21/2017 19:45	Quarry @ Psychiatry Bld	1	0
11/21/2017 19:45	Tresidder West	0	1
11/21/2017 19:50	Tresidder West	1	0
11/21/2017 19:54	PATC-University Circle	1	6
11/21/2017 19:55	Via Ortega @ Y2E2	1	0
11/21/2017 19:58	Quarry Ext @ Med School	1	0
11/21/2017 19:59	Galvez @ El Camino Real	3	0
11/21/2017 19:59	Medical Center @ Quarry	6	0
11/21/2017 20:01	Quarry @ Psychiatry Lot	7	0
11/21/2017 20:02	Quarry @ Psychiatry Bld	0	3
11/21/2017 20:05	Campus @ Escondido	1	3
11/21/2017 20:07	Campus @ Munger	2	0
11/21/2017 20:12	Tresidder West	0	0
11/21/2017 20:12	PATC-University Circle	3	12
11/21/2017 20:15	Via Ortega S at Roble Garage	0	3
11/21/2017 20:18	Quarry Ext @ Med School	2	0
11/21/2017 20:19	Medical Center @ Quarry	1	0
11/21/2017 20:21	Quarry @ Psychiatry Lot	6	0
11/21/2017 20:22	Quarry @ Psychiatry Bld	0	3
11/21/2017 20:24	Campus @ Wilbur Lot	0	1
11/21/2017 20:29	Tresidder West	0	1
11/21/2017 20:31	Tresidder West	1	0
11/21/2017 20:34	PATC-University Circle	9	6
11/21/2017 20:39	Galvez @ El Camino Real	3	0
11/21/2017 20:39	Medical Center @ Quarry	1	0
11/21/2017 20:42	Galvez @ Serra Mall	0	1
11/21/2017 20:42	Serra @ Encina Hall	0	2
11/21/2017 20:44	PATC-University Circle	0	1
11/21/2017 20:45	Campus @ Escondido	0	6
11/21/2017 20:47	Campus @ Munger	0	1
11/21/2017 20:48	Campus @ Mayfield N	0	1
11/21/2017 20:57	Via Ortega @ Y2E2	4	0
11/21/2017 20:59	Quarry Ext @ Med School	3	0
11/21/2017 21:00	Medical Center @ Quarry	2	0
11/21/2017 21:06	PATC-University Circle	7	18
11/22/2017 6:16	Unknown	2	3
11/22/2017 6:17	Unknown	0	0
11/22/2017 6:44	Tresidder West	0	2
11/22/2017 6:48	PATC-University Circle	1	0
11/22/2017 7:04	PATC-University Circle	0	0

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DateTime	StopName	Boardings	Alightings
11/22/2017 7:06	Tresidder West	2	2
11/22/2017 7:18	Campus @ Munger	0	1
11/22/2017 7:19	Campus @ Mayfield N	0	1
11/22/2017 7:31	Galvez @ Alumni Center	0	3
11/22/2017 7:32	Galvez @ Serra Mall	0	5
11/22/2017 7:33	Serra @ Encina Hall	0	2
11/22/2017 7:34	Medical Center @ Quarry	1	2
11/22/2017 7:42	Tresidder West	2	2
11/22/2017 7:43	PATC-University Circle	11	1
11/22/2017 7:44	Tresidder West	0	0
11/22/2017 7:46	Galvez @ El Camino Real	2	0
11/22/2017 7:48	Galvez @ Alumni Center	0	4
11/22/2017 7:49	Galvez @ Memorial	0	1
11/22/2017 7:50	Galvez @ Serra Mall	0	7
11/22/2017 7:51	Serra @ Encina Hall	0	2
11/22/2017 7:51	Medical Center @ Quarry	0	0
11/22/2017 7:53	Campus @ Escondido	0	1
11/22/2017 7:53	Quarry @ Psychiatry Lot	1	0
11/22/2017 7:55	Campus @ Munger	0	2
11/22/2017 8:02	Santa Teresa @ Lomita	1	0
11/22/2017 8:09	Quarry @ Psychiatry Bld	0	0
11/22/2017 8:09	PATC-University Circle	7	4
11/22/2017 8:14	Galvez @ El Camino Real	2	0
11/22/2017 8:16	Galvez @ Alumni Center	0	3
11/22/2017 8:17	Galvez @ Memorial	0	1
11/22/2017 8:18	Galvez @ Serra Mall	0	2
11/22/2017 8:18	Serra @ Encina Hall	0	1
11/22/2017 8:22	Campus @ Wilbur Field	0	1
11/22/2017 8:29	Tresidder West	1	1
11/22/2017 8:32	PATC-University Circle	17	1
11/22/2017 8:36	Galvez @ El Camino Real	3	0
11/22/2017 8:37	Quarry Ext @ Medical C	3	1
11/22/2017 8:38	Galvez @ Alumni Center	1	2
11/22/2017 8:39	Galvez @ Memorial	0	4
11/22/2017 8:40	Galvez @ Serra Mall	0	7
11/22/2017 8:42	Serra @ Manzanita Field	0	0
11/22/2017 8:44	PATC-University Circle	1	2
11/22/2017 8:45	Campus @ Munger	0	1
11/22/2017 8:46	Campus @ Mayfield N	0	1
11/22/2017 8:48	PATC-University Circle	3	2
11/22/2017 8:49	Tresidder West	0	1
11/22/2017 8:57	Serra @ Encina Hall	0	1
11/22/2017 8:58	Quarry Ext Middle	1	1
11/22/2017 9:00	Campus @ Escondido	0	0
11/22/2017 9:08	Tresidder West	2	2
11/22/2017 9:09	PATC-University Circle	0	0
11/22/2017 9:09	PATC-University Circle	1	0
11/22/2017 9:12	Via Ortega S at Roble Garage	1	0
11/22/2017 9:14	Via Ortega @ Y2E2	1	2
11/22/2017 9:16	Galvez @ Serra Mall	0	1
11/22/2017 9:17	Quarry Ext @ Medical C	3	0
11/22/2017 9:19	Quarry @ Psychiatry Lot	1	0
11/22/2017 9:26	Tresidder West	1	0
11/22/2017 9:29	PATC-University Circle	2	7
11/22/2017 9:30	Via Ortega @ Y2E2	0	1
11/22/2017 9:32	Roth @ Quarry Ext	1	0
11/22/2017 9:33	Medical Center @ Quarry	1	0
11/22/2017 9:35	Galvez @ El Camino Real	0	1
11/22/2017 9:35	Quarry @ Psychiatry Lot	2	0
11/22/2017 9:37	Galvez @ Memorial	0	1
11/22/2017 9:47	Tresidder West	1	1

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DateTime	StopName	Boardings	Alightings
11/22/2017 9:50	Via Ortega S at Roble Garage	2	0
11/22/2017 9:52	PATC-University Circle	6	7
11/22/2017 9:54	Medical Center @ Quarry	1	0
11/22/2017 9:58	Galvez @ Serra Mall	0	1
11/22/2017 10:01	Campus @ Escondido	1	0
11/22/2017 10:09	Tresidder West	0	1
11/22/2017 10:12	Via Ortega S at Roble Garage	0	1
11/22/2017 10:14	PATC-University Circle	8	6
11/22/2017 10:15	Roth @ Quarry Ext	0	1
11/22/2017 10:16	Medical Center @ Quarry	1	0
11/22/2017 10:18	Quarry @ Psychiatry Lot	0	1
11/22/2017 10:20	Galvez @ Serra Mall	0	2
11/22/2017 10:27	Campus @ Escondido	3	0
11/22/2017 10:28	Campus @ Wilbur Field	1	0
11/22/2017 10:32	Tresidder West	0	0
11/22/2017 10:35	Via Ortega S at Roble Garage	0	1
11/22/2017 10:36	Via Ortega @ Y2E2	0	1
11/22/2017 10:37	PATC-University Circle	7	3
11/22/2017 10:38	Roth @ Quarry Ext	0	3
11/22/2017 10:40	Quarry @ Psychiatry Lot	1	0
11/22/2017 10:42	Galvez @ El Camino Real	1	0
11/22/2017 10:44	Galvez @ Memorial	0	1
11/22/2017 10:45	Serra @ Encina Hall	0	2
11/22/2017 10:48	Campus @ Escondido	2	1
11/22/2017 10:49	Campus @ Munger	1	0
11/22/2017 10:52	Tresidder West	3	0
11/22/2017 10:55	PATC-University Circle	7	7
11/22/2017 10:59	Roth @ Quarry Ext	0	3
11/22/2017 11:00	Quarry Ext @ Medical C	2	0
11/22/2017 11:03	Quarry @ Psychiatry Bld	0	3
11/22/2017 11:03	Serra @ Manzanita Field	0	1
11/22/2017 11:11	Tresidder West	1	2
11/22/2017 11:14	PATC-University Circle	10	5
11/22/2017 11:14	PATC-University Circle	0	1
11/22/2017 11:14	Via Ortega S at Roble Garage	1	0
11/22/2017 11:15	PATC-University Circle	1	1
11/22/2017 11:16	Via Ortega @ Y2E2	1	0
11/22/2017 11:18	Roth @ Quarry Ext	0	3
11/22/2017 11:19	Medical Center @ Quarry	3	0
11/22/2017 11:20	Quarry @ Psychiatry Lot	1	0
11/22/2017 11:21	Galvez @ Alumni Center	0	1
11/22/2017 11:22	Galvez @ Serra Mall	0	3
11/22/2017 11:26	Campus @ Munger	0	1
11/22/2017 11:28	Campus @ Mayfield N	0	1
11/22/2017 11:32	Tresidder West	1	0
11/22/2017 11:33	PATC-University Circle	3	7
11/22/2017 11:36	Via Ortega @ Y2E2	3	0
11/22/2017 11:38	Roth @ Quarry Ext	1	0
11/22/2017 11:39	Quarry Ext @ Med School	4	3
11/22/2017 11:40	Quarry Ext @ Medical C	1	0
11/22/2017 11:42	Quarry @ Psychiatry Bld	0	2
11/22/2017 11:43	Serra @ Manzanita Field	0	1
11/22/2017 11:45	Campus @ Escondido	1	0
11/22/2017 11:46	PATC-University Circle	0	8
11/22/2017 11:51	Tresidder West	0	1
11/22/2017 11:54	PATC-University Circle	6	6
11/22/2017 11:59	Galvez @ El Camino Real	2	0
11/22/2017 12:00	Quarry @ Psychiatry Lot	1	0
11/22/2017 12:01	Galvez @ Memorial	0	1
11/22/2017 12:02	Galvez @ Serra Mall	0	1
11/22/2017 12:05	Campus @ Wilbur Field	2	0

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DateTime	StopName	Boardings	Alightings
11/22/2017 12:06	Campus @ Mayfield N	0	1
11/22/2017 12:12	Tresidder West	1	1
11/22/2017 12:14	PATC-University Circle	3	2
11/22/2017 12:16	Via Ortega @ Cypress Lot	1	0
11/22/2017 12:20	Quarry Ext @ Med School	9	2
11/22/2017 12:20	Medical Center @ Quarry	3	0
11/22/2017 12:22	Galvez @ Memorial	0	0
11/22/2017 12:22	Quarry @ Psychiatry Lot	3	0
11/22/2017 12:22	Galvez @ Serra Mall	0	3
11/22/2017 12:25	Campus @ Escondido	1	1
11/22/2017 12:32	Tresidder West	5	0
11/22/2017 12:34	PATC-University Circle	1	21
11/22/2017 12:34	Via Ortega S at Roble Garage	1	0
11/22/2017 12:36	Via Ortega @ Y2E2	7	0
11/22/2017 12:39	Quarry Ext @ Med School	4	0
11/22/2017 12:40	Quarry Ext @ Medical C	3	0
11/22/2017 12:41	Galvez @ El Camino Real	3	0
11/22/2017 12:41	Quarry @ Psychiatry Lot	1	0
11/22/2017 12:43	Quarry @ Psychiatry Bld	0	4
11/22/2017 12:43	Galvez @ Serra Mall	0	2
11/22/2017 12:46	Campus @ Escondido	1	0
11/22/2017 12:52	Tresidder West	0	1
11/22/2017 12:54	PATC-University Circle	5	16
11/22/2017 12:56	Via Ortega @ Cypress Lot	0	1
11/22/2017 12:58	Roth @ Quarry Ext	1	0
11/22/2017 12:58	Quarry Ext @ Med School	4	0
11/22/2017 12:59	Quarry Ext @ Medical C	2	0
11/22/2017 13:02	Serra @ Encina Hall	5	19
11/22/2017 13:13	Tresidder West	7	1
11/22/2017 13:13	Tresidder West	0	0
11/22/2017 13:13	PATC-University Circle	10	10
11/22/2017 13:16	Via Ortega S at Roble Garage	1	0
11/22/2017 13:17	Via Ortega @ Y2E2	6	0
11/22/2017 13:19	Roth @ Quarry Ext	1	0
11/22/2017 13:19	Quarry Ext @ Med School	1	0
11/22/2017 13:20	Quarry Ext @ Med School	0	2
11/22/2017 13:20	Quarry Ext @ Medical C	2	0
11/22/2017 13:20	Galvez @ El Camino Real	1	0
11/22/2017 13:22	Quarry @ Psychiatry Lot	1	0
11/22/2017 13:23	Quarry @ Psychiatry Bld	0	3
11/22/2017 13:23	Galvez @ Serra Mall	0	3
11/22/2017 13:24	Serra @ Encina Hall	0	1
11/22/2017 13:26	Campus @ Escondido	2	1
11/22/2017 13:28	Campus @ Mayfield N	0	2
11/22/2017 13:32	Tresidder West	5	0
11/22/2017 13:33	PATC-University Circle	3	14
11/22/2017 13:34	Via Ortega S at Roble Garage	3	0
11/22/2017 13:36	Via Ortega @ Y2E2	2	4
11/22/2017 13:38	Roth @ Quarry Ext	1	2
11/22/2017 13:38	Quarry Ext @ Med School	5	0
11/22/2017 13:39	Galvez @ El Camino Real	0	1
11/22/2017 13:40	Quarry Ext @ Medical C	2	0
11/22/2017 13:40	Quarry Ext @ Medical C	1	0
11/22/2017 13:41	Galvez @ Alumni Center	0	2
11/22/2017 13:42	Quarry @ Psychiatry Bld	0	2
11/22/2017 13:45	Campus @ Wilbur Lot	1	0
11/22/2017 13:51	Tresidder West	3	0
11/22/2017 13:54	PATC-University Circle	5	16
11/22/2017 13:56	Via Ortega @ Y2E2	4	0
11/22/2017 13:59	Roth @ Quarry Ext	1	3
11/22/2017 14:01	Medical Center @ Quarry	3	0

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DateTime	StopName	Boardings	Alightings
11/22/2017 14:01	Medical Center @ Quarry	1	0
11/22/2017 14:03	Quarry @ Psychiatry Bld	1	2
11/22/2017 14:04	Campus @ Munger	0	2
11/22/2017 14:12	Tresidder West	1	1
11/22/2017 14:14	PATC-University Circle	4	13
11/22/2017 14:15	Via Ortega S at Roble Garage	1	0
11/22/2017 14:16	Via Ortega @ Y2E2	8	0
11/22/2017 14:18	Roth @ Quarry Ext	1	0
11/22/2017 14:19	Quarry Ext @ Med School	5	0
11/22/2017 14:20	Quarry Ext @ Medical C	2	0
11/22/2017 14:21	Galvez @ Serra Mall	0	1
11/22/2017 14:22	Quarry @ Psychiatry Lot	3	4
11/22/2017 14:23	Quarry @ Psychiatry Bld	1	1
11/22/2017 14:25	Campus @ Wilbur Field	3	0
11/22/2017 14:32	Tresidder West	0	0
11/22/2017 14:34	PATC-University Circle	0	0
11/22/2017 14:34	Santa Teresa @ Lomita	1	0
11/22/2017 14:34	PATC-University Circle	0	0
11/22/2017 14:36	Via Ortega S at Roble Garage	0	2
11/22/2017 14:37	Via Ortega @ Y2E2	3	0
11/22/2017 14:38	Galvez @ El Camino Real	1	0
11/22/2017 14:40	Galvez @ Alumni Center	1	0
11/22/2017 14:40	Roth @ Quarry Ext	2	1
11/22/2017 14:40	Galvez @ Memorial	0	4
11/22/2017 14:41	Quarry Ext @ Med School	9	0
11/22/2017 14:41	Serra @ Encina Hall	2	0
11/22/2017 14:43	Quarry Ext @ Medical C	8	0
11/22/2017 14:44	Quarry @ Psychiatry Lot	12	0
11/22/2017 14:45	Quarry @ Psychiatry Bld	1	1
11/22/2017 14:50	PATC-University Circle	0	31
11/22/2017 14:52	Tresidder West	2	0
11/22/2017 14:54	PATC-University Circle	2	1
11/22/2017 14:55	Via Ortega S at Roble Garage	0	2
11/22/2017 14:57	El Camino @ PAMF SB	0	0
11/22/2017 14:58	Galvez @ El Camino Real	3	0
11/22/2017 14:59	Roth @ Quarry Ext	1	2
11/22/2017 14:59	Quarry Ext @ Med School	6	0
11/22/2017 15:00	Medical Center @ Quarry	6	0
11/22/2017 15:02	Quarry @ Psychiatry Lot	5	0
11/22/2017 15:04	Campus @ Escondido	0	1
11/22/2017 15:04	Quarry @ Psychiatry Bld	3	2
11/22/2017 15:05	Campus @ Wilbur Lot	0	2
11/22/2017 15:07	Campus @ Mayfield N	0	0
11/22/2017 15:12	Tresidder West	2	1
11/22/2017 15:14	PATC-University Circle	3	22
11/22/2017 15:17	Via Ortega @ Y2E2	2	0
11/22/2017 15:18	Quarry Ext @ Med School	3	0
11/22/2017 15:19	Galvez @ El Camino Real	0	1
11/22/2017 15:20	Quarry Ext @ Medical C	7	1
11/22/2017 15:21	Galvez @ Alumni Center	0	1
11/22/2017 15:22	Quarry @ Psychiatry Lot	2	0
11/22/2017 15:23	Quarry @ Psychiatry Bld	0	2
11/22/2017 15:32	Tresidder West	1	1
11/22/2017 15:34	PATC-University Circle	2	14
11/22/2017 15:34	PATC-University Circle	1	0
11/22/2017 15:34	Santa Teresa @ Lomita	1	0
11/22/2017 15:36	Via Ortega @ Y2E2	3	0
11/22/2017 15:39	PATC-University Circle	3	0
11/22/2017 15:39	Quarry Ext @ Med School	6	1
11/22/2017 15:41	Medical Center @ Quarry	7	0
11/22/2017 15:42	Quarry @ Psychiatry Lot	0	0

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DateTime	StopName	Boardings	Alightings
11/22/2017 15:44	Quarry @ Psychiatry Bld	0	5
11/22/2017 15:51	Campus @ Munger	1	1
11/22/2017 15:53	Tresidder West	2	4
11/22/2017 15:54	PATC-University Circle	3	15
11/22/2017 15:57	Via Ortega S at Roble Garage	0	1
11/22/2017 15:58	Via Ortega @ Y2E2	4	0
11/22/2017 15:59	Galvez @ El Camino Real	2	0
11/22/2017 16:02	Quarry Ext @ Med School	3	0
11/22/2017 16:03	Medical Center @ Quarry	5	0
11/22/2017 16:03	Serra @ Manzanita Field	0	2
11/22/2017 16:04	Quarry @ Psychiatry Lot	4	0
11/22/2017 16:05	Campus @ Escondido	0	1
11/22/2017 16:06	Campus @ Wilbur Lot	0	1
11/22/2017 16:06	Quarry @ Psychiatry Bld	1	0
11/22/2017 16:06	Quarry @ Psychiatry Bld	0	2
11/22/2017 16:08	Campus @ Wilbur Field	2	2
11/22/2017 16:09	Campus @ Munger	1	0
11/22/2017 16:12	Tresidder West	0	0
11/22/2017 16:14	PATC-University Circle	6	24
11/22/2017 16:15	Via Ortega S at Roble Garage	0	1
11/22/2017 16:16	Via Ortega @ Y2E2	1	0
11/22/2017 16:19	Quarry Ext @ Med School	3	0
11/22/2017 16:19	Galvez @ El Camino Real	0	0
11/22/2017 16:19	Medical Center @ Quarry	1	0
11/22/2017 16:22	Galvez @ Memorial	3	0
11/22/2017 16:25	Campus @ Escondido	0	1
11/22/2017 16:28	Campus @ Mayfield N	0	3
11/22/2017 16:32	Tresidder West	7	1
11/22/2017 16:34	Santa Teresa @ Lomita	1	1
11/22/2017 16:34	PATC-University Circle	5	9
11/22/2017 16:35	Via Ortega S at Roble Garage	1	3
11/22/2017 16:39	Galvez @ El Camino Real	1	0
11/22/2017 16:39	Quarry Ext @ Med School	2	1
11/22/2017 16:42	Quarry @ Psychiatry Lot	2	0
11/22/2017 16:42	Quarry @ Psychiatry Bld	0	2
11/22/2017 16:46	Campus @ Munger	0	1
11/22/2017 16:48	PATC-University Circle	3	5
11/22/2017 16:50	PATC-University Circle	2	2
11/22/2017 16:53	Tresidder West	1	1
11/22/2017 16:54	PATC-University Circle	1	1
11/22/2017 16:55	Santa Teresa @ New Guinea	1	0
11/22/2017 17:00	Galvez @ El Camino Real	2	0
11/22/2017 17:00	Medical Center @ Quarry	3	0
11/22/2017 17:02	Quarry @ Psychiatry Lot	3	0
11/22/2017 17:04	Serra @ Encina Hall	0	1
11/22/2017 17:05	Serra @ Manzanita Field	0	4
11/22/2017 17:06	PATC-University Circle	0	7
11/22/2017 17:12	Tresidder West	2	0
11/22/2017 17:14	PATC-University Circle	2	2
11/22/2017 17:19	Galvez @ El Camino Real	3	0
11/22/2017 17:21	Quarry @ Psychiatry Bld	0	1
11/22/2017 17:24	Campus @ Wilbur Lot	0	1
11/22/2017 17:32	Tresidder West	4	2
11/22/2017 17:34	Santa Teresa @ Lomita	1	0
11/22/2017 17:34	PATC-University Circle	6	3
11/22/2017 17:35	Via Ortega S at Roble Garage	1	2
11/22/2017 17:40	Medical Center @ Quarry	4	0
11/22/2017 17:40	Medical Center @ Quarry	0	0
11/22/2017 17:42	Quarry @ Crate/Barrel	0	2
11/22/2017 17:42	Serra @ Encina Hall	0	3
11/22/2017 17:44	Serra @ Manzanita Field	0	1

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DateTime	StopName	Boardings	Alightings
11/22/2017 17:45	Campus @ Escondido	4	1
11/22/2017 17:46	PATC-University Circle	0	7
11/22/2017 17:48	Campus @ Mayfield N	0	2
11/22/2017 17:52	Tresidder West	1	0
11/22/2017 17:54	PATC-University Circle	3	1
11/22/2017 17:56	Via Ortega @ Y2E2	0	1
11/22/2017 17:59	Galvez @ El Camino Real	2	0
11/22/2017 18:02	Serra @ Encina Hall	0	1
11/22/2017 18:02	Quarry @ Psychiatry Bld	0	1
11/22/2017 18:04	Campus @ Escondido	0	5
11/22/2017 18:06	PATC-University Circle	0	1
11/22/2017 18:11	Tresidder West	3	2
11/22/2017 18:14	PATC-University Circle	5	1
11/22/2017 18:18	Quarry Ext @ Med School	4	0
11/22/2017 18:19	Medical Center @ Quarry	3	0
11/22/2017 18:19	Galvez @ El Camino Real	5	0
11/22/2017 18:20	Quarry @ Psychiatry Lot	1	0
11/22/2017 18:22	Quarry @ Crate/Barrel	0	3
11/22/2017 18:23	Serra @ Encina Hall	0	1
11/22/2017 18:26	Campus @ Escondido	1	8
11/22/2017 18:32	Tresidder West	2	0
11/22/2017 18:35	PATC-University Circle	3	10
11/22/2017 18:36	Via Ortega @ Y2E2	2	0
11/22/2017 18:39	Quarry Ext @ Med School	1	0
11/22/2017 18:39	Medical Center @ Quarry	3	0
11/22/2017 18:41	Quarry @ Psychiatry Lot	5	0
11/22/2017 18:42	Quarry @ Psychiatry Bld	0	2
11/22/2017 18:54	PATC-University Circle	4	16
11/22/2017 18:55	Tresidder West	1	1
11/22/2017 19:01	Serra @ Encina Hall	0	0
11/22/2017 19:01	Serra @ Encina Hall	2	0
11/22/2017 19:02	Medical Center @ Quarry	2	0
11/22/2017 19:02	Serra @ Manzanita Field	0	1
11/22/2017 19:06	PATC-University Circle	0	1
11/22/2017 19:11	Tresidder West	1	2
11/22/2017 19:15	PATC-University Circle	2	0
11/22/2017 19:18	Quarry Ext @ Med School	1	0
11/22/2017 19:19	Quarry Ext @ Medical C	6	0
11/22/2017 19:20	Galvez @ El Camino Real	1	0
11/22/2017 19:21	Quarry @ Psychiatry Lot	2	0
11/22/2017 19:24	Serra @ Manzanita Field	1	4
11/22/2017 19:25	Campus @ Escondido	0	1
11/22/2017 19:26	Campus @ Wilbur Field	2	0
11/22/2017 19:27	Campus @ Munger	2	0
11/22/2017 19:31	Tresidder West	3	0
11/22/2017 19:34	PATC-University Circle	1	13
11/22/2017 19:34	Via Ortega S Across from Roble	0	2
11/22/2017 19:35	Via Ortega @ Y2E2	1	0
11/22/2017 19:39	Quarry Ext @ Med School	1	0
11/22/2017 19:41	Quarry @ Psychiatry Lot	0	1
11/22/2017 19:44	Campus @ Escondido	1	0
11/22/2017 19:51	Tresidder West	3	1
11/22/2017 19:54	PATC-University Circle	1	5
11/22/2017 19:54	Via Ortega S at Roble Garage	0	1
11/22/2017 19:56	Via Ortega @ Y2E2	1	0
11/22/2017 19:58	Quarry Ext @ Med School	3	0
11/22/2017 19:59	Galvez @ El Camino Real	1	0
11/22/2017 19:59	Medical Center @ Quarry	3	0
11/22/2017 19:59	Medical Center @ Quarry	1	0
11/22/2017 19:59	Medical Center @ Quarry	2	0
11/22/2017 20:01	Quarry @ Psychiatry Lot	2	2

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11/22/2017 20:02	Serra @ Encina Hall	0	1
11/22/2017 20:02	Quarry @ Psychiatry Bld	0	3
11/22/2017 20:06	Campus @ Wilbur Lot	1	1
11/22/2017 20:12	Tresidder West	0	0
11/22/2017 20:14	PATC-University Circle	3	12
11/22/2017 20:16	Via Ortega @ Y2E2	1	0
11/22/2017 20:20	Quarry @ Psychiatry Lot	4	0
11/22/2017 20:23	Campus @ Escondido	0	1
11/22/2017 20:27	Tresidder West	0	1
11/22/2017 20:33	Tresidder West	2	0
11/22/2017 20:34	PATC-University Circle	8	4
11/22/2017 20:35	Santa Teresa @ Lomita	1	0
11/22/2017 20:37	Via Ortega @ Y2E2	2	0
11/22/2017 20:39	Galvez @ El Camino Real	2	0
11/22/2017 20:42	Quarry @ Psychiatry Bld	0	2
11/22/2017 20:42	Serra @ Encina Hall	2	1
11/22/2017 20:45	Campus @ Escondido	0	6
11/22/2017 20:45	PATC-University Circle	0	3
11/22/2017 20:46	Campus @ Wilbur Field	0	4
11/22/2017 20:47	Campus @ Munger	1	0
11/22/2017 20:52	Tresidder West	0	0
11/22/2017 20:55	Via Ortega S at Roble Garage	0	3
11/22/2017 20:59	Quarry Ext @ Med School	1	0
11/22/2017 21:04	PATC-University Circle	0	1
11/27/2017 5:57	Unknown	1	1
11/27/2017 6:09	Unknown	1	1
11/27/2017 6:13	PATC-University Circle	11	1
11/27/2017 6:21	Serra @ Encina Hall	0	2
11/27/2017 6:22	Serra @ Manzanita Field	0	2
11/27/2017 6:24	Unknown	1	1
11/27/2017 6:25	Campus @ Munger	0	3
11/27/2017 6:30	PATC-University Circle	14	1
11/27/2017 6:30	PATC-University Circle	1	0
11/27/2017 6:31	Tresidder West	1	3
11/27/2017 6:34	Santa Teresa @ Lomita	0	1
11/27/2017 6:38	Galvez @ Serra Mall	1	1
11/27/2017 6:39	Serra @ Encina Hall	0	3
11/27/2017 6:40	Quarry Ext @ Medical C	2	2
11/27/2017 6:40	Serra @ Manzanita Field	0	8
11/27/2017 6:43	Campus @ Munger	0	1
11/27/2017 6:46	PATC-University Circle	0	1
11/27/2017 6:47	Tresidder West	0	2
11/27/2017 6:48	PATC-University Circle	1	1
11/27/2017 6:51	Galvez @ El Camino Real	1	0
11/27/2017 6:55	Galvez @ Serra Mall	0	1
11/27/2017 6:57	Quarry Ext @ Medical C	3	0
11/27/2017 7:00	Campus @ Mayfield N	1	0
11/27/2017 7:03	Caltrain Platform South	0	4
11/27/2017 7:05	PATC-University Circle	2	0
11/27/2017 7:06	Tresidder West	1	1
11/27/2017 7:14	Galvez @ Serra Mall	0	1
11/27/2017 7:14	Quarry Ext @ Medical C	0	1
11/27/2017 7:25	PATC-University Circle	28	2
11/27/2017 7:26	Tresidder West	1	2
11/27/2017 7:26	Tresidder West	0	0
11/27/2017 7:33	Galvez @ Alumni Center	1	5
11/27/2017 7:34	Galvez @ Serra Mall	1	9
11/27/2017 7:35	Serra @ Encina Hall	0	9
11/27/2017 7:36	Serra @ Manzanita Field	0	1
11/27/2017 7:40	Campus @ Munger	0	1
11/27/2017 7:42	PATC-University Circle	28	0

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DateTime	StopName	Boardings	Alightings
11/27/2017 7:44	Tresidder West	0	2
11/27/2017 7:47	Galvez @ El Camino Real	1	0
11/27/2017 7:48	Via Ortega S at Roble Garage	2	0
11/27/2017 7:49	Galvez @ Alumni Center	1	9
11/27/2017 7:49	Galvez @ Alumni Center	0	0
11/27/2017 7:50	Galvez @ Memorial	0	2
11/27/2017 7:50	Galvez @ Memorial	0	0
11/27/2017 7:51	Galvez @ Serra Mall	0	4
11/27/2017 7:51	Galvez @ Serra Mall	0	0
11/27/2017 7:52	Serra @ Encina Hall	0	11
11/27/2017 7:53	Quarry Ext @ Medical C	1	0
11/27/2017 7:53	Serra @ Manzanita Field	0	3
11/27/2017 7:53	Serra @ Manzanita Field	0	0
11/27/2017 7:57	Campus @ Mayfield N	0	1
11/27/2017 8:01	Tresidder West	0	2
11/27/2017 8:09	PATC-University Circle	8	6
11/27/2017 8:17	Galvez @ El Camino Real	3	0
11/27/2017 8:19	Galvez @ Alumni Center	0	1
11/27/2017 8:20	Galvez @ Memorial	0	1
11/27/2017 8:20	Galvez @ Serra Mall	0	0
11/27/2017 8:24	Campus @ Escondido	0	1
11/27/2017 8:25	Campus @ Wilbur Field	0	2
11/27/2017 8:29	Tresidder West	0	3
11/27/2017 8:35	PATC-University Circle	37	1
11/27/2017 8:35	PATC-University Circle	0	0
11/27/2017 8:39	Quarry Ext @ Medical C	0	0
11/27/2017 8:40	Galvez @ El Camino Real	3	1
11/27/2017 8:41	Galvez @ El Camino Real	0	0
11/27/2017 8:43	Galvez @ Alumni Center	2	8
11/27/2017 8:43	Galvez @ Alumni Center	0	0
11/27/2017 8:44	Galvez @ Memorial	0	1
11/27/2017 8:44	Galvez @ Memorial	0	0
11/27/2017 8:45	Galvez @ Serra Mall	0	8
11/27/2017 8:45	Galvez @ Serra Mall	0	0
11/27/2017 8:46	Serra @ Encina Hall	0	10
11/27/2017 8:47	Serra @ Manzanita Field	0	1
11/27/2017 8:49	Campus @ Escondido	1	3
11/27/2017 8:49	Campus @ Escondido	0	0
11/27/2017 8:50	PATC-University Circle	12	1
11/27/2017 8:50	Campus @ Munger	1	1
11/27/2017 8:51	Campus @ Munger	0	0
11/27/2017 8:51	Campus @ Mayfield N	0	1
11/27/2017 8:52	Campus @ Mayfield N	0	0
11/27/2017 8:53	Tresidder West	1	4
11/27/2017 8:54	Tresidder West	0	0
11/27/2017 8:57	Galvez @ El Camino Real	3	0
11/27/2017 8:59	Via Ortega @ Y2E2	0	4
11/27/2017 8:59	Galvez @ Alumni Center	0	3
11/27/2017 9:00	Galvez @ Memorial	0	2
11/27/2017 9:01	Galvez @ Serra Mall	0	5
11/27/2017 9:04	Campus @ Escondido	2	0
11/27/2017 9:05	Quarry @ Psychiatry Bld	0	1
11/27/2017 9:05	Quarry @ Psychiatry Bld	0	0
11/27/2017 9:06	Campus @ Wilbur Field	1	1
11/27/2017 9:06	Campus @ Munger	0	4
11/27/2017 9:09	PATC-University Circle	3	0
11/27/2017 9:09	Tresidder West	1	1
11/27/2017 9:09	PATC-University Circle	0	0
11/27/2017 9:12	Santa Teresa @ Lomita	0	1
11/27/2017 9:14	Via Ortega S at Roble Garage	1	0
11/27/2017 9:15	Via Ortega @ Y2E2	0	2

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DateTime	StopName	Boardings	Alightings
11/27/2017 9:16	Galvez @ Serra Mall	0	3
11/27/2017 9:18	Roth @ Quarry Ext	0	2
11/27/2017 9:19	Quarry Ext @ Medical C	2	0
11/27/2017 9:23	Tresidder West	0	0
11/27/2017 9:28	Tresidder West	2	2
11/27/2017 9:28	Tresidder West	0	0
11/27/2017 9:28	PATC-University Circle	13	3
11/27/2017 9:36	Medical Center @ Quarry	1	0
11/27/2017 9:36	Medical Center @ Quarry	0	0
11/27/2017 9:37	Galvez @ Alumni Center	0	4
11/27/2017 9:38	Galvez @ Memorial	0	1
11/27/2017 9:38	Galvez @ Serra Mall	0	3
11/27/2017 9:39	Serra @ Encina Hall	0	2
11/27/2017 9:41	Campus @ Escondido	1	1
11/27/2017 9:42	Campus @ Wilbur Field	2	0
11/27/2017 9:43	Campus @ Munger	1	0
11/27/2017 9:48	Tresidder West	4	2
11/27/2017 9:50	Santa Teresa @ New Guinea	0	1
11/27/2017 9:51	PATC-University Circle	7	3
11/27/2017 9:52	Via Ortega S at Roble Garage	2	1
11/27/2017 9:52	PATC-University Circle	0	0
11/27/2017 9:53	Via Ortega @ Y2E2	0	3
11/27/2017 9:56	Medical Center @ Quarry	0	3
11/27/2017 9:57	Medical Center @ Quarry	1	0
11/27/2017 9:58	Galvez @ Memorial	0	1
11/27/2017 9:58	Galvez @ Memorial	0	0
11/27/2017 9:59	Serra @ Encina Hall	0	2
11/27/2017 9:59	Serra @ Encina Hall	0	0
11/27/2017 10:08	Tresidder West	0	0
11/27/2017 10:08	Tresidder West	0	0
11/27/2017 10:14	PATC-University Circle	17	6
11/27/2017 10:17	Quarry Ext @ Med School	1	0
11/27/2017 10:17	Quarry Ext @ Med School	1	0
11/27/2017 10:17	Quarry Ext @ Med School	0	0
11/27/2017 10:21	Galvez @ Memorial	1	4
11/27/2017 10:21	Galvez @ Serra Mall	0	4
11/27/2017 10:22	Serra @ Encina Hall	0	1
11/27/2017 10:23	PATC-University Circle	0	2
11/27/2017 10:24	Campus @ Escondido	2	2
11/27/2017 10:25	Campus @ Escondido	1	0
11/27/2017 10:27	Campus @ Wilbur Field	0	2
11/27/2017 10:27	Campus @ Munger	0	1
11/27/2017 10:32	Tresidder West	5	3
11/27/2017 10:35	Via Ortega S at Roble Garage	0	2
11/27/2017 10:35	PATC-University Circle	16	6
11/27/2017 10:36	PATC-University Circle	0	0
11/27/2017 10:38	Roth @ Quarry Ext	0	1
11/27/2017 10:41	Galvez @ Memorial	0	1
11/27/2017 10:41	Quarry @ Psychiatry Bld	0	4
11/27/2017 10:41	Galvez @ Memorial	0	0
11/27/2017 10:42	Galvez @ Serra Mall	1	3
11/27/2017 10:42	Galvez @ Serra Mall	0	0
11/27/2017 10:43	Serra @ Encina Hall	0	1
11/27/2017 10:43	Serra @ Encina Hall	0	0
11/27/2017 10:44	Serra @ Manzanita Field	1	2
11/27/2017 10:44	Serra @ Manzanita Field	0	0
11/27/2017 10:46	Campus @ Escondido	1	1
11/27/2017 10:46	Campus @ Escondido	0	0
11/27/2017 10:48	Campus @ Munger	0	2
11/27/2017 10:48	Campus @ Munger	0	0
11/27/2017 10:52	Tresidder West	0	1

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DateTime	StopName	Boardings	Alightings
11/27/2017 10:52	Tresidder West	1	0
11/27/2017 10:52	Tresidder West	0	0
11/27/2017 10:54	PATC-University Circle	16	6
11/27/2017 10:56	Via Ortega S at Roble Garage	0	1
11/27/2017 10:56	Via Ortega S at Roble Garage	0	0
11/27/2017 10:58	Via Ortega @ Y2E2	1	2
11/27/2017 10:58	Via Ortega @ Y2E2	0	0
11/27/2017 10:58	Galvez @ El Camino Real	1	0
11/27/2017 11:00	Galvez @ Memorial	0	1
11/27/2017 11:01	Serra @ Encina Hall	0	3
11/27/2017 11:05	Campus @ Wilbur Lot	0	1
11/27/2017 11:06	Campus @ Wilbur Field	0	1
11/27/2017 11:06	Campus @ Munger	0	1
11/27/2017 11:07	Campus @ Mayfield N	0	1
11/27/2017 11:12	Tresidder West	0	1
11/27/2017 11:14	PATC-University Circle	3	1
11/27/2017 11:14	PATC-University Circle	0	0
11/27/2017 11:16	Via Ortega S at Roble Garage	2	0
11/27/2017 11:16	Via Ortega S at Roble Garage	1	0
11/27/2017 11:17	Via Ortega @ Y2E2	4	0
11/27/2017 11:19	Galvez @ El Camino Real	3	0
11/27/2017 11:20	Roth @ Quarry Ext	0	1
11/27/2017 11:20	Quarry Ext @ Med School	1	0
11/27/2017 11:21	Quarry Ext @ Medical C	1	0
11/27/2017 11:22	Galvez @ Serra Mall	0	1
11/27/2017 11:22	Quarry @ Psychiatry Lot	1	0
11/27/2017 11:23	Serra @ Encina Hall	0	2
11/27/2017 11:24	Quarry @ Psychiatry Bld	0	1
11/27/2017 11:25	Quarry @ Psychiatry Bld	0	1
11/27/2017 11:32	Tresidder West	2	3
11/27/2017 11:33	PATC-University Circle	4	8
11/27/2017 11:35	Via Ortega S at Roble Garage	0	1
11/27/2017 11:40	Galvez @ Serra Mall	0	1
11/27/2017 11:43	Campus @ Escondido	2	1
11/27/2017 11:52	Tresidder West	0	1
11/27/2017 11:54	PATC-University Circle	11	3
11/27/2017 11:55	Via Ortega S at Roble Garage	1	1
11/27/2017 11:56	Via Ortega @ Y2E2	0	1
11/27/2017 11:58	Galvez @ El Camino Real	1	0
11/27/2017 11:59	Roth @ Quarry Ext	0	1
11/27/2017 12:00	Galvez @ Memorial	0	2
11/27/2017 12:01	Galvez @ Serra Mall	0	3
11/27/2017 12:12	Tresidder West	2	1
11/27/2017 12:12	Tresidder West	1	0
11/27/2017 12:13	PATC-University Circle	10	4
11/27/2017 12:15	Via Ortega S at Roble Garage	0	1
11/27/2017 12:17	Via Ortega @ Y2E2	0	1
11/27/2017 12:17	Galvez @ El Camino Real	2	0
11/27/2017 12:19	Quarry Ext @ Med School	0	2
11/27/2017 12:20	Galvez @ Serra Mall	0	5
11/27/2017 12:20	Quarry Ext @ Medical C	6	0
11/27/2017 12:21	Quarry Ext @ Medical C	1	0
11/27/2017 12:25	Quarry @ Psychiatry Bld	0	1
11/27/2017 12:27	Campus @ Mayfield N	0	2
11/27/2017 12:32	Tresidder West	4	2
11/27/2017 12:34	PATC-University Circle	6	7
11/27/2017 12:38	Galvez @ El Camino Real	1	0
11/27/2017 12:38	Roth @ Quarry Ext	0	5
11/27/2017 12:39	Quarry Ext @ Med School	1	1
11/27/2017 12:40	Galvez @ Alumni Center	0	1
11/27/2017 12:40	Quarry Ext @ Medical C	1	0

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DateTime	StopName	Boardings	Alightings
11/27/2017 12:41	Galvez @ Serra Mall	0	3
11/27/2017 12:42	Quarry @ Psychiatry Bld	0	0
11/27/2017 12:43	Serra @ Manzanita Field	0	1
11/27/2017 12:46	Campus @ Munger	1	0
11/27/2017 12:52	Tresidder West	9	2
11/27/2017 12:54	PATC-University Circle	8	8
11/27/2017 12:55	Via Ortega S at Roble Garage	1	0
11/27/2017 12:56	Via Ortega @ Y2E2	0	2
11/27/2017 12:58	Roth @ Quarry Ext	0	1
11/27/2017 12:59	Quarry Ext @ Med School	0	1
11/27/2017 12:59	Galvez @ El Camino Real	1	0
11/27/2017 13:00	Quarry @ Psychiatry Lot	0	1
11/27/2017 13:01	Galvez @ Serra Mall	0	2
11/27/2017 13:02	Quarry @ Psychiatry Bld	0	5
11/27/2017 13:02	Serra @ Encina Hall	0	2
11/27/2017 13:05	Campus @ Wilbur Lot	0	1
11/27/2017 13:12	Tresidder West	3	2
11/27/2017 13:14	PATC-University Circle	12	8
11/27/2017 13:16	Via Ortega @ Y2E2	1	2
11/27/2017 13:19	Roth @ Quarry Ext	1	1
11/27/2017 13:19	Quarry Ext @ Med School	1	0
11/27/2017 13:20	Galvez @ El Camino Real	2	0
11/27/2017 13:20	Quarry Ext @ Medical C	0	0
11/27/2017 13:24	Serra @ Encina Hall	0	1
11/27/2017 13:26	Campus @ Escondido	1	2
11/27/2017 13:28	Campus @ Munger	1	2
11/27/2017 13:31	Tresidder West	0	2
11/27/2017 13:34	PATC-University Circle	2	6
11/27/2017 13:34	Santa Teresa @ Lomita	0	2
11/27/2017 13:36	Via Ortega @ Y2E2	1	0
11/27/2017 13:38	Quarry Ext @ Med School	1	0
11/27/2017 13:41	Galvez @ Alumni Center	0	1
11/27/2017 13:46	Campus @ Wilbur Field	1	0
11/27/2017 13:47	Campus @ Munger	1	0
11/27/2017 13:51	Tresidder West	3	0
11/27/2017 13:54	PATC-University Circle	1	4
11/27/2017 13:56	Via Ortega @ Y2E2	1	4
11/27/2017 13:59	Galvez @ Alumni Center	0	1
11/27/2017 14:00	Quarry Ext @ Medical C	3	0
11/27/2017 14:03	Campus @ Escondido	1	0
11/27/2017 14:12	Tresidder West	0	1
11/27/2017 14:14	PATC-University Circle	3	9
11/27/2017 14:17	Roth @ Quarry Ext	1	0
11/27/2017 14:18	El Camino @ PAMF SB	0	0
11/27/2017 14:18	Quarry Ext @ Med School	3	0
11/27/2017 14:19	Quarry Ext @ Medical C	3	0
11/27/2017 14:20	Galvez @ El Camino Real	2	0
11/27/2017 14:22	Quarry @ Psychiatry Bld	2	2
11/27/2017 14:24	Serra @ Manzanita Field	2	2
11/27/2017 14:26	Campus @ Escondido	1	1
11/27/2017 14:26	Campus @ Wilbur Lot	0	1
11/27/2017 14:33	Tresidder West	0	0
11/27/2017 14:34	PATC-University Circle	1	14
11/27/2017 14:36	Via Ortega S at Roble Garage	1	0
11/27/2017 14:37	Via Ortega @ Y2E2	3	0
11/27/2017 14:40	Galvez @ El Camino Real	1	0
11/27/2017 14:40	Quarry Ext @ Med School	0	0
11/27/2017 14:41	Quarry Ext @ Medical C	2	0
11/27/2017 14:43	Quarry @ Psychiatry Lot	3	1
11/27/2017 14:45	Quarry @ Psychiatry Bld	1	3
11/27/2017 14:46	Campus @ Escondido	2	1

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DateTime	StopName	Boardings	Alightings
11/27/2017 14:48	Campus @ Munger	2	0
11/27/2017 14:52	Tresidder West	6	1
11/27/2017 14:54	PATC-University Circle	1	8
11/27/2017 14:54	Santa Teresa @ Lomita	1	0
11/27/2017 14:56	Via Ortega S at Roble Garage	0	1
11/27/2017 14:57	Via Ortega @ Y2E2	1	1
11/27/2017 14:58	Galvez @ El Camino Real	1	0
11/27/2017 14:59	Roth @ Quarry Ext	0	4
11/27/2017 15:00	Quarry Ext @ Med School	2	2
11/27/2017 15:01	Medical Center @ Quarry	4	0
11/27/2017 15:02	Quarry @ Psychiatry Lot	1	0
11/27/2017 15:05	Quarry @ Psychiatry Bld	1	1
11/27/2017 15:06	Campus @ Escondido	1	2
11/27/2017 15:07	Campus @ Wilbur Field	2	0
11/27/2017 15:08	Campus @ Munger	1	0
11/27/2017 15:09	Campus @ Mayfield N	0	1
11/27/2017 15:12	Tresidder West	1	0
11/27/2017 15:14	PATC-University Circle	2	11
11/27/2017 15:15	Santa Teresa @ Lomita	2	0
11/27/2017 15:16	Via Ortega S at Roble Garage	0	1
11/27/2017 15:17	Via Ortega @ Y2E2	2	1
11/27/2017 15:20	Galvez @ El Camino Real	1	0
11/27/2017 15:20	Quarry Ext @ Med School	5	0
11/27/2017 15:22	Quarry Ext @ Medical C	3	0
11/27/2017 15:23	Quarry @ Psychiatry Lot	6	0
11/27/2017 15:24	Serra @ Manzanita Field	0	1
11/27/2017 15:25	Quarry @ Psychiatry Bld	2	4
11/27/2017 15:26	Campus @ Escondido	4	0
11/27/2017 15:27	Campus @ Wilbur Lot	0	1
11/27/2017 15:29	Campus @ Mayfield N	1	0
11/27/2017 15:32	Tresidder West	2	2
11/27/2017 15:34	PATC-University Circle	4	20
11/27/2017 15:34	Santa Teresa @ Lomita	1	0
11/27/2017 15:36	Via Ortega @ Y2E2	2	1
11/27/2017 15:38	Roth @ Quarry Ext	0	2
11/27/2017 15:39	Galvez @ El Camino Real	2	0
11/27/2017 15:39	Quarry Ext @ Med School	3	1
11/27/2017 15:41	Quarry Ext @ Medical C	1	0
11/27/2017 15:41	Galvez @ Alumni Center	0	1
11/27/2017 15:45	Campus @ Wilbur Lot	0	1
11/27/2017 15:48	PATC-University Circle	0	7
11/27/2017 15:52	Tresidder West	0	0
11/27/2017 15:54	PATC-University Circle	4	0
11/27/2017 15:55	PATC-University Circle	1	1
11/27/2017 15:56	Via Ortega @ Y2E2	7	0
11/27/2017 15:59	Quarry Ext @ Med School	4	0
11/27/2017 16:00	Quarry Ext @ Medical C	9	1
11/27/2017 16:02	Galvez @ El Camino Real	3	0
11/27/2017 16:02	Quarry @ Psychiatry Lot	0	0
11/27/2017 16:03	Quarry @ Psychiatry Bld	0	4
11/27/2017 16:04	Galvez @ Serra Mall	0	1
11/27/2017 16:05	Galvez @ Serra Mall	0	0
11/27/2017 16:06	Serra @ Manzanita Field	0	1
11/27/2017 16:08	Campus @ Escondido	0	3
11/27/2017 16:08	Campus @ Escondido	0	0
11/27/2017 16:09	Campus @ Wilbur Field	0	1
11/27/2017 16:09	Campus @ Wilbur Field	0	0
11/27/2017 16:10	PATC-University Circle	3	19
11/27/2017 16:10	Campus @ Munger	0	1
11/27/2017 16:10	Campus @ Munger	0	0
11/27/2017 16:13	Tresidder West	1	0

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DateTime	StopName	Boardings	Alightings
11/27/2017 16:13	Tresidder West	0	0
11/27/2017 16:13	PATC-University Circle	3	4
11/27/2017 16:17	Via Ortega @ Y2E2	8	1
11/27/2017 16:18	Via Ortega @ Y2E2	0	0
11/27/2017 16:20	Galvez @ El Camino Real	1	0
11/27/2017 16:20	Quarry Ext @ Med School	7	0
11/27/2017 16:20	Quarry Ext @ Med School	0	0
11/27/2017 16:21	Medical Center @ Quarry	2	0
11/27/2017 16:21	Medical Center @ Quarry	0	0
11/27/2017 16:22	Galvez @ Alumni Center	0	1
11/27/2017 16:23	Quarry @ Psychiatry Lot	1	0
11/27/2017 16:23	Quarry @ Psychiatry Lot	0	0
11/27/2017 16:26	Campus @ Escondido	0	1
11/27/2017 16:27	Campus @ Wilbur Lot	0	1
11/27/2017 16:28	Campus @ Wilbur Field	1	0
11/27/2017 16:32	Tresidder West	2	0
11/27/2017 16:34	PATC-University Circle	5	21
11/27/2017 16:34	PATC-University Circle	0	0
11/27/2017 16:34	Santa Teresa @ Lomita	1	0
11/27/2017 16:36	Via Ortega S at Roble Garage	0	1
11/27/2017 16:37	Via Ortega @ Y2E2	9	1
11/27/2017 16:41	Quarry Ext @ Med School	7	0
11/27/2017 16:41	Galvez @ El Camino Real	3	0
11/27/2017 16:41	Galvez @ El Camino Real	0	0
11/27/2017 16:42	Medical Center @ Quarry	4	0
11/27/2017 16:43	Galvez @ Alumni Center	1	1
11/27/2017 16:43	Galvez @ Alumni Center	0	0
11/27/2017 16:43	Quarry @ Psychiatry Lot	6	0
11/27/2017 16:44	Galvez @ Serra Mall	0	1
11/27/2017 16:44	Galvez @ Serra Mall	0	0
11/27/2017 16:45	Quarry @ Psychiatry Bld	0	2
11/27/2017 16:45	Serra @ Encina Hall	0	1
11/27/2017 16:45	Serra @ Encina Hall	0	0
11/27/2017 16:48	Campus @ Escondido	0	1
11/27/2017 16:48	Campus @ Escondido	0	0
11/27/2017 16:49	Campus @ Wilbur Field	1	0
11/27/2017 16:49	Campus @ Wilbur Field	0	0
11/27/2017 16:51	PATC-University Circle	0	27
11/27/2017 16:52	Tresidder West	5	1
11/27/2017 16:52	Tresidder West	0	0
11/27/2017 16:54	PATC-University Circle	4	3
11/27/2017 16:55	Santa Teresa @ Lomita	1	0
11/27/2017 16:59	Roth @ Quarry Ext	2	3
11/27/2017 16:59	Roth @ Quarry Ext	0	0
11/27/2017 17:00	Quarry Ext @ Med School	18	2
11/27/2017 17:00	Quarry Ext @ Med School	4	0
11/27/2017 17:00	Galvez @ El Camino Real	4	0
11/27/2017 17:01	Quarry Ext @ Med School	0	0
11/27/2017 17:01	Medical Center @ Quarry	6	0
11/27/2017 17:01	Medical Center @ Quarry	0	0
11/27/2017 17:03	Quarry @ Psychiatry Lot	9	0
11/27/2017 17:03	Quarry @ Psychiatry Lot	1	0
11/27/2017 17:04	Serra @ Encina Hall	0	0
11/27/2017 17:05	Quarry @ Psychiatry Bld	4	4
11/27/2017 17:05	Serra @ Manzanita Field	0	3
11/27/2017 17:05	Quarry @ Psychiatry Bld	0	0
11/27/2017 17:07	Campus @ Escondido	1	2
11/27/2017 17:09	Campus @ Munger	0	1
11/27/2017 17:12	Tresidder West	4	3
11/27/2017 17:12	PATC-University Circle	2	40
11/27/2017 17:14	Santa Teresa @ Lomita	2	0

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DateTime	StopName	Boardings	Alightings
11/27/2017 17:15	PATC-University Circle	2	0
11/27/2017 17:15	PATC-University Circle	0	0
11/27/2017 17:17	Via Ortega @ Y2E2	8	0
11/27/2017 17:19	Roth @ Quarry Ext	0	2
11/27/2017 17:20	Quarry Ext @ Med School	13	0
11/27/2017 17:21	Medical Center @ Quarry	9	0
11/27/2017 17:23	Quarry @ Psychiatry Lot	1	0
11/27/2017 17:24	Quarry @ Psychiatry Bld	2	4
11/27/2017 17:25	Galvez @ Serra Mall	2	0
11/27/2017 17:26	Serra @ Encina Hall	0	1
11/27/2017 17:26	Serra @ Encina Hall	0	0
11/27/2017 17:29	Campus @ Escondido	0	3
11/27/2017 17:29	Campus @ Escondido	0	0
11/27/2017 17:30	PATC-University Circle	0	32
11/27/2017 17:31	Campus @ Munger	1	0
11/27/2017 17:31	PATC-University Circle	0	0
11/27/2017 17:33	Tresidder West	2	0
11/27/2017 17:34	Tresidder West	0	0
11/27/2017 17:34	PATC-University Circle	0	0
11/27/2017 17:36	Santa Teresa @ Lomita	2	0
11/27/2017 17:37	Via Ortega S at Roble Garage	0	1
11/27/2017 17:38	Via Ortega S Across from Roble	0	0
11/27/2017 17:39	Via Ortega @ Y2E2	0	1
11/27/2017 17:39	Via Ortega @ Y2E2	0	0
11/27/2017 17:42	Roth @ Quarry Ext	0	1
11/27/2017 17:42	Roth @ Quarry Ext	0	0
11/27/2017 17:43	Galvez @ El Camino Real	3	0
11/27/2017 17:43	Quarry Ext @ Med School	8	0
11/27/2017 17:43	Quarry Ext @ Med School	0	0
11/27/2017 17:44	Medical Center @ Quarry	2	1
11/27/2017 17:45	Quarry @ Psychiatry Lot	1	0
11/27/2017 17:46	Galvez @ Serra Mall	0	1
11/27/2017 17:49	Campus @ Escondido	0	1
11/27/2017 17:53	Tresidder West	0	0
11/27/2017 17:54	PATC-University Circle	9	16
11/27/2017 17:55	Santa Teresa @ Lomita	1	0
11/27/2017 17:57	Via Ortega S at Roble Garage	2	0
11/27/2017 18:00	Galvez @ El Camino Real	1	1
11/27/2017 18:01	Galvez @ El Camino Real	0	0
11/27/2017 18:03	Quarry @ Psychiatry Lot	3	0
11/27/2017 18:04	Serra @ Encina Hall	0	1
11/27/2017 18:05	Quarry @ Psychiatry Bld	2	0
11/27/2017 18:05	Serra @ Manzanita Field	0	2
11/27/2017 18:07	Campus @ Escondido	0	4
11/27/2017 18:11	Tresidder West	1	0
11/27/2017 18:11	Tresidder West	0	0
11/27/2017 18:14	PATC-University Circle	2	9
11/27/2017 18:14	Santa Teresa @ Lomita	3	0
11/27/2017 18:16	Via Ortega @ Y2E2	2	0
11/27/2017 18:16	Via Ortega @ Y2E2	0	0
11/27/2017 18:19	Roth @ Quarry Ext	2	1
11/27/2017 18:19	Roth @ Quarry Ext	0	0
11/27/2017 18:20	Quarry Ext @ Med School	5	0
11/27/2017 18:20	Quarry Ext @ Med School	0	0
11/27/2017 18:21	Galvez @ Memorial	0	1
11/27/2017 18:22	Quarry @ Psychiatry Lot	2	1
11/27/2017 18:22	Quarry @ Psychiatry Lot	0	0
11/27/2017 18:23	Quarry @ Psychiatry Bld	0	2
11/27/2017 18:23	Quarry @ Psychiatry Bld	0	0
11/27/2017 18:25	Campus @ Escondido	1	0
11/27/2017 18:26	Campus @ Wilbur Field	0	1

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DateTime	StopName	Boardings	Alightings
11/27/2017 18:32	Tresidder West	1	1
11/27/2017 18:33	PATC-University Circle	3	12
11/27/2017 18:37	Via Ortega @ Y2E2	8	0
11/27/2017 18:39	Roth @ Quarry Ext	3	0
11/27/2017 18:39	Galvez @ El Camino Real	2	0
11/27/2017 18:39	Galvez @ El Camino Real	0	0
11/27/2017 18:40	Quarry Ext @ Med School	7	0
11/27/2017 18:40	Medical Center @ Quarry	2	0
11/27/2017 18:42	Quarry @ Psychiatry Lot	3	0
11/27/2017 18:43	Quarry @ Psychiatry Bld	0	2
11/27/2017 18:43	Serra @ Encina Hall	0	1
11/27/2017 18:44	Serra St @ GSB	2	0
11/27/2017 18:46	Campus @ Escondido	1	1
11/27/2017 18:46	Campus @ Escondido	0	0
11/27/2017 18:48	Campus @ Munger	0	1
11/27/2017 18:48	Campus @ Munger	0	0
11/27/2017 18:53	Tresidder West	2	5
11/27/2017 18:54	PATC-University Circle	13	25
11/27/2017 18:57	Via Ortega S Across from Roble	0	1
11/27/2017 18:57	Via Ortega S Across from Roble	0	0
11/27/2017 18:58	El Camino @ PAMF SB	1	2
11/27/2017 18:59	Galvez @ El Camino Real	3	0
11/27/2017 19:02	Galvez @ Memorial	0	2
11/27/2017 19:03	Galvez @ Serra Mall	0	1
11/27/2017 19:03	Quarry @ Psychiatry Lot	0	0
11/27/2017 19:03	Serra @ Encina Hall	0	2
11/27/2017 19:06	Campus @ Escondido	1	6
11/27/2017 19:07	Campus @ Wilbur Lot	0	2
11/27/2017 19:08	Campus @ Mayfield N	1	0
11/27/2017 19:12	Tresidder West	2	2
11/27/2017 19:13	PATC-University Circle	2	1
11/27/2017 19:15	PATC-University Circle	2	1
11/27/2017 19:17	Via Ortega @ Y2E2	5	0
11/27/2017 19:19	Roth @ Quarry Ext	1	1
11/27/2017 19:20	Quarry Ext @ Med School	4	0
11/27/2017 19:21	Galvez @ El Camino Real	3	1
11/27/2017 19:22	Quarry Ext @ Medical C	0	0
11/27/2017 19:24	Quarry @ Psychiatry Lot	2	1
11/27/2017 19:25	Quarry @ Psychiatry Bld	1	1
11/27/2017 19:27	Campus @ Escondido	1	2
11/27/2017 19:35	Via Ortega @ Y2E2	2	0
11/27/2017 19:35	PATC-University Circle	4	25
11/27/2017 19:35	Via Ortega @ Y2E2	0	0
11/27/2017 19:39	Medical Center @ Quarry	2	1
11/27/2017 19:39	Medical Center @ Quarry	0	0
11/27/2017 19:40	Galvez @ El Camino Real	2	0
11/27/2017 19:40	Quarry @ Psychiatry Lot	1	0
11/27/2017 19:45	Campus @ Escondido	0	3
11/27/2017 19:52	Tresidder West	1	1
11/27/2017 19:54	PATC-University Circle	7	9
11/27/2017 20:06	Campus @ Escondido	0	1
11/27/2017 20:06	Campus @ Escondido	0	0
11/27/2017 20:08	Campus @ Munger	0	0
11/27/2017 20:11	Tresidder West	0	0
11/27/2017 20:11	Tresidder West	0	0
11/27/2017 20:14	Santa Teresa @ Lomita	1	0
11/27/2017 20:14	Santa Teresa @ Lomita	0	0
11/27/2017 20:16	Via Ortega @ Y2E2	2	0
11/27/2017 20:16	Via Ortega @ Y2E2	0	0
11/27/2017 20:19	Quarry Ext @ Med School	1	0
11/27/2017 20:19	Quarry Ext @ Med School	0	0

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DateTime	StopName	Boardings	Alightings
11/27/2017 20:20	Medical Center @ Quarry	2	0
11/27/2017 20:20	Medical Center @ Quarry	0	0
11/27/2017 20:22	Quarry @ Psychiatry Lot	3	0
11/27/2017 20:22	Quarry @ Psychiatry Bld	0	1
11/27/2017 20:27	PATC-University Circle	1	10
11/27/2017 20:27	PATC-University Circle	0	0
11/27/2017 20:33	PATC-University Circle	0	0
11/27/2017 20:44	Campus @ Escondido	1	0
11/27/2017 20:52	Tresidder West	0	1
11/27/2017 20:55	Via Ortega S at Roble Garage	1	0
11/27/2017 20:57	Via Ortega @ Y2E2	2	0
11/27/2017 20:57	Via Ortega @ Y2E2	0	0
11/27/2017 20:59	Quarry Ext @ Med School	3	0
11/27/2017 21:00	Quarry Ext @ Med School	0	0
11/27/2017 21:00	Quarry Ext @ Medical C	2	0
11/27/2017 21:00	Quarry Ext @ Medical C	0	0
11/27/2017 21:02	Quarry @ Psychiatry Lot	1	0
11/27/2017 21:07	PATC-University Circle	0	9
11/27/2017 21:07	PATC-University Circle	0	0
11/28/2017 6:20	Unknown	1	1
11/28/2017 6:30	PATC-University Circle	23	2
11/28/2017 6:35	Galvez @ Alumni Center	0	1
11/28/2017 6:36	Galvez @ Serra Mall	1	1
11/28/2017 6:37	Serra @ Encina Hall	0	1
11/28/2017 6:39	Serra @ Manzanita Field	0	12
11/28/2017 6:42	Campus @ Munger	0	1
11/28/2017 6:45	Tresidder West	0	6
11/28/2017 7:03	PATC-University Circle	1	0
11/28/2017 7:06	PATC-University Circle	1	0
11/28/2017 7:13	Galvez @ Serra Mall	0	1
11/28/2017 7:14	Serra @ Encina Hall	0	1
11/28/2017 7:28	Tresidder West	2	1
11/28/2017 7:28	Tresidder West	0	0
11/28/2017 7:42	PATC-University Circle	33	1
11/28/2017 7:46	Galvez @ El Camino Real	1	0
11/28/2017 7:48	Galvez @ Alumni Center	1	9
11/28/2017 7:49	Galvez @ Memorial	0	2
11/28/2017 7:50	Galvez @ Serra Mall	0	16
11/28/2017 7:51	Serra @ Encina Hall	0	8
11/28/2017 7:52	Serra @ Manzanita Field	0	3
11/28/2017 7:55	Campus @ Mayfield N	0	1
11/28/2017 7:57	Tresidder West	4	1
11/28/2017 8:04	Via Ortega S at Roble Garage	0	0
11/28/2017 8:06	Via Ortega @ Y2E2	0	2
11/28/2017 8:08	Roth @ Quarry Ext	0	2
11/28/2017 8:09	Medical Center @ Quarry	2	2
11/28/2017 8:15	Caltrain Platform South	0	1
11/28/2017 8:33	PATC-University Circle	26	0
11/28/2017 8:33	PATC-University Circle	2	0
11/28/2017 8:40	Galvez @ El Camino Real	1	0
11/28/2017 8:42	Galvez @ Alumni Center	0	9
11/28/2017 8:43	Galvez @ Memorial	0	2
11/28/2017 8:43	Galvez @ Serra Mall	0	4
11/28/2017 8:44	Serra @ Encina Hall	0	4
11/28/2017 8:45	Serra @ Manzanita Field	1	3
11/28/2017 8:47	Campus @ Escondido	1	0
11/28/2017 8:48	Campus @ Wilbur Lot	2	0
11/28/2017 8:48	Campus @ Wilbur Field	2	0
11/28/2017 8:49	Campus @ Munger	0	3
11/28/2017 8:50	Campus @ Mayfield N	1	1
11/28/2017 8:52	Tresidder West	0	2

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DateTime	StopName	Boardings	Alightings
11/28/2017 8:54	Via Ortega S at Roble Garage	0	2
11/28/2017 8:56	Via Ortega @ Y2E2	0	2
11/28/2017 8:58	Roth @ Quarry Ext	0	2
11/28/2017 9:00	Quarry Ext @ Medical C	1	0
11/28/2017 9:07	PATC-University Circle	3	2
11/28/2017 9:09	PATC-University Circle	0	0
11/28/2017 9:14	Galvez @ El Camino Real	2	0
11/28/2017 9:15	Galvez @ Alumni Center	0	2
11/28/2017 9:16	Galvez @ Serra Mall	0	3
11/28/2017 9:30	Tresidder West	1	1
11/28/2017 9:36	Medical Center @ Quarry	1	0
11/28/2017 9:52	PATC-University Circle	19	2
11/28/2017 9:56	Galvez @ El Camino Real	1	0
11/28/2017 9:58	Galvez @ Alumni Center	0	3
11/28/2017 9:59	Galvez @ Memorial	0	1
11/28/2017 10:00	Galvez @ Serra Mall	0	1
11/28/2017 10:00	Serra @ Encina Hall	0	4
11/28/2017 10:03	Campus @ Escondido	1	0
11/28/2017 10:04	Campus @ Wilbur Field	2	0
11/28/2017 10:05	Campus @ Munger	0	3
11/28/2017 10:06	Campus @ Mayfield N	0	3
11/28/2017 10:10	Tresidder West	0	4
11/28/2017 10:13	Via Ortega S at Roble Garage	2	0
11/28/2017 10:16	Roth @ Quarry Ext	0	1
11/28/2017 10:17	Quarry Ext @ Medical C	1	0
11/28/2017 10:35	PATC-University Circle	18	6
11/28/2017 10:36	PATC-University Circle	0	0
11/28/2017 10:37	PATC-University Circle	1	0
11/28/2017 10:42	Galvez @ El Camino Real	1	1
11/28/2017 10:44	Galvez @ Alumni Center	0	1
11/28/2017 10:45	Galvez @ Memorial	0	1
11/28/2017 10:45	Galvez @ Serra Mall	0	2
11/28/2017 10:46	Serra @ Encina Hall	0	4
11/28/2017 10:49	Campus @ Escondido	3	3
11/28/2017 10:51	Campus @ Munger	0	1
11/28/2017 10:51	Campus @ Mayfield N	0	2
11/28/2017 10:53	Tresidder West	1	3
11/28/2017 10:56	Via Ortega S at Roble Garage	1	0
11/28/2017 10:58	Via Ortega @ Y2E2	1	1
11/28/2017 11:03	Quarry Ext @ Medical C	2	1
11/28/2017 11:06	Quarry @ Psychiatry Bld	0	5
11/28/2017 11:14	PATC-University Circle	9	2
11/28/2017 11:15	PATC-University Circle	1	0
11/28/2017 11:19	Galvez @ El Camino Real	2	0
11/28/2017 11:22	Galvez @ Memorial	0	2
11/28/2017 11:23	Galvez @ Serra Mall	0	7
11/28/2017 11:23	Serra @ Encina Hall	0	2
11/28/2017 11:26	Campus @ Escondido	0	1
11/28/2017 11:27	Campus @ Wilbur Field	1	0
11/28/2017 11:32	Tresidder West	0	1
11/28/2017 11:36	Via Ortega @ Y2E2	1	0
11/28/2017 11:39	Roth @ Quarry Ext	8	1
11/28/2017 11:40	Quarry Ext @ Medical C	3	1
11/28/2017 11:54	PATC-University Circle	12	14
11/28/2017 12:01	Galvez @ Alumni Center	0	2
11/28/2017 12:02	Galvez @ Serra Mall	0	1
11/28/2017 12:03	Serra @ Encina Hall	0	1
11/28/2017 12:05	Campus @ Escondido	2	0
11/28/2017 12:06	Campus @ Wilbur Field	4	0
11/28/2017 12:08	Campus @ Mayfield N	0	1
11/28/2017 12:12	Tresidder West	4	4

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DateTime	StopName	Boardings	Alightings
11/28/2017 12:16	Via Ortega @ Cypress Lot	0	2
11/28/2017 12:19	Quarry Ext @ Med School	1	1
11/28/2017 12:19	Quarry Ext @ Medical C	3	0
11/28/2017 12:23	Quarry @ Psychiatry Bld	0	3
11/28/2017 12:33	PATC-University Circle	4	4
11/28/2017 12:34	PATC-University Circle	1	0
11/28/2017 12:41	Galvez @ Serra Mall	0	1
11/28/2017 12:41	Serra @ Encina Hall	2	1
11/28/2017 12:44	Campus @ Escondido	0	1
11/28/2017 12:45	Campus @ Wilbur Field	0	1
11/28/2017 12:46	Campus @ Munger	0	1
11/28/2017 12:51	Tresidder West	2	0
11/28/2017 12:55	Via Ortega S at Roble Garage	2	0
11/28/2017 12:56	Via Ortega @ Cypress Lot	0	1
11/28/2017 13:01	Quarry @ Psychiatry Lot	1	0
11/28/2017 13:03	Quarry @ Psychiatry Bld	0	2
11/28/2017 13:14	PATC-University Circle	14	5
11/28/2017 13:20	Galvez @ El Camino Real	4	0
11/28/2017 13:22	Galvez @ Alumni Center	0	3
11/28/2017 13:24	Serra @ Encina Hall	0	1
11/28/2017 13:27	Campus @ Escondido	4	2
11/28/2017 13:29	Campus @ Munger	0	2
11/28/2017 13:30	Campus @ Mayfield N	0	1
11/28/2017 13:32	Tresidder West	0	6
11/28/2017 13:34	Santa Teresa @ Lomita	0	1
11/28/2017 13:36	Via Ortega @ Y2E2	1	4
11/28/2017 13:54	PATC-University Circle	7	5
11/28/2017 13:58	Galvez @ El Camino Real	3	0
11/28/2017 14:01	Galvez @ Serra Mall	0	1
11/28/2017 14:02	Serra @ Encina Hall	1	1
11/28/2017 14:05	Campus @ Wilbur Lot	0	3
11/28/2017 14:06	Campus @ Mayfield N	1	0
11/28/2017 14:12	Tresidder East	3	3
11/28/2017 14:15	Via Ortega @ Y2E2	1	0
11/28/2017 14:17	Roth @ Quarry Ext	2	0
11/28/2017 14:18	Quarry Ext @ Med School	2	0
11/28/2017 14:19	Quarry Ext @ Medical C	4	1
11/28/2017 14:20	Quarry @ Psychiatry Lot	1	0
11/28/2017 14:34	PATC-University Circle	4	13
11/28/2017 14:42	Galvez @ Memorial	0	1
11/28/2017 14:46	Campus @ Escondido	3	0
11/28/2017 14:48	Campus @ Munger	1	0
11/28/2017 14:49	Campus @ Mayfield N	0	2
11/28/2017 14:52	Tresidder West	2	1
11/28/2017 14:52	Tresidder West	1	0
11/28/2017 14:56	Via Ortega @ Y2E2	1	6
11/28/2017 14:59	Roth @ Quarry Ext	0	2
11/28/2017 15:00	Quarry Ext @ Med School	2	0
11/28/2017 15:01	Quarry Ext @ Medical C	7	0
11/28/2017 15:02	Quarry @ Psychiatry Lot	3	0
11/28/2017 15:05	Quarry @ Psychiatry Bld	1	2
11/28/2017 15:14	PATC-University Circle	3	13
11/28/2017 15:14	PATC-University Circle	2	0
11/28/2017 15:15	PATC-University Circle	1	0
11/28/2017 15:15	PATC-University Circle	1	0
11/28/2017 15:24	Serra @ Manzanita Field	0	2
11/28/2017 15:26	Campus @ Escondido	0	4
11/28/2017 15:32	Tresidder West	1	1
11/28/2017 15:35	Via Ortega S at Roble Garage	0	1
11/28/2017 15:36	Via Ortega @ Y2E2	4	0
11/28/2017 15:39	Roth @ Quarry Ext	1	0

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DateTime	StopName	Boardings	Alightings
11/28/2017 15:39	Quarry Ext @ Med School	4	0
11/28/2017 15:40	Medical Center @ Quarry	5	0
11/28/2017 15:42	Quarry @ Psychiatry Lot	0	0
11/28/2017 15:43	Quarry @ Psychiatry Bld	2	2
11/28/2017 15:54	PATC-University Circle	1	15
11/28/2017 16:06	Campus @ Wilbur Field	0	1
11/28/2017 16:12	Tresidder West	2	0
11/28/2017 16:16	Via Ortega @ Y2E2	7	0
11/28/2017 16:19	Roth @ Quarry Ext	0	1
11/28/2017 16:19	Roth @ Quarry Ext	1	0
11/28/2017 16:20	Quarry Ext @ Med School	1	0
11/28/2017 16:21	Medical Center @ Quarry	2	0
11/28/2017 16:22	Quarry @ Psychiatry Lot	1	0
11/28/2017 16:34	PATC-University Circle	2	16
11/28/2017 16:40	Galvez @ El Camino Real	3	0
11/28/2017 16:51	Tresidder West	6	1
11/28/2017 16:51	Tresidder West	0	0
11/28/2017 16:53	Santa Teresa @ Lomita	1	0
11/28/2017 16:55	Via Ortega S at Roble Garage	1	0
11/28/2017 16:56	Via Ortega @ Y2E2	12	0
11/28/2017 16:59	Quarry Ext @ Med School	9	3
11/28/2017 17:01	Quarry @ Psychiatry Lot	3	0
11/28/2017 17:16	PATC-University Circle	10	31
11/28/2017 17:23	Galvez @ Serra Mall	0	2
11/28/2017 17:26	Campus @ Escondido	0	2
11/28/2017 17:33	Tresidder West	3	1
11/28/2017 17:35	Santa Teresa @ Lomita	1	0
11/28/2017 17:43	Quarry @ Psychiatry Lot	1	0
11/28/2017 17:44	Quarry @ Crate/Barrel	0	1
11/28/2017 17:49	PATC-University Circle	0	4
11/28/2017 17:54	PATC-University Circle	7	6
11/28/2017 18:00	Galvez @ El Camino Real	1	0
11/28/2017 18:06	Campus @ Escondido	0	3
11/28/2017 18:08	Campus @ Munger	1	1
11/28/2017 18:09	Campus @ Mayfield N	0	1
11/28/2017 18:09	Campus @ Mayfield N	1	0
11/28/2017 18:12	Tresidder West	0	0
11/28/2017 18:15	Via Ortega S at Roble Garage	1	0
11/28/2017 18:17	Via Ortega @ Cypress Lot	2	0
11/28/2017 18:19	Roth @ Quarry Ext	1	0
11/28/2017 18:20	Quarry Ext @ Med School	4	0
11/28/2017 18:21	Quarry Ext @ Medical C	4	0
11/28/2017 18:23	Quarry @ Psychiatry Lot	0	0
11/28/2017 18:34	PATC-University Circle	5	16
11/28/2017 18:45	Serra @ Manzanita Field	1	0
11/28/2017 18:47	Campus @ Escondido	0	3
11/28/2017 18:48	Campus @ Wilbur Field	2	0
11/28/2017 18:49	Campus @ Munger	0	1
11/28/2017 18:53	Tresidder West	2	1
11/28/2017 18:55	Santa Teresa @ Lomita	1	0
11/28/2017 18:57	Via Ortega S Across from Roble	0	0
11/28/2017 18:58	Via Ortega @ Cypress Lot	0	3
11/28/2017 19:09	PATC-University Circle	0	3
11/28/2017 19:13	PATC-University Circle	1	1
11/28/2017 19:16	PATC-University Circle	4	1
11/28/2017 19:24	Serra @ Encina Hall	0	1
11/28/2017 19:26	Serra @ Manzanita Field	2	0
11/28/2017 19:27	Campus @ Escondido	0	2
11/28/2017 19:32	Tresidder West	2	0
11/28/2017 19:36	Via Ortega @ Y2E2	0	0
11/28/2017 19:39	Roth @ Quarry Ext	1	0

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DateTime	StopName	Boardings	Alightings
11/28/2017 19:41	Medical Center @ Quarry	6	3
11/28/2017 19:42	Quarry @ Psychiatry Lot	0	0
11/28/2017 19:55	PATC-University Circle	5	12
11/28/2017 20:05	Campus @ Escondido	1	2
11/28/2017 20:12	Tresidder West	1	1
11/28/2017 20:14	Santa Teresa @ Lomita	1	0
11/28/2017 20:16	Via Ortega S at Roble Garage	1	0
11/28/2017 20:17	Via Ortega @ Y2E2	3	0
11/28/2017 20:19	Roth @ Quarry Ext	1	0
11/28/2017 20:20	Quarry Ext @ Med School	2	0
11/28/2017 20:22	Quarry @ Psychiatry Bld	0	1
11/28/2017 20:33	PATC-University Circle	6	9
11/28/2017 20:42	Galvez @ Serra Mall	0	3
11/28/2017 20:47	Campus @ Munger	0	2
11/28/2017 20:52	Tresidder West	0	2
11/28/2017 20:56	Via Ortega @ Y2E2	2	0
11/28/2017 20:58	Quarry Ext @ Med School	4	0
11/28/2017 20:59	Medical Center @ Quarry	2	0
11/28/2017 21:00	Quarry @ Psychiatry Lot	1	0
11/28/2017 21:01	Quarry @ Psychiatry Bld	0	1
11/28/2017 21:06	PATC-University Circle	0	9
11/29/2017 5:30	Unknown	1	1
11/29/2017 5:36	Unknown	1	1
11/29/2017 5:37	Unknown	0	0
11/29/2017 5:50	Unknown	2	1
11/29/2017 5:54	Unknown	1	1
11/29/2017 6:12	PATC-University Circle	9	1
11/29/2017 6:18	Galvez @ Memorial	1	1
11/29/2017 6:20	Serra @ Encina Hall	0	2
11/29/2017 6:21	Serra @ Manzanita Field	0	2
11/29/2017 6:24	Campus @ Munger	0	1
11/29/2017 6:28	PATC-University Circle	21	5
11/29/2017 6:31	Tresidder West	1	1
11/29/2017 6:33	Santa Teresa @ Lomita	0	1
11/29/2017 6:34	Via Ortega S at Roble Garage	0	1
11/29/2017 6:35	Unknown	2	0
11/29/2017 6:36	Serra @ Encina Hall	0	4
11/29/2017 6:38	Serra @ Campus Dr	0	7
11/29/2017 6:40	Quarry Ext @ Medical C	3	1
11/29/2017 6:40	Campus @ Munger	0	1
11/29/2017 6:43	Tresidder West	0	5
11/29/2017 6:48	PATC-University Circle	1	2
11/29/2017 6:49	Unknown	1	1
11/29/2017 6:49	Unknown	0	0
11/29/2017 6:51	El Camino @ PAMF SB	0	0
11/29/2017 6:52	Galvez @ El Camino Real	1	0
11/29/2017 6:55	Galvez @ Serra Mall	0	1
11/29/2017 7:00	Campus @ Mayfield N	1	0
11/29/2017 7:05	Tresidder West	1	1
11/29/2017 7:06	PATC-University Circle	7	2
11/29/2017 7:06	PATC-University Circle	1	0
11/29/2017 7:08	PATC-University Circle	2	0
11/29/2017 7:08	PATC-University Circle	2	0
11/29/2017 7:13	Quarry Ext @ Med School	0	1
11/29/2017 7:14	Quarry Ext @ Medical C	0	0
11/29/2017 7:16	Galvez @ Serra Mall	0	2
11/29/2017 7:16	Serra @ Encina Hall	0	2
11/29/2017 7:20	Campus @ Munger	0	1
11/29/2017 7:25	PATC-University Circle	25	28
11/29/2017 7:26	PATC-University Circle	21	1
11/29/2017 7:34	Galvez @ El Camino Real	0	0

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DateTime	StopName	Boardings	Alightings
11/29/2017 7:34	Quarry Ext Middle	1	1
11/29/2017 7:36	Galvez @ Alumni Center	0	4
11/29/2017 7:37	Galvez @ Serra Mall	0	7
11/29/2017 7:38	Serra @ Encina Hall	0	5
11/29/2017 7:39	Serra @ Manzanita Field	0	2
11/29/2017 7:41	Campus @ Wilbur Field	0	1
11/29/2017 7:43	PATC-University Circle	33	1
11/29/2017 7:43	Campus @ Munger	0	1
11/29/2017 7:44	Tresidder West	0	1
11/29/2017 7:47	Via Ortega S at Roble Garage	1	0
11/29/2017 7:48	Galvez @ Alumni Center	1	11
11/29/2017 7:49	Galvez @ Memorial	0	3
11/29/2017 7:50	Galvez @ Serra Mall	0	10
11/29/2017 7:50	PATC - Bus Depot	8	10
11/29/2017 7:51	Serra @ Encina Hall	0	8
11/29/2017 7:52	Serra @ Manzanita Field	1	3
11/29/2017 7:54	Campus @ Escondido	0	1
11/29/2017 7:56	Campus @ Mayfield N	0	1
11/29/2017 7:58	Caltrain Platform South	0	1
11/29/2017 7:58	Tresidder West	0	3
11/29/2017 7:58	Caltrain Platform South	0	1
11/29/2017 8:06	Quarry Ext @ Med School	0	1
11/29/2017 8:09	Quarry Ext Middle	1	1
11/29/2017 8:10	PATC-University Circle	10	3
11/29/2017 8:11	Quarry @ Psychiatry Lot	1	0
11/29/2017 8:16	Caltrain Platform South	0	1
11/29/2017 8:16	Galvez @ Serra Mall	0	2
11/29/2017 8:17	Serra @ Encina Hall	0	1
11/29/2017 8:20	Campus @ Escondido	1	0
11/29/2017 8:21	Campus @ Wilbur Field	0	2
11/29/2017 8:22	Campus @ Munger	0	1
11/29/2017 8:28	Tresidder West	1	3
11/29/2017 8:33	PATC-University Circle	41	1
11/29/2017 8:36	Quarry Ext @ Medical C	0	0
11/29/2017 8:37	El Camino @ PAMF NB	0	5
11/29/2017 8:37	El Camino @ PAMF NB	3	0
11/29/2017 8:38	Quarry @ Psychiatry Bld	0	1
11/29/2017 8:39	Galvez @ El Camino Real	2	0
11/29/2017 8:42	Galvez @ Alumni Center	1	9
11/29/2017 8:43	Galvez @ Memorial	0	3
11/29/2017 8:44	Galvez @ Serra Mall	0	11
11/29/2017 8:44	Serra @ Encina Hall	0	8
11/29/2017 8:45	Serra @ Manzanita Field	0	3
11/29/2017 8:47	PATC-University Circle	8	2
11/29/2017 8:47	Campus @ Escondido	1	0
11/29/2017 8:49	Campus @ Munger	0	3
11/29/2017 8:50	Campus @ Mayfield N	1	0
11/29/2017 8:50	PATC-University Circle	0	0
11/29/2017 8:51	Tresidder West	0	4
11/29/2017 8:55	Via Ortega @ Y2E2	0	3
11/29/2017 8:57	Galvez @ El Camino Real	2	0
11/29/2017 8:59	Quarry Ext @ Medical C	2	0
11/29/2017 8:59	Galvez @ Alumni Center	0	2
11/29/2017 9:00	Galvez @ Memorial	0	1
11/29/2017 9:01	Galvez @ Serra Mall	0	1
11/29/2017 9:01	Serra @ Encina Hall	0	1
11/29/2017 9:02	Quarry @ Crate/Barrel	0	1
11/29/2017 9:05	Campus @ Escondido	3	0
11/29/2017 9:06	Campus @ Wilbur Field	0	1
11/29/2017 9:07	Campus @ Munger	0	3
11/29/2017 9:08	Campus @ Mayfield N	0	1

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DateTime	StopName	Boardings	Alightings
11/29/2017 9:09	PATC-University Circle	2	1
11/29/2017 9:09	Tresidder West	0	2
11/29/2017 9:12	Santa Teresa @ Lomita	0	2
11/29/2017 9:13	Via Ortega S at Roble Garage	2	0
11/29/2017 9:14	Via Ortega @ Y2E2	0	2
11/29/2017 9:15	Galvez @ El Camino Real	1	0
11/29/2017 9:16	Galvez @ Alumni Center	0	1
11/29/2017 9:16	Roth @ Quarry Ext	0	1
11/29/2017 9:17	Quarry Ext @ Med School	1	0
11/29/2017 9:17	Galvez @ Memorial	0	1
11/29/2017 9:18	Medical Center @ Quarry	3	0
11/29/2017 9:19	Quarry @ Psychiatry Lot	3	0
11/29/2017 9:20	Campus @ Escondido	2	0
11/29/2017 9:22	Campus @ Munger	1	0
11/29/2017 9:24	Campus @ Mayfield N	1	0
11/29/2017 9:28	Santa Teresa @ Lomita	0	1
11/29/2017 9:29	PATC-University Circle	11	9
11/29/2017 9:30	PATC-University Circle	1	0
11/29/2017 9:30	Via Ortega @ Y2E2	0	1
11/29/2017 9:37	Quarry Ext Middle	1	1
11/29/2017 9:38	Galvez @ Alumni Center	1	2
11/29/2017 9:38	Medical Center @ Quarry	2	0
11/29/2017 9:39	Galvez @ Memorial	0	2
11/29/2017 9:39	Galvez @ Serra Mall	0	2
11/29/2017 9:40	Serra @ Encina Hall	0	4
11/29/2017 9:43	Campus @ Escondido	3	0
11/29/2017 9:48	Tresidder West	0	2
11/29/2017 9:50	Santa Teresa @ Lomita	0	1
11/29/2017 9:52	PATC-University Circle	8	5
11/29/2017 9:53	Via Ortega @ Y2E2	0	1
11/29/2017 9:56	El Camino @ Town/Cntry	0	1
11/29/2017 9:58	Galvez @ Memorial	0	2
11/29/2017 9:59	Serra @ Encina Hall	0	2
11/29/2017 10:02	Campus @ Escondido	1	0
11/29/2017 10:04	Campus @ Munger	0	3
11/29/2017 10:08	Tresidder West	2	2
11/29/2017 10:12	Via Ortega @ Cypress Lot	2	3
11/29/2017 10:14	Quarry Ext @ Med School	0	1
11/29/2017 10:14	PATC-University Circle	15	5
11/29/2017 10:17	Quarry @ Crate/Barrel	0	1
11/29/2017 10:21	Galvez @ El Camino Real	5	0
11/29/2017 10:23	Galvez @ Alumni Center	0	3
11/29/2017 10:24	Galvez @ Memorial	0	5
11/29/2017 10:25	Galvez @ Serra Mall	0	1
11/29/2017 10:26	Serra @ Encina Hall	0	2
11/29/2017 10:29	Campus @ Escondido	3	1
11/29/2017 10:30	Campus @ Wilbur Lot	0	1
11/29/2017 10:31	Campus @ Munger	1	2
11/29/2017 10:32	Campus @ Mayfield N	0	1
11/29/2017 10:35	Tresidder West	1	2
11/29/2017 10:36	PATC-University Circle	9	5
11/29/2017 10:42	Galvez @ El Camino Real	5	1
11/29/2017 10:42	Medical Center @ Quarry	0	4
11/29/2017 10:44	Galvez @ Memorial	0	1
11/29/2017 10:45	Quarry @ Psychiatry Bld	1	0
11/29/2017 10:45	Serra @ Encina Hall	0	2
11/29/2017 10:46	Serra @ Manzanita Field	1	0
11/29/2017 10:48	Campus @ Escondido	0	1
11/29/2017 10:52	Tresidder West	2	3
11/29/2017 10:54	PATC-University Circle	9	2
11/29/2017 10:56	Via Ortega @ Y2E2	0	1

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DateTime	StopName	Boardings	Alightings
11/29/2017 10:59	Quarry Ext @ Med School	0	1
11/29/2017 11:00	Galvez @ Alumni Center	0	1
11/29/2017 11:00	Quarry Ext @ Medical C	0	0
11/29/2017 11:01	Galvez @ Memorial	0	1
11/29/2017 11:01	Galvez @ Serra Mall	0	1
11/29/2017 11:02	Serra @ Encina Hall	0	1
11/29/2017 11:05	Campus @ Wilbur Field	0	2
11/29/2017 11:12	Tresidder West	0	0
11/29/2017 11:13	PATC-University Circle	13	3
11/29/2017 11:13	PATC-University Circle	1	0
11/29/2017 11:16	Via Ortega S at Roble Garage	1	0
11/29/2017 11:17	Via Ortega @ Y2E2	1	0
11/29/2017 11:19	Galvez @ El Camino Real	0	1
11/29/2017 11:19	Roth @ Quarry Ext	2	1
11/29/2017 11:21	Medical Center @ Quarry	1	0
11/29/2017 11:22	Galvez @ Memorial	0	2
11/29/2017 11:22	Galvez @ Serra Mall	0	6
11/29/2017 11:23	Serra @ Encina Hall	0	3
11/29/2017 11:24	Serra @ Manzanita Field	1	0
11/29/2017 11:26	Campus @ Escondido	2	0
11/29/2017 11:27	Campus @ Wilbur Lot	1	1
11/29/2017 11:31	Tresidder West	0	0
11/29/2017 11:34	PATC-University Circle	9	4
11/29/2017 11:34	Via Ortega S at Roble Garage	0	2
11/29/2017 11:36	Via Ortega @ Y2E2	1	1
11/29/2017 11:39	Medical Center @ Quarry	0	1
11/29/2017 11:41	Galvez @ Alumni Center	1	0
11/29/2017 11:42	Galvez @ Serra Mall	0	3
11/29/2017 11:43	Serra @ Encina Hall	0	1
11/29/2017 11:45	Campus @ Escondido	1	2
11/29/2017 11:46	Campus @ Wilbur Field	0	2
11/29/2017 11:52	Tresidder West	4	3
11/29/2017 11:53	PATC-University Circle	11	7
11/29/2017 11:55	Via Ortega S at Roble Garage	1	0
11/29/2017 11:56	Via Ortega @ Cypress Lot	2	3
11/29/2017 11:59	Galvez @ El Camino Real	4	1
11/29/2017 12:01	Galvez @ Alumni Center	0	1
11/29/2017 12:02	Galvez @ Memorial	0	2
11/29/2017 12:02	Galvez @ Serra Mall	1	3
11/29/2017 12:03	Serra @ Encina Hall	0	1
11/29/2017 12:04	Serra @ Manzanita Field	1	1
11/29/2017 12:06	Campus @ Escondido	0	2
11/29/2017 12:07	Via Ortega @ Cypress Lot	3	3
11/29/2017 12:08	Campus @ Mayfield N	1	0
11/29/2017 12:10	Quarry Ext @ Med School	7	0
11/29/2017 12:10	Quarry Ext @ Medical C	3	0
11/29/2017 12:11	Tresidder West	2	3
11/29/2017 12:13	Quarry @ Psychiatry Bld	0	1
11/29/2017 12:14	Tresidder West	3	4
11/29/2017 12:15	Tresidder West	2	0
11/29/2017 12:17	PATC-University Circle	0	11
11/29/2017 12:22	Galvez @ El Camino Real	3	0
11/29/2017 12:28	Campus @ Escondido	1	1
11/29/2017 12:29	Campus @ Wilbur Field	1	0
11/29/2017 12:30	Campus @ Munger	0	2
11/29/2017 12:32	Tresidder West	1	1
11/29/2017 12:36	Via Ortega @ Cypress Lot	0	0
11/29/2017 12:38	Roth @ Quarry Ext	1	0
11/29/2017 12:39	Quarry Ext @ Med School	1	1
11/29/2017 12:53	PATC-University Circle	3	4
11/29/2017 12:58	Galvez @ El Camino Real	4	0

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DateTime	StopName	Boardings	Alightings
11/29/2017 13:01	Serra @ Encina Hall	0	1
11/29/2017 13:05	Campus @ Escondido	0	5
11/29/2017 13:06	Campus @ Wilbur Field	1	0
11/29/2017 13:07	Campus @ Munger	1	0
11/29/2017 13:12	Tresidder West	2	0
11/29/2017 13:12	Tresidder West	1	0
11/29/2017 13:17	Via Ortega @ Y2E2	1	3
11/29/2017 13:24	Roth @ Quarry Ext	1	0
11/29/2017 13:25	Quarry Ext @ Med School	5	0
11/29/2017 13:26	Quarry Ext @ Medical C	2	0
11/29/2017 13:29	Quarry @ Psychiatry Bld	1	2
11/29/2017 13:35	PATC-University Circle	2	13
11/29/2017 13:41	Galvez @ El Camino Real	1	0
11/29/2017 13:43	Galvez @ Alumni Center	2	0
11/29/2017 13:45	Serra @ Manzanita Field	0	2
11/29/2017 13:47	Campus @ Escondido	1	0
11/29/2017 13:51	Tresidder West	2	0
11/29/2017 13:55	Via Ortega @ Y2E2	0	4
11/29/2017 13:57	Roth @ Quarry Ext	0	1
11/29/2017 13:58	Quarry Ext @ Med School	2	0
11/29/2017 13:58	Medical Center @ Quarry	1	0
11/29/2017 14:00	Quarry @ Psychiatry Lot	1	0
11/29/2017 14:01	Quarry @ Psychiatry Bld	1	1
11/29/2017 14:14	PATC-University Circle	8	6
11/29/2017 14:19	Galvez @ El Camino Real	2	0
11/29/2017 14:22	Galvez @ Serra Mall	0	3
11/29/2017 14:27	Campus @ Mayfield N	0	1
11/29/2017 14:32	Tresidder West	3	0
11/29/2017 14:37	Via Ortega @ Y2E2	6	0
11/29/2017 14:39	Roth @ Quarry Ext	0	1
11/29/2017 14:40	Quarry Ext @ Med School	3	0
11/29/2017 14:40	Quarry Ext @ Med School	0	0
11/29/2017 14:42	Quarry @ Psychiatry Lot	1	0
11/29/2017 14:54	PATC-University Circle	5	16
11/29/2017 14:58	Galvez @ El Camino Real	2	0
11/29/2017 15:00	Galvez @ Alumni Center	0	1
11/29/2017 15:02	Galvez @ Serra Mall	0	2
11/29/2017 15:05	Campus @ Escondido	1	2
11/29/2017 15:06	Campus @ Wilbur Lot	1	0
11/29/2017 15:06	Campus @ Wilbur Field	0	0
11/29/2017 15:13	Tresidder West	5	3
11/29/2017 15:15	Santa Teresa @ Lomita	1	0
11/29/2017 15:18	Via Ortega @ Y2E2	2	0
11/29/2017 15:21	Quarry Ext @ Med School	2	4
11/29/2017 15:22	Quarry Ext @ Medical C	5	0
11/29/2017 15:23	Quarry @ Psychiatry Lot	6	0
11/29/2017 15:25	Quarry @ Psychiatry Bld	0	5
11/29/2017 15:34	PATC-University Circle	3	16
11/29/2017 15:39	Galvez @ El Camino Real	1	0
11/29/2017 15:41	Galvez @ Alumni Center	1	0
11/29/2017 15:46	Campus @ Wilbur Lot	1	1
11/29/2017 15:46	Campus @ Wilbur Field	0	0
11/29/2017 15:47	Campus @ Munger	1	0
11/29/2017 15:52	Tresidder West	0	1
11/29/2017 15:54	Santa Teresa @ Lomita	0	1
11/29/2017 15:57	Via Ortega @ Y2E2	8	1
11/29/2017 15:59	Roth @ Quarry Ext	1	0
11/29/2017 16:00	Quarry Ext @ Med School	1	0
11/29/2017 16:01	Quarry Ext @ Medical C	1	0
11/29/2017 16:03	Quarry @ Psychiatry Lot	2	0
11/29/2017 16:05	Quarry @ Psychiatry Bld	0	3

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DateTime	StopName	Boardings	Alightings
11/29/2017 16:14	PATC-University Circle	4	13
11/29/2017 16:17	El Camino @ PAMF NB	0	0
11/29/2017 16:18	El Camino @ PAMF SB	0	1
11/29/2017 16:20	Galvez @ El Camino Real	2	0
11/29/2017 16:22	Galvez @ Alumni Center	0	1
11/29/2017 16:25	Serra @ Manzanita Field	0	1
11/29/2017 16:27	Campus @ Escondido	0	1
11/29/2017 16:32	Tresidder West	1	1
11/29/2017 16:34	Santa Teresa @ Lomita	1	0
11/29/2017 16:40	Quarry Ext @ Med School	0	0
11/29/2017 16:41	Medical Center @ Quarry	1	0
11/29/2017 16:44	Quarry @ Psychiatry Bld	0	1
11/29/2017 16:50	PATC-University Circle	0	3
11/29/2017 16:55	PATC-University Circle	4	1
11/29/2017 16:56	PATC-University Circle	1	0
11/29/2017 17:02	Galvez @ El Camino Real	4	0
11/29/2017 17:05	Galvez @ Serra Mall	0	1
11/29/2017 17:07	Serra @ Manzanita Field	0	1
11/29/2017 17:09	Campus @ Escondido	0	4
11/29/2017 17:10	Campus @ Wilbur Lot	0	1
11/29/2017 17:14	Tresidder West	2	1
11/29/2017 17:16	Santa Teresa @ Lomita	1	0
11/29/2017 17:19	Via Ortega @ Y2E2	10	0
11/29/2017 17:22	Quarry Ext @ Med School	11	0
11/29/2017 17:23	Medical Center @ Quarry	5	0
11/29/2017 17:25	Quarry @ Psychiatry Lot	3	0
11/29/2017 17:26	Quarry @ Psychiatry Bld	0	1
11/29/2017 17:37	PATC-University Circle	1	30
11/29/2017 17:43	Galvez @ El Camino Real	1	0
11/29/2017 17:49	Campus @ Escondido	0	2
11/29/2017 17:55	Tresidder West	3	0
11/29/2017 17:58	Via Ortega S at Roble Garage	3	0
11/29/2017 17:59	Via Ortega @ Y2E2	1	1
11/29/2017 18:02	Quarry Ext @ Med School	2	0
11/29/2017 18:14	PATC-University Circle	4	11
11/29/2017 18:21	Galvez @ Alumni Center	0	2
11/29/2017 18:26	Campus @ Escondido	0	2
11/29/2017 18:32	Tresidder West	4	1
11/29/2017 18:36	Via Ortega S at Roble Garage	2	0
11/29/2017 18:38	Via Ortega @ Cypress Lot	0	0
11/29/2017 18:50	Via Ortega @ Cypress Lot	9	10
11/29/2017 18:57	PATC-University Circle	5	0
11/29/2017 19:02	Galvez @ El Camino Real	2	1
11/29/2017 19:03	PATC-University Circle	2	8
11/29/2017 19:04	Galvez @ Alumni Center	0	1
11/29/2017 19:05	PATC-University Circle	3	3
11/29/2017 19:05	Galvez @ Serra Mall	0	0
11/29/2017 19:07	Serra @ Manzanita Field	0	1
11/29/2017 19:09	Campus @ Escondido	0	3
11/29/2017 19:12	Campus @ Mayfield N	1	0
11/29/2017 19:14	Tresidder West	1	0
11/29/2017 19:19	Via Ortega @ Y2E2	4	0
11/29/2017 19:20	Via Ortega @ Y2E2	1	1
11/29/2017 19:23	Quarry Ext @ Med School	8	0
11/29/2017 19:24	Medical Center @ Quarry	12	0
11/29/2017 19:26	Quarry @ Psychiatry Lot	2	0
11/29/2017 19:31	PATC-University Circle	2	31
11/29/2017 19:34	PATC-University Circle	3	1
11/29/2017 19:45	Campus @ Wilbur Field	1	0
11/29/2017 19:45	Campus @ Munger	1	1
11/29/2017 19:52	Tresidder West	3	1

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DateTime	StopName	Boardings	Alightings
11/29/2017 19:56	Via Ortega @ Y2E2	3	1
11/29/2017 19:59	Quarry Ext @ Med School	4	0
11/29/2017 20:00	Medical Center @ Quarry	1	0
11/29/2017 20:01	Quarry @ Psychiatry Lot	1	0
11/29/2017 20:14	PATC-University Circle	0	13
11/29/2017 20:26	Tresidder West	1	1
11/29/2017 20:31	Tresidder West	2	1
11/29/2017 20:39	Medical Center @ Quarry	1	0
11/29/2017 20:41	Quarry @ Psychiatry Bld	0	1
11/29/2017 20:45	PATC-University Circle	0	1
11/30/2017 6:01	Unknown	0	0
11/30/2017 6:13	PATC-University Circle	11	2
11/30/2017 6:21	Galvez @ Alumni Center	2	0
11/30/2017 6:22	Serra @ Encina Hall	0	1
11/30/2017 6:24	Serra @ Manzanita Field	0	3
11/30/2017 6:27	Campus @ Munger	0	2
11/30/2017 6:31	Tresidder West	0	0
11/30/2017 6:33	Santa Teresa @ Lomita	0	1
11/30/2017 6:34	Via Ortega S at Roble Garage	0	1
11/30/2017 6:39	Quarry Ext @ Medical C	1	0
11/30/2017 6:48	PATC-University Circle	2	2
11/30/2017 6:51	Galvez @ El Camino Real	1	0
11/30/2017 6:54	Galvez @ Serra Mall	0	1
11/30/2017 6:59	Campus @ Mayfield N	1	0
11/30/2017 7:06	Tresidder West	1	1
11/30/2017 7:13	Quarry Ext @ Med School	0	2
11/30/2017 7:25	PATC-University Circle	24	0
11/30/2017 7:30	Galvez @ Alumni Center	1	4
11/30/2017 7:32	Galvez @ Serra Mall	0	11
11/30/2017 7:33	Serra @ Encina Hall	0	6
11/30/2017 7:34	Serra @ Manzanita Field	0	1
11/30/2017 7:37	Campus @ Wilbur Field	0	1
11/30/2017 7:38	Campus @ Mayfield N	0	1
11/30/2017 7:44	Tresidder West	1	3
11/30/2017 7:48	Via Ortega @ Y2E2	0	0
11/30/2017 7:52	Medical Center @ Quarry	1	0
11/30/2017 7:54	Quarry @ Psychiatry Lot	1	0
11/30/2017 8:10	PATC-University Circle	7	3
11/30/2017 8:14	Galvez @ El Camino Real	1	0
11/30/2017 8:17	Galvez @ Alumni Center	0	3
11/30/2017 8:18	Galvez @ Serra Mall	0	1
11/30/2017 8:19	Serra @ Encina Hall	0	1
11/30/2017 8:23	Campus @ Wilbur Field	0	1
11/30/2017 8:24	Campus @ Munger	1	0
11/30/2017 8:25	Campus @ Mayfield N	1	0
11/30/2017 8:28	Tresidder West	1	1
11/30/2017 8:32	Via Ortega @ Y2E2	0	1
11/30/2017 8:34	Roth @ Quarry Ext	0	1
11/30/2017 8:45	PATC-University Circle	32	1
11/30/2017 8:49	PATC-University Circle	1	0
11/30/2017 8:49	PATC-University Circle	1	0
11/30/2017 8:55	Galvez @ El Camino Real	2	0
11/30/2017 8:58	Galvez @ Alumni Center	0	14
11/30/2017 9:00	Galvez @ Memorial	0	2
11/30/2017 9:01	Galvez @ Serra Mall	0	11
11/30/2017 9:02	Serra @ Encina Hall	0	1
11/30/2017 9:04	Serra @ Manzanita Field	0	3
11/30/2017 9:06	Campus @ Escondido	1	0
11/30/2017 9:07	Campus @ Wilbur Field	0	2
11/30/2017 9:08	Campus @ Munger	0	5
11/30/2017 9:10	Tresidder West	0	2

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DateTime	StopName	Boardings	Alightings
11/30/2017 9:14	Via Ortega S at Roble Garage	1	0
11/30/2017 9:18	Quarry Ext @ Med School	0	1
11/30/2017 9:19	Medical Center @ Quarry	1	0
11/30/2017 9:30	PATC-University Circle	9	5
11/30/2017 9:34	Galvez @ El Camino Real	1	0
11/30/2017 9:36	Galvez @ Alumni Center	0	2
11/30/2017 9:37	Galvez @ Memorial	0	1
11/30/2017 9:38	Galvez @ Serra Mall	0	1
11/30/2017 9:38	Serra @ Encina Hall	0	2
11/30/2017 9:42	Campus @ Escondido	0	0
11/30/2017 9:43	Campus @ Wilbur Lot	1	0
11/30/2017 9:45	Campus @ Munger	1	0
11/30/2017 9:48	Tresidder West	0	0
11/30/2017 9:52	Via Ortega @ Y2E2	0	1
11/30/2017 9:55	Roth @ Quarry Ext	0	1
11/30/2017 9:56	Quarry Ext @ Medical C	1	0
11/30/2017 10:14	PATC-University Circle	17	2
11/30/2017 10:18	Galvez @ El Camino Real	3	0
11/30/2017 10:21	Galvez @ Alumni Center	0	2
11/30/2017 10:21	Galvez @ Memorial	0	7
11/30/2017 10:22	Galvez @ Serra Mall	0	2
11/30/2017 10:23	Serra @ Encina Hall	0	1
11/30/2017 10:27	Campus @ Escondido	2	0
11/30/2017 10:29	Campus @ Wilbur Field	0	1
11/30/2017 10:30	Campus @ Munger	0	2
11/30/2017 10:33	Tresidder West	1	3
11/30/2017 10:36	Santa Teresa @ New Guinea	0	1
11/30/2017 10:38	Via Ortega @ Y2E2	1	0
11/30/2017 10:40	Roth @ Quarry Ext	0	1
11/30/2017 10:43	Quarry @ Psychiatry Bld	0	1
11/30/2017 10:54	PATC-University Circle	7	3
11/30/2017 10:59	Galvez @ Alumni Center	0	2
11/30/2017 11:00	Galvez @ Memorial	1	2
11/30/2017 11:01	Galvez @ Serra Mall	0	1
11/30/2017 11:12	Tresidder West	0	0
11/30/2017 11:15	Via Ortega S at Roble Garage	1	0
11/30/2017 11:19	Roth @ Quarry Ext	0	1
11/30/2017 11:20	Quarry Ext @ Medical C	3	0
11/30/2017 11:34	PATC-University Circle	10	8
11/30/2017 11:38	Galvez @ El Camino Real	2	0
11/30/2017 11:40	Galvez @ Memorial	0	1
11/30/2017 11:41	Galvez @ Serra Mall	0	2
11/30/2017 11:42	Serra @ Encina Hall	0	3
11/30/2017 11:44	Campus @ Escondido	1	0
11/30/2017 11:45	Campus @ Wilbur Lot	1	0
11/30/2017 11:52	Tresidder West	2	2
11/30/2017 11:56	Via Ortega @ Cypress Lot	1	1
11/30/2017 11:58	Roth @ Quarry Ext	0	1
11/30/2017 11:59	Quarry Ext @ Medical C	2	0
11/30/2017 12:01	Quarry @ Psychiatry Lot	1	0
11/30/2017 12:13	PATC-University Circle	9	8
11/30/2017 12:17	Galvez @ El Camino Real	2	0
11/30/2017 12:19	Galvez @ Alumni Center	0	4
11/30/2017 12:20	Galvez @ Serra Mall	0	1
11/30/2017 12:23	Serra @ Manzanita Field	0	1
11/30/2017 12:24	Campus @ Escondido	4	1
11/30/2017 12:27	Campus @ Mayfield N	0	1
11/30/2017 12:31	Tresidder West	1	3
11/30/2017 12:34	Via Ortega S at Roble Garage	1	0
11/30/2017 12:36	Via Ortega @ Y2E2	3	3
11/30/2017 12:38	Roth @ Quarry Ext	0	2

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DateTime	StopName	Boardings	Alightings
11/30/2017 12:39	Quarry Ext @ Med School	1	0
11/30/2017 12:41	Quarry @ Psychiatry Lot	1	0
11/30/2017 12:54	PATC-University Circle	7	9
11/30/2017 12:57	El Camino @ PAMF SB	0	1
11/30/2017 12:58	Galvez @ El Camino Real	2	0
11/30/2017 13:00	Galvez @ Serra Mall	0	1
11/30/2017 13:01	Serra @ Encina Hall	0	1
11/30/2017 13:03	Serra @ Campus Dr	0	1
11/30/2017 13:05	Campus @ Wilbur Lot	1	0
11/30/2017 13:06	Campus @ Munger	0	1
11/30/2017 13:07	Campus @ Mayfield N	0	1
11/30/2017 13:11	Tresidder West	4	0
11/30/2017 13:12	Tresidder West	1	0
11/30/2017 13:16	Via Ortega @ Y2E2	2	2
11/30/2017 13:18	Roth @ Quarry Ext	0	2
11/30/2017 13:19	Quarry Ext @ Med School	3	0
11/30/2017 13:19	Quarry Ext @ Medical C	3	0
11/30/2017 13:23	Quarry @ Psychiatry Bld	0	1
11/30/2017 13:34	PATC-University Circle	5	12
11/30/2017 13:39	Galvez @ El Camino Real	0	0
11/30/2017 13:41	Galvez @ Alumni Center	0	2
11/30/2017 13:46	Campus @ Escondido	0	1
11/30/2017 13:48	Campus @ Mayfield N	0	1
11/30/2017 13:53	Tresidder West	2	0
11/30/2017 13:59	Via Ortega @ Y2E2	4	0
11/30/2017 14:01	Roth @ Quarry Ext	1	2
11/30/2017 14:02	Quarry Ext @ Med School	2	0
11/30/2017 14:03	Medical Center @ Quarry	4	0
11/30/2017 14:06	Quarry @ Psychiatry Lot	1	0
11/30/2017 14:08	Quarry @ Psychiatry Bld	0	5
11/30/2017 14:14	PATC-University Circle	8	8
11/30/2017 14:20	Galvez @ El Camino Real	2	0
11/30/2017 14:23	Galvez @ Serra Mall	0	3
11/30/2017 14:25	Serra @ Manzanita Field	0	1
11/30/2017 14:26	Campus @ Escondido	0	3
11/30/2017 14:28	Campus @ Wilbur Field	0	1
11/30/2017 14:32	Tresidder West	1	0
11/30/2017 14:35	Via Ortega S at Roble Garage	1	0
11/30/2017 14:36	Via Ortega @ Y2E2	4	0
11/30/2017 14:38	Roth @ Quarry Ext	1	1
11/30/2017 14:40	Quarry Ext @ Medical C	8	0
11/30/2017 14:42	Quarry @ Psychiatry Lot	3	0
11/30/2017 14:43	Quarry @ Psychiatry Bld	0	2
11/30/2017 14:54	PATC-University Circle	4	19
11/30/2017 15:01	Galvez @ Serra Mall	3	0
11/30/2017 15:02	Serra @ Encina Hall	0	1
11/30/2017 15:05	Campus @ Escondido	0	2
11/30/2017 15:07	Campus @ Munger	1	0
11/30/2017 15:08	Campus @ Mayfield N	0	1
11/30/2017 15:12	Tresidder West	2	1
11/30/2017 15:15	Via Ortega S at Roble Garage	1	0
11/30/2017 15:16	Via Ortega @ Y2E2	2	0
11/30/2017 15:19	Roth @ Quarry Ext	0	1
11/30/2017 15:20	Quarry Ext @ Med School	7	0
11/30/2017 15:22	Medical Center @ Quarry	3	0
11/30/2017 15:24	Quarry @ Psychiatry Lot	7	1
11/30/2017 15:25	Quarry @ Psychiatry Bld	0	2
11/30/2017 15:34	PATC-University Circle	1	23
11/30/2017 15:43	Serra @ Campus Dr	0	0
11/30/2017 15:45	Campus @ Escondido	2	0
11/30/2017 15:46	Campus @ Wilbur Field	0	1

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/30/2017 15:52	Tresidder West	2	1
11/30/2017 15:56	Via Ortega @ Y2E2	3	0
11/30/2017 15:57	Via Ortega @ Y2E2	1	0
11/30/2017 15:57	Via Ortega @ Y2E2	1	0
11/30/2017 16:00	Quarry Ext @ Med School	4	2
11/30/2017 16:01	Quarry Ext @ Medical C	6	0
11/30/2017 16:03	Quarry @ Psychiatry Lot	2	0
11/30/2017 16:04	Quarry @ Psychiatry Bld	1	0
11/30/2017 16:09	PATC-University Circle	5	18
11/30/2017 16:14	PATC-University Circle	4	1
11/30/2017 16:20	Galvez @ El Camino Real	2	0
11/30/2017 16:22	Galvez @ Alumni Center	1	2
11/30/2017 16:23	Galvez @ Memorial	0	1
11/30/2017 16:24	Galvez @ Serra Mall	0	1
11/30/2017 16:27	Campus @ Escondido	0	3
11/30/2017 16:28	Campus @ Wilbur Lot	1	0
11/30/2017 16:29	Campus @ Munger	0	2
11/30/2017 16:32	Tresidder West	1	0
11/30/2017 16:35	Santa Teresa @ Lomita	3	1
11/30/2017 16:36	Via Ortega S at Roble Garage	0	1
11/30/2017 16:38	Via Ortega @ Y2E2	2	1
11/30/2017 16:42	Quarry Ext @ Med School	3	0
11/30/2017 16:42	Medical Center @ Quarry	1	0
11/30/2017 16:43	Medical Center @ Quarry	1	0
11/30/2017 16:44	Quarry @ Psychiatry Lot	0	0
11/30/2017 16:46	Quarry @ Psychiatry Bld	0	1
11/30/2017 16:54	PATC-University Circle	3	11
11/30/2017 17:00	Galvez @ El Camino Real	3	0
11/30/2017 17:03	Galvez @ Serra Mall	1	0
11/30/2017 17:07	Campus @ Escondido	0	2
11/30/2017 17:09	Campus @ Munger	0	1
11/30/2017 17:13	Tresidder West	3	2
11/30/2017 17:15	Santa Teresa @ Lomita	1	0
11/30/2017 17:16	Via Ortega S at Roble Garage	1	0
11/30/2017 17:18	Via Ortega @ Y2E2	5	0
11/30/2017 17:22	Quarry Ext @ Med School	16	0
11/30/2017 17:23	Quarry Ext @ Medical C	8	0
11/30/2017 17:25	Quarry @ Psychiatry Lot	2	0
11/30/2017 17:25	Quarry @ Psychiatry Lot	1	0
11/30/2017 17:27	Quarry @ Psychiatry Bld	0	1
11/30/2017 17:35	Caltrain Platform South	5	38
11/30/2017 17:36	PATC-University Circle	0	0
11/30/2017 17:43	Galvez @ El Camino Real	1	0
11/30/2017 17:46	Galvez @ Memorial	0	1
11/30/2017 17:50	Campus @ Escondido	0	1
11/30/2017 17:55	Tresidder West	2	1
11/30/2017 17:59	Via Ortega S at Roble Garage	7	0
11/30/2017 18:01	Via Ortega @ Y2E2	0	1
11/30/2017 18:04	Roth @ Quarry Ext	0	1
11/30/2017 18:05	Quarry Ext @ Med School	2	1
11/30/2017 18:06	Quarry Ext @ Medical C	3	0
11/30/2017 18:08	Quarry @ Psychiatry Lot	1	0
11/30/2017 18:09	Quarry @ Psychiatry Bld	0	0
11/30/2017 18:17	PATC-University Circle	3	15
11/30/2017 18:21	Galvez @ El Camino Real	1	0
11/30/2017 18:24	Galvez @ Memorial	0	0
11/30/2017 18:24	Galvez @ Serra Mall	0	1
11/30/2017 18:26	Serra @ Manzanita Field	0	1
11/30/2017 18:28	Campus @ Munger	0	2
11/30/2017 18:32	Tresidder West	3	0
11/30/2017 18:34	Santa Teresa @ Lomita	4	0

Start Date:11/01/2017 12:00 AM End Date:12/01/2017 12:00 AM

DateTime	StopName	Boardings	Alightings
11/30/2017 18:35	Via Ortega S at Roble Garage	1	0
11/30/2017 18:36	Via Ortega @ Y2E2	3	0
11/30/2017 18:38	Roth @ Quarry Ext	2	0
11/30/2017 18:39	Quarry Ext @ Med School	6	0
11/30/2017 18:40	Quarry Ext @ Medical C	4	2
11/30/2017 18:42	Quarry @ Psychiatry Lot	0	0
11/30/2017 18:43	Quarry @ Psychiatry Bld	1	4
11/30/2017 18:54	PATC-University Circle	4	3
11/30/2017 18:55	PATC-University Circle	0	0
11/30/2017 18:57	El Camino @ PAMF NB	0	0
11/30/2017 19:04	Campus @ Escondido	1	0
11/30/2017 19:11	Tresidder West	4	1
11/30/2017 19:14	Santa Teresa @ Lomita	0	1
11/30/2017 19:15	Santa Teresa @ West Res	1	1
11/30/2017 19:17	Via Ortega @ Y2E2	4	0
11/30/2017 19:19	Roth @ Quarry Ext	2	0
11/30/2017 19:20	Quarry Ext @ Med School	3	0
11/30/2017 19:20	Medical Center @ Quarry	3	0
11/30/2017 19:21	Medical Center @ Quarry	2	0
11/30/2017 19:22	Quarry @ Psychiatry Lot	0	0
11/30/2017 19:23	Quarry @ Psychiatry Bld	0	2
11/30/2017 19:35	PATC-University Circle	5	22
11/30/2017 19:44	Campus @ Escondido	1	5
11/30/2017 19:51	Tresidder West	2	1
11/30/2017 19:52	Tresidder East	1	0
11/30/2017 19:54	Santa Teresa @ Lomita	1	0
11/30/2017 19:59	Quarry Ext @ Med School	3	0
11/30/2017 20:00	Medical Center @ Quarry	5	0
11/30/2017 20:02	Quarry @ Psychiatry Bld	0	3
11/30/2017 20:14	PATC-University Circle	2	10
11/30/2017 20:19	Galvez @ El Camino Real	2	0
11/30/2017 20:24	Campus @ Escondido	0	1
11/30/2017 20:26	Campus @ Munger	0	1
11/30/2017 20:33	Tresidder West	1	2
11/30/2017 20:39	Roth @ Quarry Ext	1	0
11/30/2017 20:39	Quarry Ext @ Med School	1	0
11/30/2017 20:41	Quarry @ Psychiatry Lot	1	0
11/30/2017 20:42	Quarry @ Psychiatry Bld	0	2
11/30/2017 20:46	PATC-University Circle	0	1

Attachment M

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 101			Train 103			Train 305			Train 207			Train 309			Train 211		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamien	0	0	0	14	0	14	0	0	0	22	0	22	139	0	139	0	0	0
San Jose Diridon	19	0	19	22	0	36	181	0	181	22	1	43	138	2	276	68	0	68
College Park	0	0	19	0	0	36	0	0	181	0	0	43	0	0	276	0	0	68
Santa Clara	5	0	25	7	0	42	0	0	181	22	1	64	0	0	276	40	0	108
Lawrence	3	1	27	9	0	51	0	0	181	21	4	81	0	0	276	0	0	108
Sunnyvale	12	0	39	16	2	66	0	0	181	39	2	118	178	4	451	48	3	153
Mountain View	4	1	43	8	0	74	88	3	266	61	6	173	0	0	451	26	7	173
San Antonio	2	0	45	3	1	76	0	0	266	35	3	204	0	0	451	0	0	173
California Ave.	3	2	45	6	4	78	0	0	266	28	7	226	0	0	451	0	0	173
Palo Alto	6	5	46	5	20	63	52	42	276	28	44	209	62	123	389	0	0	173
Menlo Park	2	2	46	7	3	67	0	0	276	54	15	248	0	0	389	6	39	140
Redwood City	16	4	58	21	4	83	0	0	276	92	14	326	93	19	463	22	22	139
San Carlos	5	2	62	10	3	91	0	0	276	0	0	326	0	0	463	28	24	143
Belmont	3	1	64	10	1	100	0	0	276	0	0	326	0	0	463	21	15	150
Hillsdale	12	1	75	17	2	115	63	11	328	111	17	419	0	0	463	18	5	163
Hayward Park	3	0	78	5	1	119	0	0	328	0	0	419	0	0	463	14	4	174
San Mateo	8	1	85	11	1	129	0	0	328	0	0	419	56	7	511	38	10	202
Burlingame	7	3	89	19	1	147	0	0	328	0	0	419	0	0	511	44	11	235
Millbrae	3	16	77	9	29	126	16	41	303	20	53	386	21	60	472	8	48	195
San Bruno	6	2	81	17	6	138	0	0	303	0	0	386	0	0	472	30	13	212
South SF	2	2	80	5	6	136	0	0	303	17	26	377	0	0	472	9	15	206
Bayshore	0	1	79	0	4	133	0	0	303	0	0	377	0	0	472	7	11	203
22nd Street	0	4	76	1	13	121	0	0	303	0	0	377	0	0	472	1	19	185
San Francisco	0	76	0	0	121	0	0	303	0	0	377	0	0	472	0	0	185	0
TOTAL	122	122		222	222		400	400		570	570		687	687		431	431	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 313			Train 215			Train 217			Train 319			Train 221			Train 323		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	70	0	70	0	0	0	45	0	45	0	0	0
San Martin	0	0	0	0	0	0	25	0	94	0	0	0	16	0	61	0	0	0
Morgan Hill	0	0	0	0	0	0	57	0	151	0	0	0	42	0	102	0	0	0
Blossom Hill	0	0	0	0	0	0	27	0	177	0	0	0	27	1	129	0	0	0
Capitol	0	0	0	0	0	0	14	1	190	0	0	0	15	1	143	0	0	0
Tamien	0	0	0	0	0	0	28	83	134	419	0	419	48	13	177	0	0	0
San Jose Diridon	460	0	460	143	0	143	33	8	160	280	0	699	81	13	246	518	0	518
College Park	0	0	460	0	0	143	0	0	160	0	0	699	0	0	246	0	0	518
Santa Clara	0	0	460	0	0	143	74	8	226	0	0	699	90	10	326	0	0	518
Lawrence	0	0	460	0	0	143	61	18	269	0	0	699	37	20	343	0	0	518
Sunnyvale	0	0	460	229	2	369	127	7	389	317	14	1002	112	18	438	0	0	518
Mountain View	268	13	715	55	5	419	139	36	491	0	0	1002	74	41	471	357	26	849
San Antonio	0	0	715	0	0	419	125	14	602	0	0	1002	0	0	471	0	0	849
California Ave.	0	0	715	47	26	441	70	40	632	0	0	1002	0	0	471	0	0	849
Palo Alto	109	183	641	63	92	412	74	137	569	96	321	777	0	0	471	179	222	807
Menlo Park	0	0	641	0	0	412	122	38	653	0	0	777	36	110	397	0	0	807
Redwood City	0	0	641	0	0	412	170	26	797	164	90	851	48	76	370	0	0	807
San Carlos	0	0	641	92	31	474	0	0	797	0	0	851	56	39	386	0	0	807
Belmont	0	0	641	0	0	474	0	0	797	0	0	851	52	24	414	0	0	807
Hillsdale	129	26	744	101	21	554	182	63	916	0	0	851	43	36	421	192	79	919
Hayward Park	0	0	744	0	0	554	0	0	916	0	0	851	27	31	417	0	0	919
San Mateo	0	0	744	90	19	625	0	0	916	70	45	877	62	38	441	0	0	919
Burlingame	0	0	744	83	12	696	0	0	916	0	0	877	55	19	477	0	0	919
Millbrae	48	86	706	0	0	696	34	102	848	42	97	822	16	122	371	54	79	893
San Bruno	0	0	706	39	21	714	0	0	848	0	0	822	27	18	380	16	21	888
South SF	0	0	706	0	0	714	18	62	805	0	0	822	16	29	367	0	0	888
Bayshore	0	0	706	0	0	714	0	0	805	0	0	822	15	10	373	0	0	888
22nd Street	0	0	706	0	0	714	0	0	805	0	0	822	4	42	334	0	0	888
San Francisco	0	706	0	0	714	0	0	805	0	0	822	0	0	334	0	0	888	0
TOTAL	1015	1015		941	941		1449	1449		1389	1389		1045	1045		1316	1316	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 225			Train 227			Train 329			Train 231			Train 233			Train 135		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	58	0	58	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	28	1	86	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	84	0	169	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	53	2	220	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	27	0	247	0	0	0	0	0	0	0	0	0	0	0	0
Tamien	0	0	0	19	65	201	377	0	377	0	0	0	112	0	112	0	0	0
San Jose Diridon	171	0	171	33	22	213	316	1	692	182	0	182	184	0	296	156	0	156
College Park	0	0	171	3	38	178	0	0	692	0	0	182	0	0	296	0	0	156
Santa Clara	0	0	171	53	14	216	0	0	692	99	1	281	66	2	360	71	1	226
Lawrence	0	0	171	64	34	247	0	0	692	0	0	281	74	10	424	46	4	268
Sunnyvale	310	8	473	109	14	341	388	26	1054	172	11	442	196	28	592	150	12	407
Mountain View	108	15	566	153	34	461	0	0	1054	104	27	519	143	48	686	111	24	494
San Antonio	0	0	566	104	18	547	0	0	1054	0	0	519	63	20	730	47	9	532
California Ave.	87	56	596	77	59	565	0	0	1054	0	0	519	59	74	715	27	54	505
Palo Alto	63	110	549	65	127	503	82	298	838	0	0	519	74	231	558	37	152	390
Menlo Park	0	0	549	59	42	521	0	0	838	24	96	447	31	30	560	15	25	379
Redwood City	0	0	549	84	40	564	186	112	912	32	100	379	65	73	552	37	72	344
San Carlos	76	37	588	0	0	564	0	0	912	24	36	367	26	20	558	8	14	338
Belmont	0	0	588	0	0	564	0	0	912	32	17	382	22	12	568	14	4	349
Hillsdale	121	39	670	117	33	648	0	0	912	47	44	385	59	32	595	25	18	356
Hayward Park	0	0	670	0	0	648	0	0	912	24	16	394	0	0	595	6	8	354
San Mateo	98	33	734	0	0	648	81	37	956	53	32	414	47	31	612	25	20	360
Burlingame	89	14	810	0	0	648	0	0	956	34	17	431	22	13	621	13	14	359
Millbrae	0	0	810	30	68	610	44	83	917	22	43	411	21	51	591	10	53	316
San Bruno	32	19	823	0	0	610	0	0	917	18	12	416	11	13	589	8	8	316
South SF	0	0	823	16	32	594	0	0	917	11	12	415	0	0	589	4	5	315
Bayshore	0	0	823	0	0	594	0	0	917	9	6	418	0	0	589	2	3	314
22nd Street	0	0	823	0	0	594	0	0	917	2	21	399	0	0	589	0	20	295
San Francisco	0	823	0	0	594	0	0	917	0	0	399	0	0	589	0	0	295	0
TOTAL	1155	1155		1237	1237		1474	1474		889	889		1276	1276		814	814	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 237			Train 139			Train 241			Train 143			Train 245			Train 147		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamien	40	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Jose Diridon	89	2	127	71	0	71	0	0	0	79	0	79	0	0	0	64	0	64
College Park	0	0	127	0	0	71	0	0	0	0	0	79	0	0	0	0	0	64
Santa Clara	35	1	161	19	2	89	0	0	0	23	1	101	0	0	0	21	0	85
Lawrence	35	3	192	19	2	106	0	0	0	10	2	109	0	0	0	9	1	93
Sunnyvale	93	8	277	56	4	158	0	0	0	50	3	156	0	0	0	35	2	126
Mountain View	79	15	341	40	6	191	0	0	0	42	9	189	0	0	0	35	5	156
San Antonio	28	3	366	17	3	205	0	0	0	16	5	200	0	0	0	16	3	169
California Ave.	18	24	361	16	17	204	0	0	0	19	7	213	0	0	0	21	5	185
Palo Alto	35	91	304	31	57	178	0	0	0	45	46	213	0	0	0	55	32	208
Menlo Park	17	14	308	14	10	181	0	0	0	13	10	215	0	0	0	18	8	218
Redwood City	37	43	301	28	21	189	0	0	0	33	16	233	0	0	0	42	22	238
San Carlos	10	8	303	10	3	195	0	0	0	9	4	238	0	0	0	9	7	240
Belmont	11	4	310	8	4	200	0	0	0	11	5	244	0	0	0	13	11	242
Hillsdale	20	11	319	15	5	210	0	0	0	18	7	256	0	0	0	19	13	249
Hayward Park	0	0	319	4	3	211	0	0	0	4	4	256	0	0	0	6	3	251
San Mateo	15	13	320	12	8	215	0	0	0	20	13	263	0	0	0	22	10	263
Burlingame	10	6	324	10	5	219	0	0	0	8	8	263	0	0	0	10	14	260
Millbrae	5	42	287	6	46	180	0	0	0	4	49	218	0	0	0	5	55	210
San Bruno	3	5	286	7	3	184	0	0	0	4	7	214	0	0	0	6	6	209
South SF	0	0	286	5	4	185	0	0	0	2	4	212	0	0	0	3	3	209
Bayshore	0	0	286	0	2	183	0	0	0	1	6	207	0	0	0	1	4	206
22nd Street	0	0	286	0	17	166	0	0	0	0	11	197	0	0	0	0	12	195
San Francisco	0	286	0	0	166	0	0	0	0	0	197	0	0	0	0	0	195	0
TOTAL	579	579		388	388		0	0		412	412		0	0		410	410	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 249			Train 151			Train 253			Train 155			Train 257			Train 159		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamien	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0
San Jose Diridon	0	0	0	71	0	71	0	0	0	53	0	53	30	0	34	42	0	42
College Park	0	0	0	0	0	71	0	0	0	0	0	53	0	0	34	45	0	87
Santa Clara	0	0	0	39	1	109	0	0	0	18	0	71	11	1	44	12	1	98
Lawrence	0	0	0	15	2	123	0	0	0	10	2	79	9	0	52	8	5	102
Sunnyvale	0	0	0	34	4	152	0	0	0	26	3	101	23	1	74	18	6	114
Mountain View	0	0	0	37	3	186	0	0	0	52	5	148	43	1	115	56	14	157
San Antonio	0	0	0	14	3	197	0	0	0	11	3	157	12	1	126	11	6	162
California Ave.	0	0	0	17	6	209	0	0	0	18	5	170	20	2	144	30	5	188
Palo Alto	0	0	0	70	22	257	0	0	0	85	20	234	65	14	195	115	22	281
Menlo Park	0	0	0	27	10	274	0	0	0	26	8	252	27	9	213	48	15	313
Redwood City	0	0	0	38	19	293	0	0	0	44	24	272	26	16	222	44	26	330
San Carlos	0	0	0	10	7	297	0	0	0	13	9	276	7	12	217	19	22	327
Belmont	0	0	0	13	8	301	0	0	0	14	7	282	11	7	221	9	13	324
Hillsdale	0	0	0	20	29	292	0	0	0	20	19	283	15	12	224	37	27	333
Hayward Park	0	0	0	4	6	290	0	0	0	14	11	286	0	0	224	8	14	327
San Mateo	0	0	0	17	15	292	0	0	0	18	21	284	9	20	213	21	34	315
Burlingame	0	0	0	10	12	291	0	0	0	17	16	285	8	10	211	12	31	296
Millbrae	0	0	0	4	61	234	0	0	0	8	66	227	4	49	166	9	79	226
San Bruno	0	0	0	7	11	229	0	0	0	5	17	215	3	10	159	6	23	209
South SF	0	0	0	3	4	228	0	0	0	8	8	215	0	0	159	9	9	209
Bayshore	0	0	0	0	7	221	0	0	0	2	9	208	0	0	159	1	19	190
22nd Street	0	0	0	0	17	204	0	0	0	4	24	188	0	0	159	0	39	151
San Francisco	0	0	0	0	204	0	0	0	0	0	188	0	0	159	0	0	151	0
TOTAL	0	0		451	451		0	0		464	464		325	325		561	561	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 261			Train 263			Train 365			Train 267			Train 269			Train 371		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamien	2	0	2	3	0	3	0	0	0	0	0	0	3	0	3	0	0	0
San Jose Diridon	49	0	52	31	0	35	69	0	69	23	0	23	13	0	16	63	0	63
College Park	0	0	52	0	0	35	0	0	69	0	0	23	0	0	16	0	0	63
Santa Clara	16	0	68	27	1	61	0	0	69	0	0	23	25	0	41	0	0	63
Lawrence	25	1	92	0	0	61	0	0	69	67	1	90	23	1	63	0	0	63
Sunnyvale	56	2	146	0	0	61	0	0	69	0	0	90	90	4	149	0	0	63
Mountain View	96	4	238	0	0	61	204	7	267	127	1	216	62	5	205	171	11	223
San Antonio	40	4	274	0	0	61	0	0	267	0	0	216	76	14	267	0	0	223
California Ave.	91	6	359	0	0	61	0	0	267	0	0	216	214	13	468	0	0	223
Palo Alto	238	21	577	135	8	188	218	10	475	206	16	406	216	25	660	315	14	524
Menlo Park	52	16	613	0	0	188	71	14	532	37	12	431	62	22	700	0	0	524
Redwood City	91	50	654	51	16	222	139	34	637	0	0	431	206	86	820	0	0	524
San Carlos	42	43	653	21	13	230	0	0	637	37	41	428	47	72	795	0	0	524
Belmont	0	0	653	21	23	228	0	0	637	0	0	428	0	0	795	0	0	524
Hillsdale	0	0	653	43	46	225	0	0	637	62	101	389	0	0	795	58	63	518
Hayward Park	0	0	653	24	15	234	0	0	637	0	0	389	0	0	795	0	0	518
San Mateo	36	67	623	22	20	236	0	0	637	36	58	366	55	110	740	0	0	518
Burlingame	0	0	623	16	29	223	0	0	637	17	50	333	0	0	740	0	0	518
Millbrae	13	169	467	9	72	160	19	160	496	0	0	333	11	165	586	9	161	367
San Bruno	0	0	467	7	23	144	0	0	496	6	41	298	0	0	586	0	0	367
South SF	0	0	467	23	11	156	0	0	496	0	0	298	0	0	586	0	0	367
Bayshore	0	0	467	1	22	135	0	0	496	0	0	298	0	0	586	0	0	367
22nd Street	6	124	350	1	24	112	3	143	356	7	82	223	7	159	434	8	112	263
San Francisco	0	350	0	0	112	0	0	356	0	0	223	0	0	434	0	0	263	0
TOTAL	856	856		435	435		723	723		625	625		1109	1109		624	624	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 273			Train 375			Train 277			Train 279			Train 381			Train 283		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamien	4	0	4	0	0	0	0	0	0	5	0	5	0	0	0	4	0	4
San Jose Diridon	63	0	66	105	0	105	45	0	45	32	3	34	72	0	72	46	1	48
College Park	0	0	66	0	0	105	0	0	45	0	0	34	0	0	72	0	0	48
Santa Clara	50	1	115	0	0	105	0	0	45	26	9	51	0	0	72	31	4	76
Lawrence	0	0	115	0	0	105	104	3	146	28	2	77	0	0	72	0	0	76
Sunnyvale	0	0	115	0	0	105	0	0	146	72	6	144	0	0	72	0	0	76
Mountain View	0	0	115	325	14	416	194	6	334	58	9	193	163	6	229	0	0	76
San Antonio	0	0	115	0	0	416	0	0	334	58	16	236	0	0	229	0	0	76
California Ave.	0	0	115	0	0	416	0	0	334	133	20	348	0	0	229	0	0	76
Palo Alto	174	18	271	244	28	632	189	20	503	134	20	462	202	12	419	94	14	156
Menlo Park	0	0	271	52	20	664	47	21	528	50	23	489	0	0	419	0	0	156
Redwood City	76	32	314	139	56	747	0	0	528	113	71	532	0	0	419	46	20	182
San Carlos	27	23	318	0	0	747	33	58	503	30	41	520	0	0	419	14	12	184
Belmont	23	50	291	0	0	747	0	0	503	0	0	520	0	0	419	13	26	171
Hillsdale	43	59	275	0	0	747	44	92	455	0	0	520	28	54	393	27	41	158
Hayward Park	27	27	275	0	0	747	0	0	455	0	0	520	0	0	393	13	10	161
San Mateo	27	32	269	0	0	747	42	84	413	27	66	482	0	0	393	12	15	158
Burlingame	18	35	252	0	0	747	15	57	372	0	0	482	0	0	393	13	29	142
Millbrae	9	77	184	16	158	605	0	0	372	6	98	389	12	114	292	6	44	104
San Bruno	10	30	163	0	0	605	5	42	335	0	0	389	0	0	292	3	18	89
South SF	22	14	171	0	0	605	0	0	335	0	0	389	0	0	292	8	9	87
Bayshore	1	28	145	0	0	605	0	0	335	0	0	389	0	0	292	0	15	72
22nd Street	1	27	118	5	170	440	0	104	231	1	119	271	3	90	205	0	15	57
San Francisco	0	118	0	0	440	0	0	231	0	0	271	0	0	205	0	0	57	0
TOTAL	572	572		886	886		718	718		774	774		480	480		330	330	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 385			Train 287			Train 289			Train 191			Train 193			Train 195		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamien	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	2	0	2
San Jose Diridon	78	0	78	27	0	29	36	0	36	24	0	24	51	0	51	63	0	65
College Park	0	0	78	0	0	29	0	0	36	0	0	24	0	0	51	0	0	65
Santa Clara	0	0	78	0	0	29	0	0	36	17	1	40	11	2	60	19	1	83
Lawrence	0	0	78	42	6	65	13	1	48	6	2	45	8	1	67	9	1	91
Sunnyvale	0	0	78	0	0	65	0	0	48	33	4	74	17	3	81	22	2	111
Mountain View	209	11	276	80	8	137	73	6	115	20	5	89	65	6	140	45	6	150
San Antonio	0	0	276	0	0	137	0	0	115	25	7	107	10	4	146	10	4	156
California Ave.	0	0	276	0	0	137	61	6	169	23	2	128	36	4	178	30	4	182
Palo Alto	179	16	439	108	9	236	106	9	266	47	11	164	113	7	284	101	8	275
Menlo Park	30	12	457	19	12	243	17	8	275	8	6	166	20	13	291	20	7	288
Redwood City	74	29	502	0	0	243	58	34	298	18	18	165	37	28	301	31	25	294
San Carlos	0	0	502	15	20	238	10	11	297	7	6	166	9	13	296	9	8	294
Belmont	0	0	502	0	0	238	0	0	297	6	13	159	7	10	293	5	10	290
Hillsdale	0	0	502	17	42	213	18	22	293	8	12	155	13	20	286	11	14	287
Hayward Park	0	0	502	0	0	213	0	0	293	6	6	155	5	6	284	4	4	288
San Mateo	0	0	502	16	34	195	10	24	279	8	16	148	14	19	279	10	19	278
Burlingame	0	0	502	10	22	182	3	19	262	6	8	146	7	11	275	9	12	275
Millbrae	9	85	426	0	0	182	4	55	211	4	32	118	4	52	227	2	51	226
San Bruno	0	0	426	1	15	169	0	0	211	3	9	113	2	11	218	3	18	211
South SF	0	0	426	0	0	169	0	0	211	3	5	111	1	3	216	2	4	209
Bayshore	0	0	426	0	0	169	0	0	211	1	11	100	0	8	208	0	9	200
22nd Street	2	132	296	0	44	125	2	52	160	0	23	77	1	49	160	0	41	160
San Francisco	0	296	0	0	125	0	0	160	0	0	77	0	0	160	0	0	160	0
TOTAL	581	581		336	336		410	410		273	273		430	430		407	407	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
NORTHBOUND PASSENGERS

Avg Weekday Passengers	Train 197			Train 199			TOTAL		
	On	Off	On Board	On	Off	On Board	On	Off	On Board
Gilroy	0	0	0	0	0	0	173	0	173
San Martin	0	0	0	0	0	0	69	2	241
Morgan Hill	0	0	0	0	0	0	182	0	422
Blossom Hill	0	0	0	0	0	0	107	2	527
Capitol	0	0	0	0	0	0	55	2	579
Tamien	2	0	2	0	0	0	1249	161	1667
San Jose Diridon	36	0	37	32	0	32	4468	54	6081
College Park	0	0	37	0	0	32	48	38	6091
Santa Clara	17	0	54	11	0	44	957	61	6987
Lawrence	8	1	61	3	1	46	767	128	7626
Sunnyvale	16	3	74	7	2	51	3050	209	10467
Mountain View	25	3	95	23	3	71	4024	455	14036
San Antonio	6	3	99	3	3	71	732	145	14623
California Ave.	13	3	109	6	3	74	1171	453	15341
Palo Alto	52	7	155	35	6	103	4602	2689	17254
Menlo Park	7	6	156	4	4	103	1043	681	17616
Redwood City	25	14	167	13	12	104	2436	1365	18687
San Carlos	13	5	175	2	3	104	728	646	18768
Belmont	3	5	174	2	4	102	324	273	18820
Hillsdale	6	13	167	3	7	98	1781	1135	19466
Hayward Park	3	4	166	1	3	96	204	176	19494
San Mateo	9	14	161	6	4	98	1102	991	19604
Burlingame	5	8	158	1	6	93	572	492	19685
Millbrae	3	35	127	1	14	80	582	3018	17249
San Bruno	2	6	123	1	9	72	286	436	17099
South SF	4	4	122	0	4	68	190	275	17014
Bayshore	1	5	118	0	3	65	44	183	16874
22nd Street	1	21	98	0	11	54	60	1779	15156
San Francisco	0	98	0	0	54	0	0	15156	0
TOTAL	257	257		155	155		31006	31006	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 102			Train 104			Train 206			Train 208			Train 210			Train 312		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	18	0	18	16	0	16	104	0	104	42	0	42	175	0	175	202	0	202
22nd Street	6	0	24	9	0	25	51	0	155	13	0	55	98	0	273	106	1	307
Bayshore	7	0	31	7	0	32	0	0	155	19	0	74	0	0	273	0	0	307
South SF	4	0	35	6	0	38	0	0	155	12	3	83	0	0	273	0	0	307
San Bruno	5	0	40	6	1	43	0	0	155	24	2	104	0	0	273	0	0	307
Millbrae	6	2	45	28	0	71	58	2	211	62	4	162	93	1	365	127	3	431
Burlingame	6	1	50	6	1	77	17	2	226	21	1	182	0	0	365	0	0	431
San Mateo	2	0	52	13	1	89	21	6	242	22	6	198	107	11	461	0	0	431
Hayward Park	3	1	54	7	2	94	0	0	242	27	11	214	0	0	461	0	0	431
Hillsdale	11	1	64	11	2	103	32	10	265	43	11	245	0	0	461	0	0	431
Belmont	4	1	67	8	2	108	0	0	265	33	9	269	0	0	461	0	0	431
San Carlos	8	2	72	6	5	110	20	10	274	27	17	280	35	33	463	0	0	431
Redwood City	7	6	73	12	12	110	22	29	268	32	47	265	40	46	457	50	99	382
Menlo Park	5	3	75	7	7	110	11	14	265	0	0	265	33	79	411	17	37	362
Palo Alto	4	28	51	4	51	63	9	106	169	11	198	77	26	153	284	10	176	196
California Ave.	2	5	49	2	9	56	5	28	146	0	0	77	13	76	221	0	0	196
San Antonio	1	1	49	3	8	50	0	0	146	0	0	77	18	37	202	0	0	196
Mountain View	2	12	38	2	18	35	4	83	67	0	0	77	23	60	165	7	133	69
Sunnyvale	1	6	33	2	10	26	0	0	67	0	0	77	10	49	126	0	0	69
Lawrence	1	2	32	1	4	24	3	31	38	0	0	77	9	27	108	0	0	69
Santa Clara	0	8	24	0	7	18	0	0	38	4	31	51	0	14	94	0	0	69
College Park	0	0	24	0	0	18	0	0	38	0	0	51	0	79	16	0	0	69
San Jose Diridc	0	24	0	0	14	4	0	38	0	1	48	4	0	14	3	0	69	0
Tamien	0	0	0	0	4	0	0	0	0	0	4	0	0	3	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	105	105		156	156		359	359		392	392		681	681		518	518	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 314			Train 216			Train 218			Train 220			Train 322			Train 324		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	252	0	252	162	0	162	84	0	84	380	0	380	385	0	385	386	0	386
22nd Street	123	1	375	69	0	231	29	0	113	160	0	539	140	1	523	158	3	541
Bayshore	0	0	375	0	0	231	29	1	142	0	0	539	0	0	523	0	0	541
South SF	0	0	375	0	0	231	17	22	137	0	0	539	0	0	523	0	0	541
San Bruno	0	0	375	47	5	273	26	3	160	0	0	539	0	0	523	0	0	541
Millbrae	94	6	463	0	0	273	80	4	236	103	12	631	119	8	634	118	12	647
Burlingame	0	0	463	66	9	330	43	6	272	0	0	631	0	0	634	0	0	647
San Mateo	0	0	463	74	14	390	37	15	294	86	37	681	0	0	634	0	0	647
Hayward Park	0	0	463	0	0	390	22	19	298	0	0	681	0	0	634	0	0	647
Hillsdale	107	76	494	79	31	438	56	25	329	0	0	681	0	0	634	87	84	650
Belmont	0	0	494	0	0	438	44	20	354	0	0	681	0	0	634	0	0	650
San Carlos	0	0	494	59	29	467	34	14	374	46	41	686	0	0	634	0	0	650
Redwood City	0	0	494	0	0	467	60	83	351	73	95	665	58	172	521	0	0	650
Menlo Park	0	0	494	33	73	426	0	0	351	21	56	630	16	51	485	0	0	650
Palo Alto	12	253	252	15	193	248	11	261	101	43	188	485	13	239	259	10	324	335
California Ave.	0	0	252	0	0	248	0	0	101	23	194	314	0	0	259	0	0	335
San Antonio	0	0	252	0	0	248	0	0	101	13	69	258	0	0	259	0	0	335
Mountain View	5	182	75	12	121	139	0	0	101	6	122	143	11	186	84	5	280	61
Sunnyvale	0	0	75	0	0	139	0	0	101	6	82	67	0	0	84	0	0	61
Lawrence	0	0	75	5	95	49	0	0	101	2	41	28	0	0	84	0	0	61
Santa Clara	0	0	75	0	0	49	1	56	46	0	13	15	0	0	84	0	0	61
College Park	0	0	75	0	0	49	0	0	46	0	0	15	0	0	84	0	0	61
San Jose Diridc	0	75	0	0	49	0	1	45	3	0	14	2	0	84	0	0	61	0
Tamien	0	0	0	0	0	0	0	3	0	0	2	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	593	593		621	621		575	575		964	964		742	742		763	763	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 226			Train 228			Train 230			Train 332			Train 134			Train 236		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	211	0	211	133	0	133	376	0	376	375	0	375	146	0	146	245	0	245
22nd Street	70	0	281	31	1	164	114	2	487	142	0	516	39	0	185	0	0	245
Bayshore	0	0	281	27	2	188	0	0	487	0	0	516	21	2	205	0	0	245
South SF	0	0	281	10	26	173	0	0	487	0	0	516	10	13	202	0	0	245
San Bruno	38	12	308	16	5	184	0	0	487	0	0	516	16	5	213	17	4	257
Millbrae	0	0	308	83	5	262	72	11	549	87	12	591	33	5	242	74	3	328
Burlingame	43	22	328	21	12	270	0	0	549	0	0	591	19	11	250	12	10	329
San Mateo	62	31	359	21	19	272	43	57	535	0	0	591	26	25	251	18	31	317
Hayward Park	0	0	359	16	20	269	0	0	535	0	0	591	9	19	241	0	0	317
Hillsdale	52	21	390	22	28	262	0	0	535	0	0	591	37	41	237	16	21	311
Belmont	0	0	390	33	19	276	0	0	535	0	0	591	12	9	240	10	8	313
San Carlos	35	36	389	19	19	276	14	25	524	0	0	591	11	11	240	6	13	306
Redwood City	0	0	389	39	73	241	37	91	470	35	147	479	26	35	231	15	56	265
Menlo Park	28	56	361	0	0	241	13	40	443	9	36	452	7	19	219	7	23	250
Palo Alto	12	143	230	6	179	68	42	143	343	11	196	267	8	89	137	11	117	144
California Ave.	0	0	230	0	0	68	9	128	223	0	0	267	2	42	98	4	28	119
San Antonio	0	0	230	0	0	68	8	46	186	0	0	267	1	8	91	1	14	107
Mountain View	2	142	90	0	0	68	5	103	87	5	210	62	3	45	49	6	46	67
Sunnyvale	0	0	90	0	0	68	1	44	44	0	0	62	1	21	30	1	16	52
Lawrence	2	64	27	0	0	68	1	18	27	0	0	62	1	8	23	1	8	44
Santa Clara	0	0	27	2	40	30	1	12	15	0	0	62	0	10	13	0	14	30
College Park	0	0	27	0	0	30	0	0	15	0	0	62	0	0	13	0	0	30
San Jose Diridc	0	27	0	0	28	2	0	12	4	0	62	0	0	13	0	0	28	2
Tamien	0	0	0	0	2	0	0	4	0	0	0	0	0	0	0	0	2	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	555	555		478	478		737	737		664	664		429	429		443	443	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 138			Train 240			Train 142			Train 244			Train 146			Train 248		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	144	0	144	0	0	0	191	0	191	0	0	0	167	0	167	0	0	0
22nd Street	52	0	196	0	0	0	32	0	224	0	0	0	19	0	186	0	0	0
Bayshore	14	0	210	0	0	0	11	1	234	0	0	0	11	0	197	0	0	0
South SF	5	5	210	0	0	0	6	4	235	0	0	0	4	3	198	0	0	0
San Bruno	9	3	215	0	0	0	10	3	243	0	0	0	14	4	208	0	0	0
Millbrae	44	3	256	0	0	0	55	9	289	0	0	0	58	3	263	0	0	0
Burlingame	9	6	259	0	0	0	13	8	294	0	0	0	8	9	262	0	0	0
San Mateo	14	21	252	0	0	0	18	18	294	0	0	0	19	13	269	0	0	0
Hayward Park	6	9	249	0	0	0	4	5	293	0	0	0	3	6	266	0	0	0
Hillsdale	10	14	246	0	0	0	14	12	295	0	0	0	11	20	257	0	0	0
Belmont	7	6	247	0	0	0	5	9	290	0	0	0	6	11	253	0	0	0
San Carlos	4	12	240	0	0	0	7	9	288	0	0	0	10	11	252	0	0	0
Redwood City	14	35	219	0	0	0	18	34	273	0	0	0	21	35	238	0	0	0
Menlo Park	6	12	212	0	0	0	8	20	261	0	0	0	11	21	227	0	0	0
Palo Alto	11	94	130	0	0	0	24	97	187	0	0	0	30	78	180	0	0	0
California Ave.	3	23	110	0	0	0	7	27	167	0	0	0	7	17	170	0	0	0
San Antonio	2	8	103	0	0	0	3	12	158	0	0	0	3	15	158	0	0	0
Mountain View	4	42	65	0	0	0	6	46	118	0	0	0	4	41	120	0	0	0
Sunnyvale	1	17	50	0	0	0	3	30	92	0	0	0	2	23	99	0	0	0
Lawrence	0	5	44	0	0	0	2	9	85	0	0	0	1	8	92	0	0	0
Santa Clara	1	11	34	0	0	0	0	23	63	0	0	0	0	26	67	0	0	0
College Park	0	0	34	0	0	0	0	0	63	0	0	0	0	0	67	0	0	0
San Jose Diridc	0	34	0	0	0	0	0	63	0	0	0	0	0	67	0	0	0	0
Tamien	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	359	359		0	0		438	438		0	0		410	410		0	0	

Ons and Offs are averaged over five days and rounded
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Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 150			Train 252			Train 152			Train 254			Train 156			Train 258		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	170	0	170	0	0	0	179	0	179	224	0	224	145	0	145	336	0	336
22nd Street	9	0	179	0	0	0	9	0	187	0	0	224	14	1	159	0	0	336
Bayshore	7	1	185	0	0	0	2	1	189	0	0	224	9	1	168	0	0	336
South SF	4	2	187	0	0	0	4	6	187	0	0	224	22	3	188	0	0	336
San Bruno	14	4	197	0	0	0	10	5	192	8	6	227	9	5	192	13	11	338
Millbrae	62	8	250	0	0	0	58	7	243	87	6	308	57	12	237	108	12	434
Burlingame	11	12	249	0	0	0	13	9	248	9	13	304	14	13	238	17	15	436
San Mateo	15	17	246	0	0	0	12	19	241	18	20	301	43	16	266	25	34	426
Hayward Park	3	5	245	0	0	0	6	5	241	0	0	301	15	9	271	0	0	426
Hillsdale	11	21	235	0	0	0	13	16	238	12	30	284	59	21	309	31	48	410
Belmont	6	10	231	0	0	0	5	11	232	14	10	288	15	10	314	14	21	402
San Carlos	6	8	230	0	0	0	9	9	232	7	12	283	17	15	316	28	23	408
Redwood City	19	35	214	0	0	0	21	36	216	32	45	270	45	47	314	89	64	433
Menlo Park	12	18	207	0	0	0	15	21	210	22	28	264	58	31	341	61	35	459
Palo Alto	37	48	196	0	0	0	61	46	225	112	47	329	212	59	495	288	52	695
California Ave.	7	16	187	0	0	0	12	16	220	18	19	327	51	20	526	45	30	710
San Antonio	3	13	177	0	0	0	5	13	213	10	14	323	15	28	513	25	38	696
Mountain View	7	41	143	0	0	0	11	40	183	17	40	301	61	59	515	49	83	662
Sunnyvale	3	33	112	0	0	0	6	46	143	6	64	244	36	67	485	22	129	555
Lawrence	1	9	104	0	0	0	1	12	133	4	19	228	40	31	494	12	53	514
Santa Clara	1	27	77	0	0	0	1	36	98	2	39	191	25	60	459	5	124	395
College Park	0	0	77	0	0	0	0	0	98	0	0	191	29	8	480	0	0	395
San Jose Diridc	0	77	0	0	0	0	0	98	0	3	127	67	33	156	358	1	235	160
Tamien	0	0	0	0	0	0	0	0	0	0	67	0	9	74	293	0	160	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	21	272	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	1	40	233	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	100	133	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	40	93	0	0	0
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	93	0	0	0	0
TOTAL	407	407		0	0		452	452		606	606		1036	1036		1167	1167	

Ons and Offs are averaged over five days and rounded
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Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 360			Train 262			Train 264			Train 366			Train 268			Train 370		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	526	0	526	412	0	412	107	0	107	698	0	698	657	0	657	791	0	791
22nd Street	0	0	526	0	0	412	24	2	129	0	0	698	0	0	657	0	0	791
Bayshore	0	0	526	0	0	412	11	3	137	0	0	698	0	0	657	0	0	791
South SF	0	0	526	0	0	412	41	14	164	0	0	698	68	15	709	0	0	791
San Bruno	0	0	526	19	24	407	15	5	174	0	0	698	0	0	709	0	0	791
Millbrae	72	17	581	0	0	407	63	8	229	92	33	757	73	31	751	76	38	830
Burlingame	0	0	581	19	33	393	20	15	234	0	0	757	0	0	751	0	0	830
San Mateo	0	0	581	26	51	368	25	15	244	34	55	737	0	0	751	0	0	830
Hayward Park	0	0	581	0	0	368	27	17	253	0	0	737	0	0	751	0	0	830
Hillsdale	68	80	569	39	43	364	70	34	290	0	0	737	47	143	655	48	148	729
Belmont	0	0	569	0	0	364	29	29	289	0	0	737	0	0	655	0	0	729
San Carlos	0	0	569	36	38	362	51	19	321	0	0	737	0	0	655	0	0	729
Redwood City	0	0	569	0	0	362	136	43	415	158	141	754	58	108	606	0	0	729
Menlo Park	0	0	569	0	0	362	122	39	498	0	0	754	56	56	606	0	0	729
Palo Alto	211	99	681	192	35	519	0	0	498	316	84	986	240	77	769	161	113	778
California Ave.	0	0	681	79	41	556	0	0	498	0	0	986	77	64	782	0	0	778
San Antonio	0	0	681	0	0	556	0	0	498	0	0	986	28	108	702	0	0	778
Mountain View	43	221	503	41	96	501	41	135	403	0	0	986	31	142	591	29	309	498
Sunnyvale	0	0	503	22	252	272	15	108	310	33	339	680	19	191	420	0	0	498
Lawrence	0	0	503	0	0	272	0	0	310	0	0	680	37	113	344	0	0	498
Santa Clara	0	0	503	0	0	272	2	126	187	0	0	680	11	72	282	0	0	498
College Park	0	0	503	0	0	272	0	0	187	0	0	680	0	0	282	0	0	498
San Jose Diridc	0	503	0	0	272	0	0	187	0	24	396	308	89	66	305	0	498	0
Tamien	0	0	0	0	0	0	0	0	0	0	308	0	4	100	209	0	0	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	1	32	179	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	1	41	139	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	1	59	81	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	20	62	0	0	0
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	62	0	0	0	0
TOTAL	920	920		885	885		799	799		1354	1354		1498	1498		1106	1106	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 272			Train 274			Train 376			Train 278			Train 380			Train 282		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	785	0	785	252	0	252	1009	0	1009	814	0	814	696	0	696	541	0	541
22nd Street	0	0	785	31	2	281	0	0	1009	0	0	814	0	0	696	0	0	541
Bayshore	0	0	785	7	16	271	0	0	1009	0	0	814	0	0	696	0	0	541
South SF	0	0	785	33	17	287	0	0	1009	23	13	824	0	0	696	0	0	541
San Bruno	30	67	748	21	16	292	0	0	1009	0	0	824	0	0	696	15	38	518
Millbrae	0	0	748	99	7	384	88	70	1027	96	51	869	54	36	714	0	0	518
Burlingame	29	117	660	14	35	362	0	0	1027	0	0	869	0	0	714	19	91	446
San Mateo	42	132	570	27	25	364	36	101	962	0	0	869	0	0	714	31	91	386
Hayward Park	0	0	570	17	23	358	0	0	962	0	0	869	0	0	714	0	0	386
Hillsdale	36	97	509	38	52	344	0	0	962	25	197	697	28	128	613	12	58	340
Belmont	0	0	509	21	44	321	0	0	962	0	0	697	0	0	613	0	0	340
San Carlos	36	105	440	22	23	320	0	0	962	0	0	697	0	0	613	17	57	300
Redwood City	0	0	440	69	45	344	74	188	848	32	149	580	0	0	613	0	0	300
Menlo Park	0	0	440	54	36	362	0	0	848	20	71	529	0	0	613	0	0	300
Palo Alto	81	52	469	0	0	362	129	134	842	117	83	563	50	126	537	42	45	297
California Ave.	39	68	440	0	0	362	0	0	842	30	68	525	0	0	537	21	38	280
San Antonio	0	0	440	0	0	362	0	0	842	17	101	441	0	0	537	0	0	280
Mountain View	23	101	362	31	97	296	0	0	842	12	122	331	12	249	300	9	75	214
Sunnyvale	9	252	120	17	74	239	13	371	484	4	169	165	0	0	300	4	142	76
Lawrence	0	0	120	7	38	208	0	0	484	4	52	117	0	0	300	0	0	76
Santa Clara	0	0	120	3	78	133	0	0	484	2	51	68	0	0	300	0	0	76
College Park	0	0	120	0	0	133	0	0	484	0	0	68	0	0	300	0	0	76
San Jose Diridc	0	120	0	6	66	72	8	333	160	17	48	37	0	300	0	0	76	0
Tamien	0	0	0	3	19	56	0	160	0	0	37	0	0	0	0	0	0	0
Capitol	0	0	0	0	6	50	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	12	38	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	18	20	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	6	14	0	0	0	0	0	0	0	0	0	0	0	0
Gilroy	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1111	1111		770	770		1357	1357		1213	1213		839	839		711	711	

Ons and Offs are averaged over five days and rounded
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Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 284			Train 386			Train 288			Train 190			Train 192			Train 194		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	159	0	159	616	0	616	517	0	517	480	0	480	415	0	415	236	0	236
22nd Street	22	2	179	0	0	616	0	0	517	16	0	496	16	1	430	13	1	249
Bayshore	5	8	176	0	0	616	0	0	517	3	5	494	4	3	431	4	0	252
South SF	17	10	183	0	0	616	9	10	516	6	7	493	4	4	431	3	3	252
San Bruno	8	6	186	0	0	616	0	0	516	9	16	487	7	9	429	8	7	253
Millbrae	51	8	229	53	48	621	37	29	523	57	24	520	42	13	457	36	8	280
Burlingame	9	26	212	0	0	621	0	0	523	12	31	501	11	17	451	8	14	275
San Mateo	11	15	208	16	81	556	0	0	523	20	58	463	19	32	438	9	15	269
Hayward Park	4	19	193	0	0	556	0	0	523	2	11	454	1	6	432	1	4	266
Hillsdale	18	40	171	0	0	556	9	108	424	12	55	411	7	41	398	4	19	252
Belmont	7	24	154	0	0	556	0	0	424	4	17	398	5	9	393	1	8	245
San Carlos	9	14	148	0	0	556	0	0	424	6	21	383	6	16	383	3	8	240
Redwood City	20	25	143	32	130	457	19	70	373	28	56	356	20	46	357	11	35	216
Menlo Park	12	24	131	0	0	457	10	35	348	12	25	342	7	23	341	4	17	203
Palo Alto	0	0	131	53	92	418	69	62	354	51	54	339	35	52	325	15	37	181
California Ave.	0	0	131	0	0	418	17	42	330	11	31	319	9	32	302	4	17	168
San Antonio	0	0	131	0	0	418	7	50	286	4	29	293	2	26	278	2	21	150
Mountain View	9	48	92	0	0	418	6	87	205	10	83	220	5	73	209	2	43	109
Sunnyvale	3	33	61	5	207	216	7	89	123	5	79	145	2	70	142	1	35	75
Lawrence	0	0	61	0	0	216	3	28	98	0	19	126	1	22	120	1	10	67
Santa Clara	1	28	34	0	0	216	2	22	78	1	31	96	1	28	93	0	13	54
College Park	0	0	34	0	0	216	0	0	78	0	0	96	0	0	93	0	0	54
San Jose Diridc	0	34	0	7	153	70	1	61	18	0	96	0	3	74	22	0	48	6
Tamien	0	0	0	0	70	0	0	18	0	0	0	0	0	22	0	0	6	0
Capitol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blossom Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan Hill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gilroy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	364	364		782	782		711	711		750	750		621	621		368	368	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Caltrain 2017 Annual Counts
SOUTHBOUND PASSENGERS

Avg Weekday Passengers	Train 196			Train 198			TOTAL		
	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	179	0	179	83	0	83	15220	0	15220
22nd Street	13	1	192	7	0	90	1636	18	16838
Bayshore	1	0	192	2	0	92	202	44	16995
South SF	1	4	189	2	2	92	311	185	17121
San Bruno	4	3	190	1	1	92	418	269	17269
Millbrae	24	3	211	12	3	101	2796	579	19487
Burlingame	2	7	206	0	3	98	489	550	19425
San Mateo	5	11	200	2	7	94	1001	1101	19325
Hayward Park	1	2	199	0	2	92	176	196	19305
Hillsdale	3	11	191	1	6	87	1179	1793	18691
Belmont	1	7	185	0	2	85	283	297	18677
San Carlos	1	6	180	0	2	84	599	664	18612
Redwood City	9	24	166	3	10	76	1436	2389	17659
Menlo Park	2	12	155	0	7	69	698	1029	17327
Palo Alto	8	29	134	2	13	59	2802	4744	15385
California Ave.	2	15	121	0	5	54	498	1098	14785
San Antonio	1	13	109	0	8	46	172	681	14277
Mountain View	0	32	77	1	15	32	561	4062	10777
Sunnyvale	1	26	52	0	12	20	261	3084	7954
Lawrence	0	10	42	0	2	18	138	740	7353
Santa Clara	0	13	30	0	4	15	66	1014	6404
College Park	0	0	30	0	0	15	30	87	6347
San Jose Diridc	0	30	0	0	15	0	194	4935	1606
Tamien	0	0	0	0	0	0	16	1063	558
Capitol	0	0	0	0	0	0	1	59	501
Blossom Hill	0	0	0	0	0	0	2	93	410
Morgan Hill	0	0	0	0	0	0	1	177	234
San Martin	0	0	0	0	0	0	0	65	169
Gilroy	0	0	0	0	0	0	0	169	0
TOTAL	257	257		118	118		31184	31184	

Ons and Offs are averaged over five days and rounded
which may lead to single-digit discrepancies in On Board totals.

Attachment O

Management & Operations

ETA Transit Systems completes Stanford ITS installation

Posted on March 1, 2016

Post a comment | Comments 0 | 0

Haha169

ETA Transit Systems announced the successful deployment of its Intelligent Transit System (ITS), SPOT™, to Stanford University's Marguerite campus shuttle service.

The expansive project saw the outfitting of all 81 of the university's shuttles with on-board equipment that provides real-time GPS, automatic on-board announcements and integration with existing automatic passenger counters.

The SPOT ITS will provide Stanford students and campus riders with real-time bus tracking and arrival predictions, and through GTFS, allows the university's transit schedules to be communicated in real-time through Google Transit.

Tags: contract | ETA Transit Systems | ITS | Stanford University

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Attachment P

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Memorandum

TO: HONORABLE MAYOR
CITY COUNCIL AND
SUCCESSOR AGENCY BOARD

FROM: Kim Walesh
Richard Keit

SUBJECT: SEE BELOW

DATE: June 8, 2017

Approved D-DSyL Date 6/9/17

COUNCIL DISTRICT: 3

SUBJECT: EXCLUSIVE NEGOTIATION AGREEMENT WITH GOOGLE FOR ACQUISITION AND POTENTIAL DEVELOPMENT OF PROPERTIES OWNED BY THE CITY AND PROPERTIES OWNED BY THE SUCCESSOR AGENCY TO THE REDEVELOPMENT AGENCY IN THE DIRIDON STATION AREA

RECOMMENDATION

Adopt a resolution authorizing the City Manager to negotiate and execute an Exclusive Negotiation Agreement (ENA) with Google for the acquisition of properties owned by the City of San Jose and properties owned by the Successor Agency to the Redevelopment Agency (SARA) in the Diridon Station Area for the potential future construction of a mixed-use, transit-oriented development including office and R&D space.

OUTCOME

An ENA enables the City to negotiate with the company regarding the purchase and sale of SARA, and City-owned properties within the Diridon Station Area Plan (DSAP) boundaries.

BACKGROUND

Approved by the City Council in June 2014, the DSAP anticipates significant new infill development opportunities in over 240 acres to the north, east, and south of Diridon Station, creating a new destination at a major crossroads of transit. This Plan anticipates tens of thousands of new office workers, a 50%+ increase in Downtown office capacity, retail, entertainment amenities, and 3,000 new residential units. With the planned arrival of California High Speed Rail and BART in 2025-2026 Diridon Station will host the most active convergence of transit modes in California. The combination of new transit service and new real estate

development at Diridon Station is intended to be transformative for San Jose. Diridon Station will become the Bay Area's transit hub and the premier location in the Bay Area for significant transit-oriented job growth.

ANALYSIS

Since December 2016, Google and its development partner, Trammel Crow, have acquired several parcels in the central zone of the Diridon Station Area, most significantly the former AT&T property on Montgomery Street. Google wants to negotiate with the City for the acquisition of the four SARA-owned properties that were included in the planned ballpark site. Google also wants to acquire the City's Fire Training property, located at the corner of Park Avenue and Montgomery Street.

Preliminary discussions with Google indicate interest in planning and building a master-planned transit-oriented development that includes between 6 and 8 million square feet of office/R&D space and retail/commercial amenities. This development could support more than 20,000 new Downtown employees, significantly aiding the City's need for local jobs and supporting ridership on existing and new public transportation investments. The development will engage and integrate with the surrounding community and be a permeable, open-style development with active, high-quality public open spaces. The company has demonstrated a commitment to quality and innovation in workplace design and sustainability. No development applications have been submitted to the City, nor are expected to be submitted in 2017.

Securing a marquee employer like Google as a lead private partner can help accelerate the quality, and timely development of the Diridon Station Area. Google would join the collaboration with the City of San Jose, VTA, Caltrain, Arena Management, and High Speed Rail to make the Diridon area as one visionary, cohesive project, and destination place.

The first step in the process of selling these SARA and City properties is the proposed ENA. This non-binding agreement has a term of one year for the preparation of a Memorandum of Understanding (MOU). The ENA has a rigorous schedule and both Google and the City are committed to an expedited negotiation process.

The sale of the SARA properties will be subject to a Compensation Agreement between the SARA and all the taxing agencies affected by these properties. Staff has been working with Santa Clara County on the terms of a Compensation Agreement.

Sale of the Fire Training property would require identification of an appropriate site for relocation of the facility and ultimately construction of that facility. The Fire Training site is identified as a Park site in the DSAP. Google will create quality buildings, parks, and open space amenities.

Staff will work collaboratively with the SAP Center to address the parking impacts of any proposed development. The City's goal is to develop shared parking infrastructure to support the destination area as it evolves over time.

Because of the potential scale of development and Google's desire to coordinate critical infrastructure work with the construction of the transit projects (BART and HSR), close coordination between Google and the transit agencies will be an essential element in working through the ENA schedule, as well as the ultimate property disposition. Within the ENA schedule of performance is also the requirement for Google to undertake significant community outreach.

Any future development project on these sites or revisions to the DSAP will require further environmental review under the California Environmental Quality Act (CEQA).

EVALUATION AND FOLLOW-UP

The Schedule of Performance in the ENA anticipates creation of a MOU by March 2018. This document will be the next check-in point for the potential transaction. The timing for submittal of any development applications will be addressed in the MOU.

PUBLIC OUTREACH

This memorandum will be posted on the City's Council Agenda website for the June 20, 2017 Council Meeting.

COORDINATION

This memorandum was coordinated with the City Attorney's Office, Department of Planning, Building, and Code Enforcement, and Finance.

COMMISSION RECOMMENDATION/INPUT

No commission recommendation or input is associated with this action.

COST SUMMARY/IMPLICATIONS

Future reports will contain information on the financial implications resulting from sale of the subject parcels.

CEQA

Not a Project, File No. PP10-066, Agreements and Contracts.

/s/
RICHARD KEIT
Managing Director
Successor Agency to the Redevelopment Agency

/s/
KIM WALESH
Deputy City Manager
Director of Economic Development

For questions, please contact Nanci Klein, Assistant Director of Economic Development, at (408) 535-8184.

Attachment Q

SPUR REPORT

FEBRUARY 2017

THE CALTRAIN CORRIDOR VISION PLAN

How to keep the Bay Area's innovation economy moving

Contents

Acknowledgments

The Caltrain Corridor Vision Plan was generously supported by Stanford University, Silicon Valley Community Foundation, Facebook, Ron Conway, Steven Denning and Reid Hoffman.

The SPUR Executive Board adopted this report as official policy on August 1, 2016.

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We are grateful to the staff and leadership of the transportation agencies in the Caltrain Corridor for participating in this research and to the many advocates, experts and elected officials who participated in interviews and workshops that informed this study. We thank the SPUR San Francisco Board, SPUR San Jose Board, SPUR Transportation Policy Board and SPUR San Jose Policy Board for their leadership, expertise and thoughtful review of drafts of this report.

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The Caltrain Corridor Vision Plan

How to keep the Bay Area's innovation economy moving

Executive Summary

The Caltrain Corridor, home of the Silicon Valley innovation economy, holds much of the San Francisco Bay Area's promise and opportunity, but its transportation system is breaking down. Along this corridor — which includes Highway 101, Caltrain rail service and all the cities connected by those systems from San Francisco to San Jose — the typical methods of getting around have become untenable.

Growth in jobs, uncoordinated land uses, underinvestment in transit and inefficient infrastructure are straining the corridor's transportation network. Caltrain railcars are overcrowded during peak commute hours and service is limited at other times, making it an unreliable option. Driving — especially on Highway 101 — is now synonymous with congestion, an outcome closely tied to the corridor's low density and high rates of car ownership. Bus ridership in the corridor has declined, as buses are not time-competitive with driving. The continued unbalanced growth in housing and jobs in the area will only exacerbate the current inefficiencies.

The Caltrain Corridor needs to be able to move more people, provide greater convenience and better connect to the rest of the region. How can we transform today's underperforming system — which undermines the region's economy and threatens its ability to meet sustainability goals — into what the corridor needs?

Our Vision for the Caltrain Corridor

In our vision of the future, the Caltrain Corridor is shaped by an outstanding rail system. Caltrain and high-speed rail provide the backbone of the corridor and offer modern, attractive rail service. Growth is concentrated around transit stations, which reinforces the use of transit, biking and walking. Highway 101 includes an express high-occupancy/toll lane with dynamic pricing for buses and carpools, and it's possible to reach more parts of the Peninsula by ferry. People rely much more on non-driving options because they are convenient, functional and reliable and feel like one easy-to-use system — a result of collaboration among the cities and transit agencies in the corridor. Because of the decrease in driving, California is poised to reach its climate goals.

How do we achieve this vision?

It won't be easy. The corridor faces key challenges: Caltrain lacks a dedicated source of funding and is financially unstable; the fragmentation of transportation agencies makes it difficult to take a corridor-wide approach to planning; and rail growth is hampered by the impacts of railroad infrastructure on local cities.

At the same time, there are a number of opportunities we can leverage to reinvent the Caltrain Corridor. Caltrain's plans to switch its train fleet from diesel to electric power will dramatically improve rail capacity, comfort and reliability and allow Caltrain to become cost-efficient. High-speed rail, which is expected to arrive as soon as 2025, will add capacity and create statewide connections. The private and public sectors are actively pursuing real alternatives to driving alone. And new technologies are transforming the transit passenger experience, providing new options for safer, more efficient and more convenient transportation.

With these opportunities and challenges in mind, we recommend policies, projects and programs to achieve our vision for the Caltrain Corridor.

Develop reliable, frequent all-day rail service with enough capacity to meet demand.

As driving becomes less convenient, transit is poised to become a reliable and efficient transportation solution to get to and from Caltrain Corridor cities. Caltrain should plan to grow its ridership to nearly five times what it is today by offering an attractive, competitive rail schedule, pursuing system and infrastructure upgrades that support additional capacity, and extending the rail corridor to reach downtown San Francisco. Caltrain should also develop a business plan and use the period before electrification to pursue near-term improvements that can manage demand and attract riders.

Offer quick and intuitive connections at modern, high-amenity stations.

As Caltrain grows and extends its service offerings, stations should be upgraded to attract and accommodate more riders. Well-designed multi-operator stations can attract riders to transit and help them feel comfortable and informed. Station access will also need to be upgraded and should prioritize easy access by travel modes other than driving. Accomplishing this will require advancing the right street, parking and pricing policies and designating a responsible party to manage access at each station. Caltrain and other agencies should set aside funds to modernize stations.

Move more people on Highway 101, with less delay.

Highway 101 needs to support transit, not just private cars. It should have continuous high-occupancy/toll lanes with dynamic pricing for buses and carpools. These toll lanes should be converted from existing lanes, as new construction is costly and likely to be counterproductive. Funds raised from the tolls should go toward increasing public transit services. Equity policies and programs need to be adopted to make sure that using toll lanes provides a net benefit to low-income travelers. Changes and enhancements to 101 will only succeed if paired with policies and programs that address demand for driving alone.

Establish public ferry service for Peninsula travelers.

Ferry service should be added to get more people to and from the Peninsula. Ferries add redundancy and provide a way to reach new markets that are difficult to reach with rail, such as the North Bay or East Bay. We recommend establishing a ferry terminal at the Port of Redwood City for both private and public ferry service.

Sergio Ruiz

Create a coordinated and convenient transportation network.

For transit use to grow, the passenger experience must be convenient and attractive. The corridor's many transit agencies should coordinate their services so they work together as one rational, easy-to-use network. Transit information should be presented consistently across agencies, and transit riders should have the option to plan, book and manage their trips on a single mobile platform. To maximize ridership, transit operators should work together to develop a shared fare payment system and structure. Clipper technology will need to be upgraded to support these functions.

Develop a strategy to fund this vision.

The Vision Plan will cost between $16 billion and $21 billion to implement, and we recommend a funding plan to make these changes happen. Funding strategies include using fares and tolls to cover transit operating costs, dedicating funds from county sales taxes, developing new regional and state funding, and identifying opportunities for private investments and private-public partnerships.

See pages 56-57 for a plan of action identifying the parties who can implement the vision plan's recommendations.

The Caltrain Corridor Is Poised for Transformation

The Caltrain Corridor is home to the world's innovation economy — but its transportation system is falling short.

As the San Francisco Bay Area grows in population, its transportation network is in need of significant upgrades. It must be able to carry many more people, and it must also become much more convenient and appealing in order to serve as a truly viable option for most travelers. These changes are necessary if we want to improve our quality of life, reach our sustainability goals and maintain our strong economy. This vision plan focuses on what we are calling the Caltrain Corridor: the transportation corridor along the San Francisco Peninsula, which includes Highway 101,[1] Caltrain rail service and all the cities connected by those lines, from San Francisco to San Jose.

The Caltrain Corridor is the most dynamic economic corridor in the world, home of the Silicon Valley innovation economy and headquarters to valuable companies like Google, LinkedIn, Facebook, Adobe, Box, Salesforce, Tesla, Apple, Genentech and Twitter, to name just a few. The corridor also includes major global institutions and destinations, such as Stanford University, University of California San Francisco, San Francisco International Airport (SFO) and stadiums for the San Francisco 49ers, San Francisco Giants, San Jose Sharks and, soon, the Golden State Warriors. It passes through San Francisco, San Mateo and Santa Clara counties and is home to 19 cities and 3 million people.[2]

However, job growth, uncoordinated land use, underinvestment in transportation and inefficient use of infrastructure are leading to breakdowns in the Peninsula's transportation system. Highway 101, Caltrain, BART, Interstate 280 and El Camino Real — the major pieces of transportation infrastructure in this corridor — are increasingly unreliable and crowded. Because of the Peninsula's land use pattern and high rate of car ownership, its transportation system is largely based on driving. Even that option is failing for many, as stop-and-go traffic becomes the norm for many hours of the day. Transit has had a long history in this corridor, and though it lost its market to the car during the 20th century, trains and buses are now poised for a comeback as a convenient and efficient way to get to and from Caltrain Corridor cities.

A severe shortage of affordable housing in this corridor is pushing workers farther away as they search for affordable places to live, putting additional demands on the transportation system. The large expanse of the San Francisco Bay, which separates the Peninsula from other communities, exacerbates the housing and transportation challenges. Demographic changes also call for new solutions: Younger generations have a less favorable attitude about driving, and an aging generation will also need ways to get around without driving.[3] There is growing recognition that significant changes must take place or else the corridor, and the region, will cease to function.

In a world of economic competition between regions, those with more efficient transportation systems have an advantage.[4] In order to keep people moving, major transportation investments, innovation and policy changes are required. The corridor's transportation system needs more services, more capacity and more space-efficiency — and it needs to connect with the way cities are planning to grow. In order to benefit the entire Bay Area, we must enable more people to access the rich economic and social opportunities that continue to grow along the Caltrain Corridor.

These moves are also needed to address the growing threat of climate change: We must reduce our reliance on automobiles, the single greatest source of carbon emissions produced in the Bay Area and California. Our region aims to grow while decreasing our contribution to climate change, and we are starting to succeed.[5] Now it is time for us to lead once again.

In addition to their climate impacts, automobiles are also an inefficient use of space. The cities along the Caltrain Corridor are confined between the Bay and the coastal mountains; cars and parking consume precious space needed for housing, jobs, parks and schools. There simply is not enough space for people to continue to drive to meet all their needs. The future of Silicon Valley requires transit, biking, walking and on-demand services (such as carpools or taxis) to work well and work together. This means a transportation experience that is as comfortable, available and intuitive as driving one's own car.

We Need a Bigger Vision for the Corridor

Despite the Peninsula's obvious transportation needs, the solutions we have underway now will not offer significant enough results to fix the problems. Plans to manage Highway 101 and make it work better for transit riders are only now being developed. The immediate projects to improve Caltrain — switching the train fleet from diesel to electric power — though very significant, will result in only a 20 to 25 percent increase in capacity above today, which means service may continue to fall short of demand. And even if we do increase Caltrain capacity and provide better options than driving alone on Highway 101, we need sufficient services and routes to get people to and from transit stations.

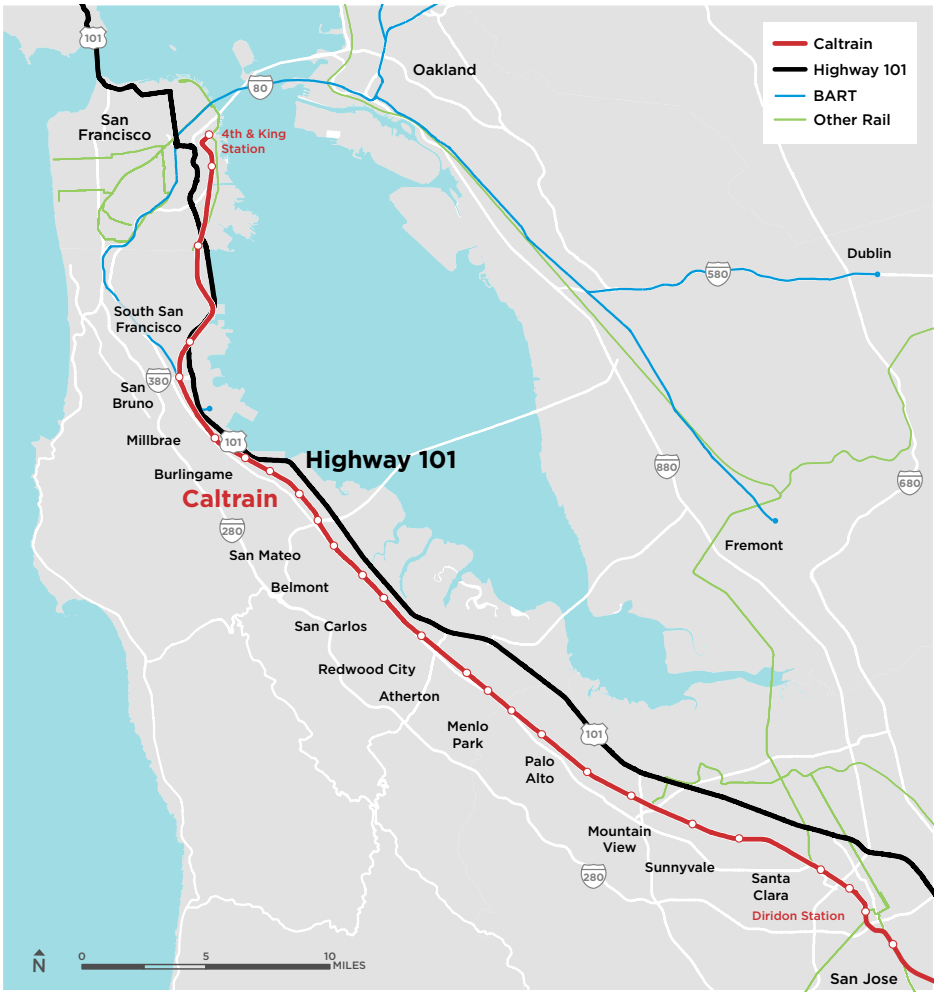
Four leading Bay Area institutions — SPUR, Silicon Valley Leadership Group, Stanford University and the San Mateo County Economic Development Association — joined forces to develop the Caltrain Corridor Vision Plan. This plan explains the investments and policy changes that civic leaders, transportation agencies, cities, businesses and the general public will need to lead together to ensure that this corridor becomes more connected, more livable and more sustainable as the region grows. We also recommend a funding plan to make these changes happen.

FIGURE 1

The Caltrain Corridor

The Caltrain Corridor, with a population of 3 million, is the home of the Silicon Valley innovation economy. Transit is poised to become a convenient, efficient transportation solution to and from Caltrain Corridor cities. The existing railroad presents an outstanding opportunity to shape transportation.

Source: Produced for SPUR by Arup



A Corridor Shaped by an Outstanding Rail System

Our vision plan research focused on defining how Caltrain and high-speed rail can play a much bigger role in the corridor's transportation system and communities, as well as how both highways and rail can work as one system.

There are two possible paths for growth in the Caltrain Corridor. The first is to grow and build around the transit system, which reinforces using transit, biking and walking. In this scenario, transit isn't only used for shuttling commuters to burgeoning job centers; it's useful to all kinds of people, for all kinds of trips, during all hours and days of the week. The vision plan imagines a completely new quality of transit experience in this corridor: frequent and reliable Caltrain service, with quick, all-day connections to and from stations; an attractive high-speed rail service; an express high-occupancy/toll lane on Highway 101 for buses and carpools; and new ferry service to the Peninsula from other points on the Bay. Making transit and other nondriving options work well in the corridor will build confidence that we can grow our communities without adding to gridlock.

The second option is to continue on the current path, with some development near rail stations and significant growth farther away from stations, reinforcing the use of cars to accommodate growth and leaving transit capacity underutilized. In this scenario, growth becomes difficult to manage because there are few attractive or efficient transportation options, and locations in this corridor become less, rather than more, connected to the rest of the region. To avoid this outcome, we must work to build the system described in the first scenario. We outline our vision for the Caltrain Corridor in Chapter 2.

CHAPTER 1

How We Got Here

The corridor's transportation system was built for a different era.

A mural at the San Mateo Caltrain station recalls the history of Peninsula transportation.

Today's Caltrain Corridor was shaped first by the construction of a railroad and then by the construction of highways. Before the railroad, cities were linked primarily by various paths used by horse-based transportation. (Many of these, including El Camino Real, later became roads and highways for cars.) In the 1800s, ferries connected San Jose and San Francisco, using the Bay to transport goods and people.

The 49.5-mile San Francisco and San Jose Railroad — the forebear of today's Caltrain — was first proposed in 1851 and opened for service in January 1863. The privately developed $2 million system was paid for in part with $600,000 in bonds issued by Santa Clara, San Mateo and San Francisco counties. The railroad cut the eight-hour steamboat or stagecoach trip to just three and a half hours. For the next 90 years, this railroad, which merged with the Southern Pacific Railroad in 1870, was the primary mode of transportation over long distances on the Peninsula.

Towns and villages grew around the railroad stations, forming a string of walkable, mixed-use downtowns that characterize Peninsula cities to this day. Until World War II, these towns were mostly small, with productive farmland at their edges. The Santa Clara Valley, dubbed "the Valley of Heart's Delight," produced food and goods that were transported by freight trains to San Francisco and its ports.

Passenger service on the railroad began in 1863. Local streetcar networks complemented the rail line, including the San Mateo Interurban line, providing service from South San Francisco to San Mateo starting in 1892, and the Peninsular Interurban, providing service from San Jose to Palo Alto starting in 1902.[6] The railroad led to the emergence of bedroom communities along its route: small towns where businesspeople who worked in San Francisco lived. Inter-regional trains also used the corridor, including some that traveled to Los Angeles.[7]

Southern Pacific's Peninsula Commute Service, which was focused on getting workers to and from San Francisco, hit its postwar peak in 1954, with 9.2 million annual boardings — a number that would not be surpassed for nearly 50 years.[8] The end of World War II brought major shifts in both passenger and freight travel patterns in the corridor. Beginning in the 1950s, suburban housing, office parks and factories for the defense, technology and research industries — later known as "Silicon Valley" — began to replace agricultural lands.

During this period, employers often located their offices in places with ample land for production — and parking. Most of the locations that saw growth — such as Stanford Industrial/Research Park (1951) in Palo Alto and NASA Ames Research Center (1958) and Fairchild Semiconductor (1959), both in Mountain View — were far from train stations and oriented toward the car. The 1962 completion of the eight-lane Bayshore Freeway (Highway 101) further eroded the importance, and revenues, of the railroad. Passenger rail volumes

Streetcar lines and the Southern Pacific railroad predated automobiles in the Caltrain Corridor. Many towns on the Peninsula grew up around these systems.

reached their nadir in 1977, with 4.4 million annual boardings — less than half the ridership of 23 years prior.[9]

The combination of a postwar explosion in car ownership, increasing federal and state investment in highways, and new car-oriented neighborhoods and offices chipped away at both passenger and freight rail usage. As jobs and stores left the traditional downtowns, the overall development pattern rendered rail less practical. People began to find driving an easier, or necessary, way to get to the store or even just have lunch on the other side of a busy street. Smaller rail lines were replaced with roads, as happened when the branch rail line to Los Gatos became the Foothill Expressway in 1964.

During the 1920s and 1930s, the first segments of the new Bayshore Highway, now Highway 101, were built, eventually connecting San Francisco and San Jose with a road that was wide, smooth and solely focused on cars (unlike El Camino Real, which was used by streetcars, horse-drawn carriages and pedestrians). In the 1940s and 1950s, at the dawn of the highway era, the California Department of Public Works (the predecessor to Caltrans) began converting the Bayshore Highway into the 10-lane freeway we know today.

While development patterns and auto-focused transportation investments were undermining the traditional rail-oriented communities of the Peninsula, the companies located in the corridor were reinventing the economy. Starting with defense contracts, the area has ridden a series of innovation waves, from the integrated circuit and semiconductors to the personal computer, biotech, genomics, the internet and social media. The core strength of Silicon Valley is the area's combination of innovative research with venture capital and the entrepreneurial know-how to turn ideas into companies.

When BART was first planned in the 1950s, it was designed to connect San Francisco, San Mateo and Santa Clara counties as part of a loop around the Bay. However, in 1962, San Mateo and Santa Clara county leaders opted out of the BART District, citing the existence of the Southern Pacific Railroad among other reasons. Both counties went on to create new public transit districts, the San Mateo County Transit District (SMCTD) and the Santa Clara Valley Transportation Authority (VTA).

The Emergence of Today's Caltrain

In 1977, Southern Pacific petitioned the California Department of Transportation (Caltrans) to discontinue passenger service, motivated by dropping ridership and revenue. The state and the three counties worked out an agreement for Caltrans to take over operation of the railroad in 1980, with the state supplying half of the operating funds and the three transit agencies in the corridor (Muni, SamTrans and the Santa Clara County Transit District) providing the other half, keeping Southern Pacific as a contract operator of train service. The Caltrain brand began with the 1985 purchase of new branded train cars, which replaced old Southern Pacific equipment.

Around the same time, several planning studies about the future of Peninsula rail were conducted. One was the 1977 Peninsula Transit Alternatives Project created by the Metropolitan Transportation Commission, which focused on preserving rail service and connecting it with downtown San Francisco. The California Legislature then asked for a comprehensive mass transit plan for the Peninsula. The resulting 1985 Peninsula Mass Transit Study evaluated nine systems-level solutions to Peninsula transportation demand, including rail, BART and bus-only transit. The study recommended extending Caltrain to downtown San Francisco and extending BART to SFO.[10] The project led to the 1987 creation of the Peninsula Corridor Study Joint Powers Board, composed of officials from the three counties with Caltrain service (Santa Clara, San Mateo and San Francisco counties). This entity was the predecessor to today's Peninsula Corridor Joint Powers Board (PCJPB), which owns the railroad and operates Caltrain.

In 1991, PCJPB purchased the 51.4-mile railroad right-of-way from Southern Pacific for $220 million, taking over control from the state. PCJPB extended its Caltrain service to Gilroy through the $4 million purchase of track usage rights from Union Pacific.[11] PCJPB gradually acquired new equipment, rehabilitated existing facilities, completed several grade separations and added two new stations and new services to the schedule.

Starting in the 1980s, new rail lines connected with Caltrain, including Muni's light-rail line to the 4th and King Caltrain station and VTA's light-rail service to the Diridon and Mountain View Caltrain stations. In 2003, San Mateo County and SFO opened an 8.7-mile extension of BART from Colma to the airport, which connects with Caltrain at Millbrae Station. The study's other recommendation,

Starting in the 1980s, new rail lines connected with Caltrain, including Muni's N Judah in San Francisco.

to extend Caltrain to downtown San Francisco, is only now being realized as part of the construction of the Transbay Transit Center.

In 2004, the PCJPB introduced Caltrain's Baby Bullet service, which offered faster travel times that were competitive with driving. The service was facilitated by the construction of new passing tracks (which enabled Baby Bullet trains to overtake slower trains), new train engines and cars, and a new signaling system. Weekday ridership more than doubled between 1997 and 2015, from 24,600 to 62,400.[12] This dramatic increase resulted from the new services, continuing growth in housing and jobs in the corridor, and related congestion on highways. Today, three Baby Bullet stations near job centers — San Francisco, Palo Alto and Mountain View — handle about half of all passengers on the line. (See Figure 4 on page 10.)

The Caltrain Corridor Today

Caltrain cars are increasingly crowded during peak hours.

Caltrain riders are experiencing increasing crowding during peak commute hours, though this overcrowding is not spread evenly across all trains. Large differences in ridership exist between different tiers of service (local, limited and Baby Bullet), times of day, directions and seasons.[13]

In summer, the busiest season, peak-period northbound trains run at as much as 58 percent over capacity while similar southbound trains run at up to 49 percent over capacity. On these trains, up to 37 percent of passengers (378 people) are unable to get a seat. Meanwhile, the overall number of "full" trains — defined by Caltrain as trains at 95 percent seated capacity or above — continues to increase.[14] In 2015, 22 trains (out of 96 total) ran at full capacity per day, up from 15 the previous year. Special events, such as baseball and football games, add more people to already crowded trains. Another factor affecting train car capacity is bicycles, which are commonly brought on board because often neither origins nor destinations are near train stations. The number of bikes brought on board has reached more than 10 percent of boardings (6,207 bicycles in 2015).[15]

Caltrain's limited off-peak service makes transit less usable.

Caltrain operates far fewer trains outside of peak hours, leading to long waits. For example, at Palo Alto Station, service drops from four trains per hour between 7 a.m. and 9 a.m. to only one train per hour between 11 a.m. and 3 p.m.

During both peak and off-peak hours, it's possible that the constrained service schedule keeps stations with low service levels from growing to the same boarding levels as larger stations. The attractiveness of Baby Bullet service at stations such as Redwood City and Hillsdale draws riders who may actually live or work closer to Caltrain stations not served by Baby Bullets.

There are a number of reasons why there are not more trains and why service can be unreliable, which we discuss in Chapter 4.

Users of Highway 101 face growing delays due to traffic and inefficiencies.

Motorists using Highway 101 increasingly face delays and unpredictable travel times. To avoid sitting in traffic, drivers are leaving their homes earlier or later, causing the morning rush hour to get longer and longer. Stop-and-go conditions on Peninsula freeways now routinely start as early as 7 a.m. on weekdays, with traffic remaining heavy on some segments of Highway 101 until nearly 11 a.m. The evening commute is no better, with delays starting as early as 2:30 p.m. and routinely running until 7 p.m. These trip delays and the lengthening of the peak period wreak havoc on trip planning, making even routine trips extremely unpredictable.

FIGURE 2

Caltrain Ridership Is Outpacing Growth in Service

Since the state and then the PCJPB took over passenger services, in 1980 and 1991 respectively, Caltrain service and ridership have grown. Recently, ridership has grown much faster than new service has been provided, creating crowded conditions, as shown by this comparison of Caltrain's annual ridership and number of trains per day since 1941.

Source: Data compiled from *Accommodating Long-Term Growth on North America's Commuter Railroads*, John G. Allen, 2013; *The Peninsula Commute Story*, Steve Miller, 1987; *The San Francisco Peninsula Railroad Passenger Service; Past, Present, and Future*, Mark Duncan, 2005; *Caltrain and the Peninsula Commute Service*, Janet McGovern, 2001.

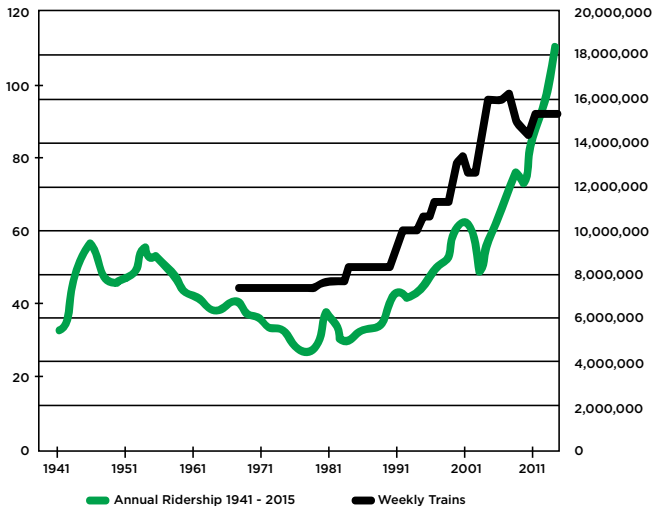


FIGURE 3

Caltrain Ridership vs. Capacity During Peak Hours

During peak hours, the average number of passengers exceeds the seat capacity on Baby Bullet and limited trains, meaning some passengers must stand.

Source: Caltrain 2016 Annual Passenger Counts

Service Type	Average Passengers per Train	Seated Capacity	Percent of Seating Capacity Used
Baby Bullet	870	762	114%
Limited	754	650	116%
Local	415	650	64%

For example, for the 9.4-mile trip from Redwood City Transit Center to downtown Burlingame, riding the bus on El Camino Real would take more than one hour during the morning peak. Driving would take approximately 20 to 45 minutes via El Camino Real and 16 to 28 minutes via Highway 101. The El Camino Real bus runs every 15 minutes at its peak, and while this is frequent for the Bay Area, it adds waiting time to the length of the trip.

Since reaching a peak in 2001, overall bus ridership across the Caltrain Corridor counties has declined for all three public agencies: VTA, SamTrans and the San Francisco Municipal Transportation Agency (SFMTA). Providing reliable bus service that riders will choose over driving requires rethinking bus routes and getting buses out of traffic through dedicated bus lanes and other improvements.

Few people use carpools or buses on 101.

Together, Muni, SamTrans, AC Transit, Dumbarton Express and VTA offer 11 public bus routes that serve portions of the 101 corridor. While buses are full overall, few people use these services to travel on Highway 101. Single-passenger cars are the prevailing users of Highway 101, comprising approximately 75 percent of vehicles on 101 despite carrying only 52 percent of passengers. Buses make up less than 1 percent of vehicles yet carry 15 percent of passengers. (See Figure 5 on page 12.)[16] Private transit buses, particularly those provided by employers, are a growing mode of transportation on Highway 101 — but those buses are also stuck in traffic.[17]

With an average of 1.5 people per vehicle, including buses, limited freeway capacity is being consumed inefficiently. The actual number of people moved can be increased either with more buses or with a greater number of people occupying each car. This requires a change in how the highway is managed. With no road pricing (charging a user fee to people who drive, especially at peak hours) and limited high-occupancy vehicle lanes (which allow carpools to drive faster), solo drivers have little incentive to economize, exacerbating the heavily congested conditions. An additional unfortunate consequence of heavy car use on 101 is safety: Cars are much more likely than buses to be in collisions.[18]

Local buses don't compete well with driving.

Today it is possible to make trips between neighborhoods located on El Camino Real using local bus services, and many do use the bus. But few people who have the option to drive choose the bus over their cars, because transit is not time-competitive with driving.

Caltrain serves a narrow market.

Caltrain riders today are almost entirely between the ages of 18 and 64 and nearly three-quarters of riders report incomes above $60,000 per year.[19] The majority of riders are making work trips during traditional peak hours; 75 percent of them use the system three or more days per week.

Although fares are not necessarily high for the quality of service, they may be too high for some people, especially when the cost of connecting services is included. Fares range from $3.20 to $13.75 one way; the average fare across all categories is about $4.50 for a 20-mile trip.[20] Caltrain does offer a variety of discounts through the GoPass (highly discounted passes that large businesses can purchase for their employees), monthly passes (unlimited rides between designated zones) and other programs (such as half-price fares for seniors, youth and disabled passengers). Today 41 percent of riders use a monthly pass and 18 percent use GoPasses.[21] In addition, many travelers must pay for connecting bus or taxi service to get to the train station, often on both ends of the trip. Caltrain riders receive a 50-cent discount when transferring to Muni. (However, there is no discount for Muni riders transferring to Caltrain). Caltrain's monthly pass includes bus transfers to VTA and SamTrans transit, but non-pass holders have no transfer discount.

Another challenge is Americans with Disabilities Act (ADA) accessibility: Currently, every Caltrain has at least one car designated as ADA accessible with the use of a wheelchair lift. In total, a Caltrain train can accommodate between three and 10 wheelchairs, depending on the train type. Boarding assistance is available from conductors for those in wheelchairs or who have difficulty with stairs. Six Caltrain stations are currently not wheelchair accessible.[22]

FIGURE 4

2016 Weekday Service Levels and Boardings at Caltrain Stations

Caltrain stations have varying levels of service and large differences in ridership. The highest-ridership stations are those with the most Baby Bullet trains and the most nearby destinations.

Source: Caltrain 2016 Annual Passenger Counts

Station	Average weekday boardings	Number of trains (weekday, per direction)			
		Local	Limited-stop	Baby Bullet	Total number of trains
San Francisco	14,769	14	21	11	46
Palo Alto	7,424	14	18	11	43
Diridon	4,712	14	21	11	46
Mountain View	4,659	14	18	8	40
Redwood City	3,814	14	16	6	36
Millbrae	3,606	14	16	11	41
Sunnyvale	3,190	14	14	3	31
Hillsdale	2,958	14	18	5	37
San Mateo	2,179	14	18	3	35
Menlo Park	1,796	14	16	3	33
22nd	1,715	14	13	5	32
Cal Avenue	1,628	14	12	0	26
San Carlos	1,475	14	18	0	32
Santa Clara	1,093	14	15	0	29
Burlingame	1,054	14	15	0	29
San Antonio	942	14	9	0	23
Lawrence	901	14	14	0	28
San Bruno	717	14	14	0	28
Belmont	664	14	9	0	23
South San Francisco	471	14	9	0	23
Hayward Park	427	14	6	0	20
Bayshore	253	14	5	0	19

As the Region Grows, We'll Need to Move More People

The Bay Area is growing rapidly. From 2010 to 2015, the three counties of the Caltrain Corridor added 388,600 workers — 18 percent growth — surpassing the 1997–2000 dot-com boom. The number of people who live in the Caltrain Corridor counties also grew significantly, with 242,630 residents added over this five-year period. Housing growth, though substantial at 45,775 new homes, has not kept pace with employment growth. This means that an increasing number of workers in the corridor are commuting from more affordable housing elsewhere in the Bay Area and, increasingly, the Central Valley and Monterey and San Benito counties.[23] Consequently, the region's housing shortage is aggravating its transportation problems.

Plan Bay Area 2040, the region's plan for growth, projects that employment will increase by 51 percent in San Francisco County, 37 percent in San Mateo County and 42 percent in Santa Clara County. That's 802,000 new jobs between 2010 and 2040. The number of households in the three counties is projected to increase by 40 percent, 23 percent and 42 percent, respectively.[24]

A further indication of the potential for new jobs and expanded travel demand is the amount of new and proposed office and commercial development. Many cities are planning growth near Caltrain stations; cities with transit-oriented development plans in the works include San Jose (the Diridon and Tamien station areas), Santa Clara, Sunnyvale, Mountain View, Palo Alto (California Avenue), San Mateo (Hillsdale and Bay Meadows), Millbrae, South San Francisco and San Francisco (the Transbay Transit Center and Central SoMa districts and development projects near 22nd Street Station, such as Pier 70). Almost 5 million square feet of new office/commercial/industrial space are planned for the Diridon Station area in San Jose, 6.4 million square feet are planned in Mountain View's North Bayshore and 6 million square feet are expected in the Transbay Transit Center District in San Francisco.[25] Furthermore, the Grand Boulevard Initiative, a reimagining of El Camino Real, envisions bus and rail transit playing a key role in how people get around.

Companies farther away from Caltrain stations, at places such as Stanford Research Park in Palo Alto, North Bayshore in Mountain View

Like many cities with Caltrain stations, Redwood City is putting new housing and jobs near Caltrain, giving people the option of commuting and running errands by rail. This choice links land use policy with efficient use of the existing transportation system.

or Santana Row in San Jose, are increasingly planning their growth with Caltrain in mind, with the expectation that connections will be facilitated by shuttle buses, light rail, bicycles and walking. Some growing cities, such as Mountain View, have begun to consider new rail connections that would meet the Caltrain line.[26]

Growth in the Caltrain Corridor Is Becoming Transit-Oriented

New growth in the Caltrain Corridor, both near and far from train stations, is taking place in the form of densification. Formerly single-use or low-density office spaces are being redeveloped into high-density or mixed-use developments. The Bayshore Precise Plan, the Moffett Park Specific Plan and the Santa Clara Square development project are all examples of densification. Densification can solve some transportation challenges by putting stores and housing within reach of jobs. However, densification also requires rethinking how to get people in and out of a particular location.

Many places in this corridor were built as automobile-dependent developments. These types of places have received very little attention in urban and regional transportation plans and have little public transit infrastructure, making it difficult to reduce car use and organize transportation solutions. Densification of these places will require changes to transportation infrastructure and services, such as new bicycle lanes and shuttle buses, and new travel behaviors, such as staggering work hours in order to avoid gridlock.[27]

Demand for train travel is likely to keep growing because of increased congestion on Highway 101, easier ways to reach rail stations (such as ride sharing and shuttles) and growth near rail stations. New transit connections will also add riders to the Caltrain line. In the near term, San Francisco's Central Subway, opening in 2019, and increased BART frequencies will add demand. In the medium term (mid-2020s), major transit connections such as BART Silicon Valley and the extension of Caltrain to the Transbay Transit Center will connect today's Caltrain to entirely new transit markets and thousands of new riders each day. Special events, especially baseball games at AT&T Park and football games at Levi's Stadium, bring another type and level of crowding — which will grow with the opening of the Warriors' arena (Chase Center) in San Francisco in 2019. Both San Francisco International Airport and Mineta San Jose International Airport, already major generators of trips in the corridor, will handle larger volumes of air travelers in the future.[28]

In the longer run, new Caltrain and bus riders would come from regional growth, new transportation connections and changes in land use and public policy (such as the price of parking).

FIGURE 5

Buses on 101 Carry More People in Less Space

Vehicles containing only one person make up approximately 75 percent of vehicles on 101, despite carrying only 52 percent of passengers. Buses make up less than 1 percent of vehicles yet carry 15 percent of passengers.

Source: Produced for SPUR by Arup based on observation data from San Mateo County, Metropolitan Transportation Commission 2015, http://www.transformca.org/sites/default/files/Optimized%20HOT%20SMC%20101%20Factsheet%20Final.pdf

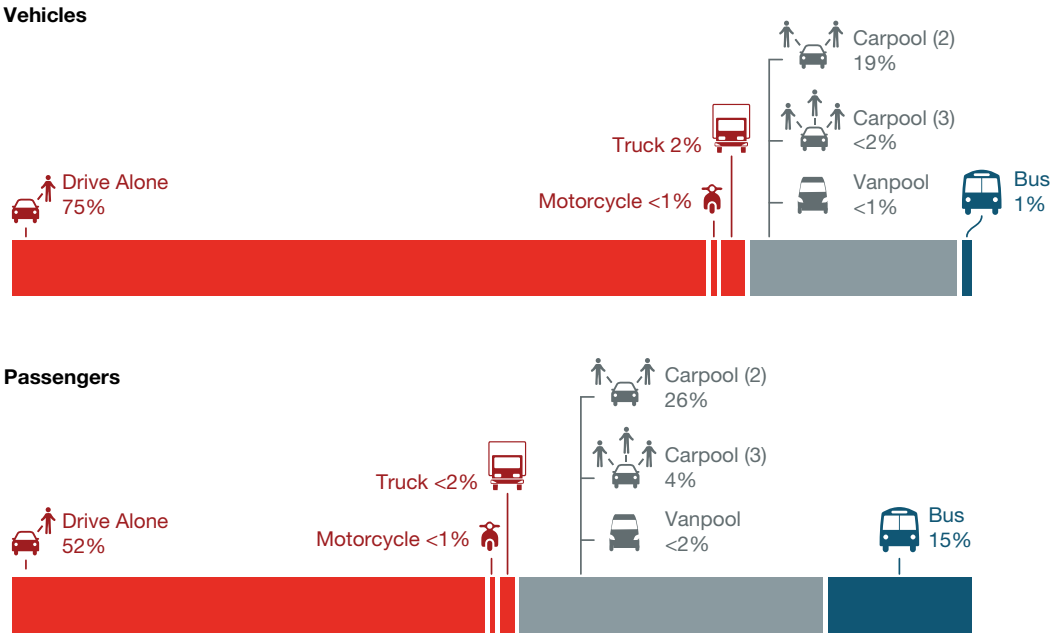
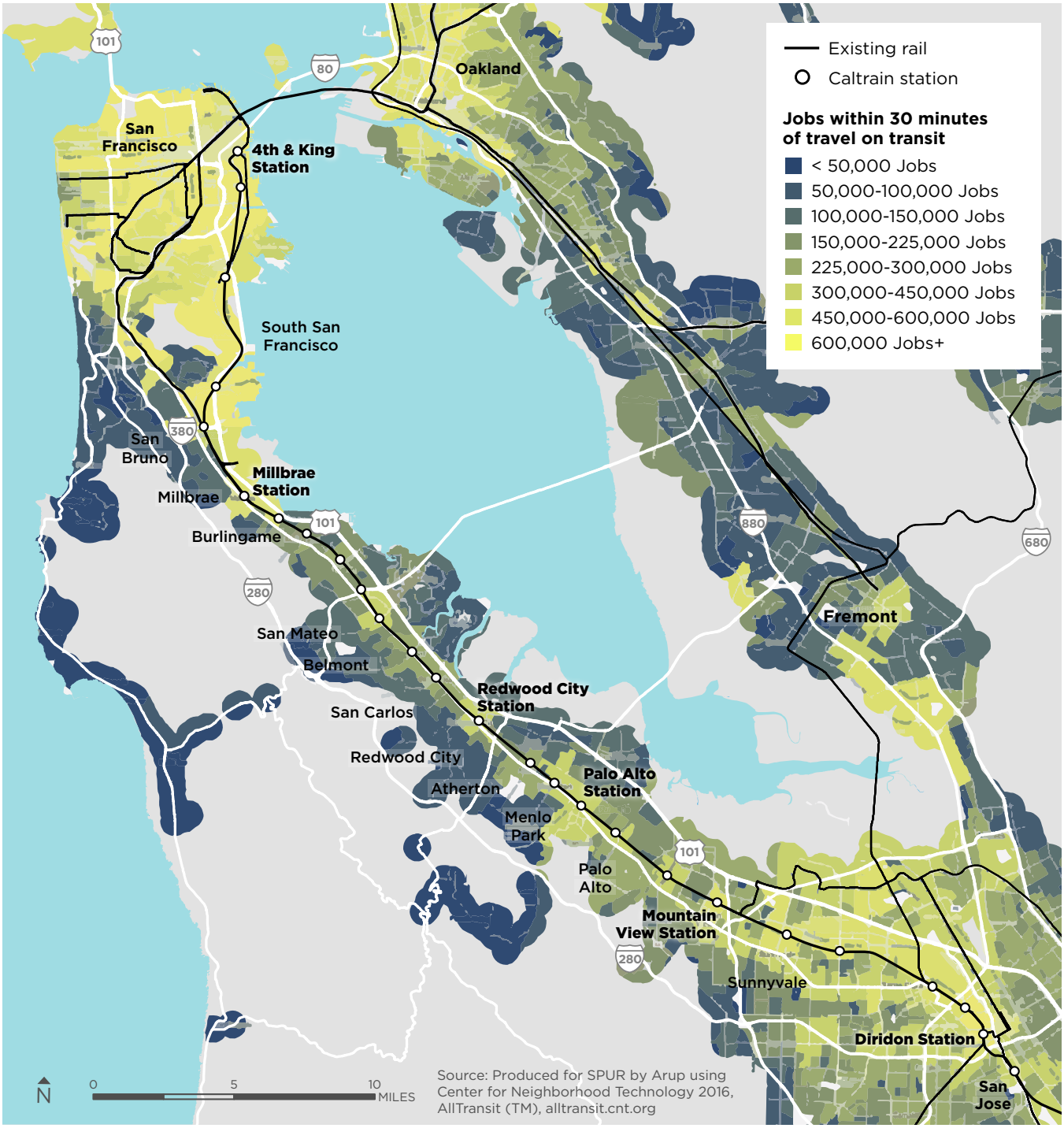


FIGURE 6

Number of Jobs Accessible by a 30-Minute or Less Transit Ride

The density of jobs and availability of efficient transit varies dramatically in the Caltrain Corridor, which affects workers' ability to access jobs. Improved transit services, as well as building more housing near jobs, would give more people access to work opportunities and a higher quality of life.



Source: Produced for SPUR by Arup using Center for Neighborhood Technology 2016, AllTransit (TM), alltransit.cnt.org

CHAPTER 2

Our Vision for the Caltrain Corridor

Convenience, Connectivity, Capacity, Community and Climate Protection

In the future, the way we use transit in the Caltrain Corridor may be vastly different than it is today. Our vision for the Caltrain Corridor centers on a modern and attractive rail system, catalyzed by the electrification of rail in the corridor and the arrival of high-speed rail service, both expected by 2025. Rail can and should be the backbone of Peninsula transportation: It can be fast and frequent, it can shape compact city growth and it's a low-carbon, low-pollution form of transportation.

In this vision, the Caltrain Corridor evolves in five ways:

Convenience

The corridor's robust transit system is useful for many kinds of trips that once took place with a car, or else didn't take place at all:

- Daily trips to work for all types of workers, during both crowded peak commute hours and off-peak hours
- Long-distance trips, such as from San Francisco to San Jose and beyond
- Trips to and from the San Francisco and San Jose airports
- Off-peak work trips or trips to school, such as from San Mateo to Stanford at midday or at night
- Leisure trips for social visits, shopping, entertainment, sporting and cultural events

Frequent Caltrain and other transit services are available throughout the day, allowing more noncommuter trips and freeing people from planning their trips around transit schedules. Trains reliably arrive and depart at the same time each hour on a predictable, frequent and regular schedule. With waits of 10 minutes or less most of the day, frequency is similar to BART service — and average train speed increases, with local, express and eventually high-speed trains.

All transit services — rail, buses and shared mobility — use the same fare structure, easy-to-understand branding and shared information tools, making the system more legible and attractive for users. Transportation services in the corridor are available and affordable to as many people as possible because fare subsidies and policies increase access and help match travelers with empty seats.

Connectivity

The corridor is seamlessly connected with the rest of the region and the state — not just on paper but in the passenger experience. Major rail transfer facilities like the Transbay Transit Center, Millbrae Station and San Jose Diridon Station offer timed connections between services, such as when switching from a high-speed rail train to an express Caltrain. When the Caltrain from San Francisco arrives at Diridon Station, a VTA light rail train waits for Caltrain passengers. Because trains arrive and depart predictably, it is easy to schedule reliable bus connections to and from the corridor's rail stations. Local rail stations are easy to get to and depart from; new types of transit and personal mobility innovations such as e-bikes grow station access.

The ultimate build-out of Caltrain connects to the Transbay Transit Center and then continues under the Bay to Oakland and then all the way to Sacramento (the Capitol Corridor alignment, as envisioned in the Capitol Corridor Vision Plan). In other words, improvements to Caltrain are planned with much more than just the Bay Area, or even high-speed rail to Los Angeles, in mind; this segment is the crux of a San Diego–to–Sacramento high-speed rail corridor that propels California into a sustainable era of mobility and greatly improved quality of life as envisioned in the 2040 California Transportation Plan.[29] Local rail services connect seamlessly to statewide rail services through the Transbay Corridor, the Altamont Corridor, the Dumbarton Corridor, the Capitol Corridor and the Gilroy Corridor. The seamless connections between local, state and regional rail make it logical to use rail instead of driving or flying for longer trips.

Capacity

The transit system moves far more people than it once did. There are more trains operating all day long. Publicly and privately operated regional buses complement rail and provide feeder services to deliver passengers. Buses use a new managed lane on Highway 101 that operates from San Francisco to San Jose. Revenues from dynamic pricing will help subsidize new public transit options along the same corridor, especially for lower income people. Carpools also use this managed lane and enjoy faster trip times. Pricing the lane helps prevent congestion, offering significant time savings for buses and carpools. Ferry service creates a new and expanded option to reach the Peninsula from other parts of the Bay in a shorter amount of time.

The system's expanded capacity has also added resiliency and support for disaster recovery. New transportation modes and transit links help people keep moving in the event of hazards both major and minor. Long-term planning for earthquakes and sea level rise has also prepared the network to handle day-to-day disruptions such as traffic incidents and construction projects.

Community

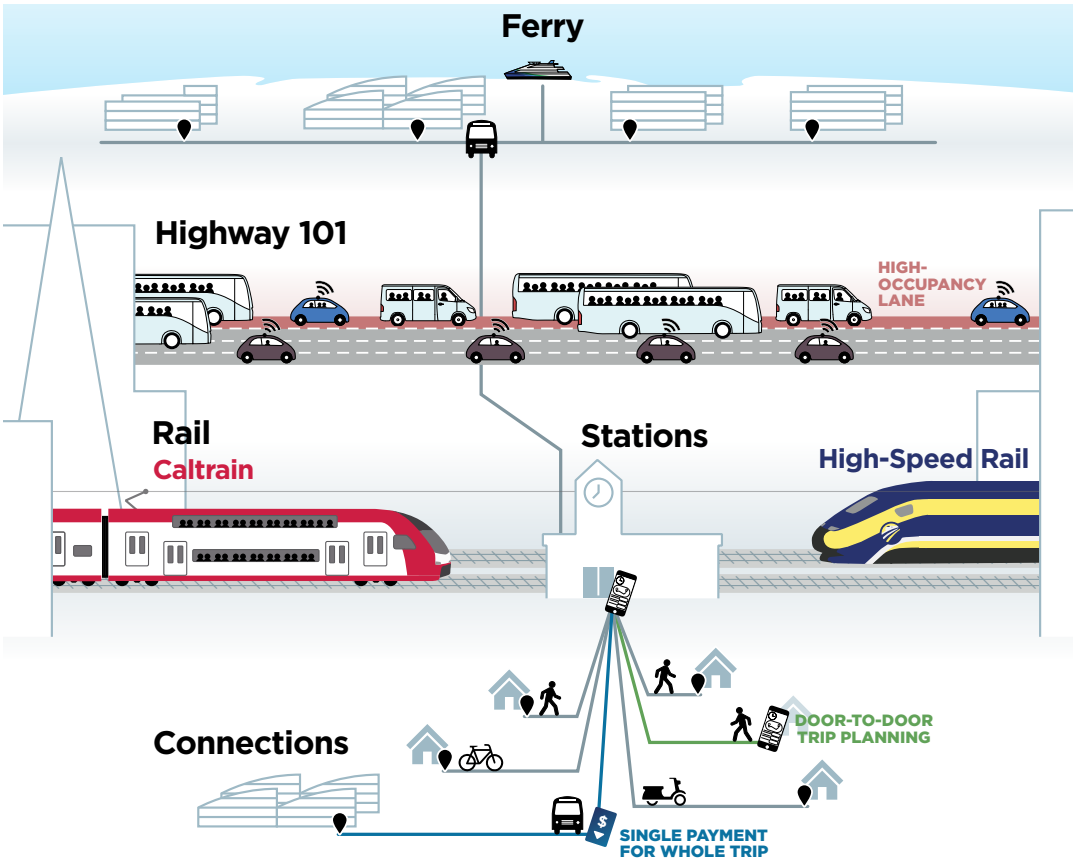
Rail is viewed and used as an asset in local communities. Stations are points of civic pride; architecture and urban design function to make the station both a place to spend time and a gateway to the community. Well-designed and cared for, rail stations signal that they are the heart of the transportation system and a part of the community identity. Stations are integrated with surrounding streets and land uses, which attracts new riders and encourages transit-oriented land use. Local negative impacts from transit — noise, pollution, safety — are reduced or eliminated. Cities are partners in helping transit succeed.

FIGURE 7

How the Corridor Transportation System Would Work

Our vision for transportation in the Caltrain Corridor is a convenient transit system with ample capacity to meet the corridor's needs. Travelers who use transit would have easy trip planning and payment options and a choice of travel modes throughout the day. This approach also supports the development of compact and walkable communities, particularly around rail stations.

Source: Produced for SPUR by Arup



Climate Protection

In this vision of the future, addressing passenger transportation in the corridor has helped California reach its climate goals, such as reducing greenhouse gas emissions to 40 percent below 1990 levels by 2030. Automobiles, the Bay Area's largest single source of climate pollution, are no longer the primary way to travel in the corridor. Walking, biking and public transit make up a much larger percentage of trips than they once did, and the electrification of Caltrain has further reduced emissions. With fewer greenhouse gas emissions, air pollution is down and public health is better. Residents are breathing cleaner air and are at less risk for developing asthma or allergies. The region has saved millions of dollars in avoided hospitalizations and sick days.[30] Meanwhile, cars and their infrastructure no longer interfere with the use of low- or no-carbon modes of transportation. For example, large roadways and fast-moving vehicles are no longer barriers to walking and biking in most of the corridor. People walk to and from stations and around station areas, and walking is prioritized as a means of transportation. Walkers and cyclists of all ages and abilities feel safe due to careful street design.

State, regional and local policies have successfully moved toward a zero-carbon transportation system in the Bay Area. The performance targets in Plan Bay Area, which guides investments and policy decisions for transportation funding, are met and exceeded: We have reduced per capita greenhouse gas emissions from cars and trucks and increased the percentage of trips made by modes other than cars.[31]

FIGURE 8

Upgrading the Capacity to Move People in the Caltrain Corridor

Adding capacity is a key part of the vision plan. As the region grows, highways, rail and ferries should move more people each day.

*Does not include new capacity added by high-speed rail service.

Source: SPUR analysis

	People moved during peak hour today (each direction)	People moved during peak hour under the vision plan (each direction)
Caltrain	3,250	10,800*
Highway 101 (one lane, converted to high occupancy)	1,780	5,680
Ferry	0	1,400

CHAPTER 3

Opportunities and Challenges

Achieving this vision for a great corridor will not be easy. We will need to overcome many long-standing challenges. At the same time, there are opportunities unique to this moment that we can leverage to create a new kind of transportation system. The following opportunities and challenges drive the recommendations in this vision plan.

Opportunity: Electrification and high-speed rail can dramatically improve rail capacity, comfort and reliability.

The next major, long-awaited improvement to rail service on the Peninsula is electrification of the railroad — that is, converting the train fleet from diesel to electric. This project includes electrifying Caltrain tracks between 4th and King Station in San Francisco and Tamien Station in San Jose, together with installing a new train control system and replacing today's diesel locomotives with electric ones. The result will be trains that can run closer together (allowing greater frequency), safer train operations, less pollution, less noise and — importantly — the ability for high-speed rail trains to use the same tracks. Together, these projects are known as the Caltrain Modernization Program (CalMod). The first electric train service is anticipated in 2021.[32]

However, the CalMod project on its own may not increase capacity enough to meet possible future growth in demand. (See page 21 for more discussion.)

The Role of High-Speed Rail

As soon as 2025, high-speed rail will begin operating in the Caltrain Corridor with plans to serve three stations: San Francisco's Transbay Transit Center, Millbrae Station and San Jose's Diridon Station. A fourth station in the Caltrain Corridor, most likely between Millbrae and Diridon, is still under consideration. Seats on high-speed rail trains may be available for local trips (between San Jose and Millbrae, for example), but this will depend on availability, given that many seats will be filled with passengers who started their trip in Fresno or Los Angeles. It will also depend on the price of high-speed rail seats. Pricing policies for high-speed rail will be determined by the concessionaire who operates the service in the future. Nonetheless, high-speed rail seats do contribute new capacity in the corridor as high-speed rail passengers are making trips that would otherwise use Caltrain or Highway 101.

The California High-Speed Rail Authority and Caltrain were part of a nine-party agreement, in 2012, to develop a blended system in which the two services will share tracks and stations, thus avoiding expanding rail to four tracks throughout the corridor. Sharing infrastructure, a practice used in France and Germany,[33] minimizes the cost and impacts on communities and maximizes the benefits from investments in new infrastructure. It can better serve passengers by making stations more compact and transfers between trains easier. This creates an entirely new role for Caltrain as a high-speed rail connector service. (However, as discussed in Chapter 4, high-speed rail service will have to be carefully integrated with local trains.)

High-speed rail trains will use electric multiple units — train cars that receive power from overhead wires. Each car receives its own power, rather than having a single engine at the front or back of the trains.

The rail authority's business plan proposes to deliver the project and begin service in phases.[34] As the size of the high-speed rail network and demand for it grow, the number of trains per hour will increase from two during peak hours and one during off-peak hours to four trains per hour all day.[35] Completion of these phases will depend on funding availability:

Phase 1: Service Between San Francisco and Anaheim

- Silicon Valley (San Jose) to Central Valley (Bakersfield) service begins in 2025. If funding becomes available and the Caltrain Corridor is ready, the northern terminus of this service could be San Francisco and the southern terminus could be Bakersfield. As of publication, this project segment is under construction.
- San Francisco to Los Angeles/Anaheim service would begin in 2029 if funding becomes available.

Phase 2: Service Extended to Sacramento and San Diego

- Service is extended south from Los Angeles/Anaheim to San Diego.
- Service is extended north from Merced to Sacramento.

FIGURE 9

The Future Statewide Rail Network

The ultimate build-out of Caltrain would reach the Transbay Transit Center and then continue under the Bay to connect with a new, electrified and straightened Capitol Corridor alignment (per the Capitol Corridor Vision Plan). In other words, the Caltrain upgrade project is about much more than just the Bay Area or even high-speed rail to Los Angeles and San Diego; this segment is the crux of the San Diego–to–Sacramento high-speed rail corridor that can propel California into a sustainable era of mobility and greatly improved quality of life.

*BART includes VTA's BART Silicon Valley project.

Source: Produced for SPUR by Arup

The Caltrain Corridor will become part of an improved statewide rail network.

High-speed rail and many other statewide rail modernization projects will connect this corridor with other California cities via Amtrak and local services that have timed connections with high-speed rail at transfer points across the state. Regional rail projects will also connect the Caltrain Corridor to the rest of the region and state: BART Silicon Valley (under construction, needs funding), rail service on Dumbarton Rail Bridge (under study, needs funding) and a second transbay crossing (under study, needs funding) could connect the Caltrain Corridor with the Capitol Corridor, reaching Sacramento and beyond.

Opportunity: Electrification can transform the economics of the railroad.

Electrification gives us the chance to create an attractive train schedule with frequent service between the places people want to go while also operating more cost-efficiently. The new electric trains will be electric multiple units: Each rail car has its own propulsion, so cars can be added to make longer trains without losing performance. One of the primary reasons why electrification allows for more efficient service, where trains can run closer together, is that electric trains accelerate much faster than diesel trains. Faster acceleration is important because it reduces the time penalty for making a stop. This makes it more cost-efficient to add new trains to the schedule. The result could be that adding trains to the schedule actually brings in revenue rather than requiring more subsidy. This is especially true in the Caltrain Corridor: Caltrain is almost unique in the world as a single-line commuter rail with bidirectional demand, which makes it possible to fill seats in both directions all day long.

Opportunity: Public-private partnerships and policies can make transit work better.

Private organizations in the Caltrain Corridor are leaders in shifting people away from driving and toward more sustainable travel modes. Tools for reducing solo driving — collectively known as transportation demand management — include charging for previously free parking (with discounts for carpoolers), offering transit passes, and improving infrastructure and facilities for bicyclists and pedestrians. In addition, many large employers run employee shuttle services directly to their campuses from neighborhoods around the region. These shuttles provide employees with an alternative to driving alone and allow workers to begin their workdays while commuting.[36]

Some of this innovation is driven by public policy, such as the trip cap goal that Santa Clara County and Stanford University agreed upon when the county granted a permit for campus expansion.[37] The cap set a limit on the number of vehicles that are allowed onto campus during certain hours of the day. From 2002 to 2015, Stanford University reduced employee single-occupancy vehicle trips from 72 percent to 50 percent by using these strategies and offering services such as the popular Marguerite Shuttle bus system, which is open to the public. Trip caps increase demand for transit services and other more sustainable transportation solutions.[38]

Transportation management associations (TMAs) are another emerging public-private partnership to solve transportation problems for particular communities. TMAs help people shift from driving alone to other travel modes by offering or facilitating carpools, offering transit subsidies and passes, running buses and shuttles for groups of companies, operating "guaranteed ride home" programs, and coordinating parking pricing and other policies. Many of these associations serve downtowns and include smaller business, not just office parks with a few big companies.

One such example is the Downtown Palo Alto Transportation Management Association, which was created to help achieve the city's goal of a 30 percent drive-alone rate.[39] These associations enable employment-rich areas to pool funds to coordinate express buses and carpool/vanpool services for companies too small to run their own. (Technology companies that can afford to operate private shuttles represent a minority of all the employment in the corridor.) Another example of a TMA is Commute.org, a nonprofit governed by 17 cities and San Mateo County. It runs shuttles to multi-tenant office parks, such as a route between Oyster Point and the South San Francisco BART station.

Private employers and institutions are also working proactively to increase bicycling by partnering with cities to build new bike trails and coordinate their plans. For example, the Google Bike Vision Plan, an evaluation of the greater Mountain View area bike network, has proposed changes to make biking safer and more comfortable for a greater segment of the population.

Opportunity: The digital age of transportation portends safe, efficient, convenient passenger transportation.

The digital age of transportation — heralded by the emergence of technology based on apps, sensors and communications — is being invented in the Caltrain Corridor. This creates a multitude of opportunities for new partnerships, pilot projects and testing. Some of these technologies include:

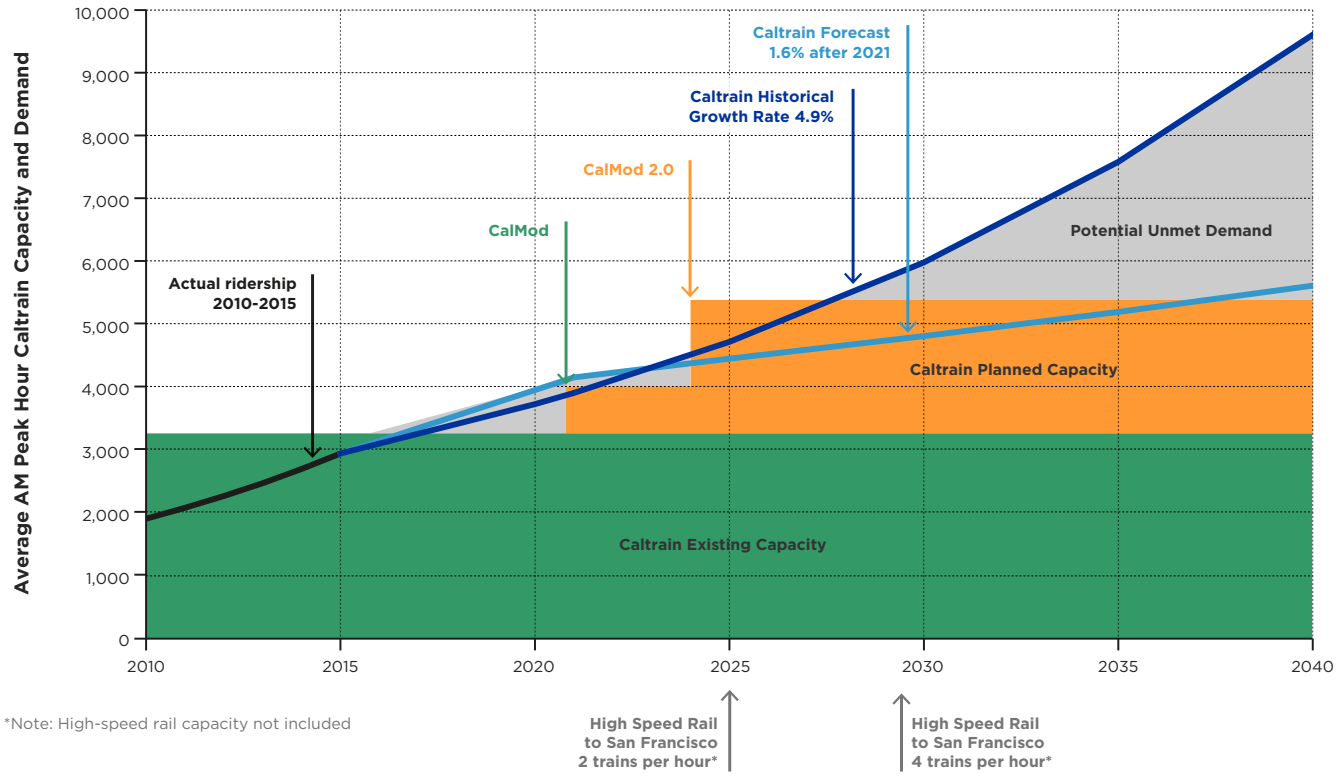
- **Personal mobility options.** Traditional bikes and bike sharing are already common options for personal mobility. Emerging tools include tricycles, cargo bikes, e-bikes, e-scooters and e-skateboards.
- **New delivery options.** Increasingly, people are using delivery services to receive goods rather than making a trip. These services, and perhaps someday automated delivery vehicles (both wheeled and flying), could further transform how people acquire goods.
- **New ways to form carpools.** Alternatives to driving alone have focused on ride-sharing services such as carpools and vanpools. New services are emerging that use internet features and mobile applications to provide on-demand carpooling.
- **On-demand rides.** Transportation network companies, such as Uber and Lyft, provide on-demand rides hailed through a smartphone app (also known as ride hailing). Major growth and change are expected in this sector in the coming years, especially as auto manufacturers and other companies launch ride-hailing services. The ease of ride-hailing may actually increase single-occupant (excluding the driver) auto trips, which works against transportation goals. Ride-hailing could also make high-occupancy carpool lanes overfull with cars with only one passenger (and one driver). A remedy for this is to require three-person carpools in high-occupancy lanes.
- **Mobility as a service.** Mobility as a service refers to the idea that a traveler can get around by comparing mobility services — such as train, taxi, bike sharing or bus — and purchasing services all on one platform. The Moovel smartphone app is an example of this, and a pilot has started in the greater Palo Alto area.[40] Having a single platform enables the public sector or businesses to offer mobility subsidies or discounts to employees, and it also enables data collection.
- **Widespread real-time information.** Continually updated information on conditions and prices for transit and roads — provided through smartphones, electronic signs and other applications — increasingly shapes where, when and how people travel. For example, telling travelers how much parking is available or how long driving would take at a particular time can lead them to choose a different transportation mode. Informing transit passengers when the next train will be arriving both increases comfort and allows passengers to make better use of their waiting time, which can help avoid crowded platforms.

FIGURE 10

More Can Be Done to Meet Possible Demand

Growth in demand could exceed the amount of transit service Caltrain has planned for in the CalMod and CalMod 2.0 projects. (Read more about CalMod 2.0 on page 27.) Transportation solutions for a high-growth scenario need to be developed for rail service.

Source: SPUR analysis of data from the Caltrain Modernization Program



*Note: High-speed rail capacity not included

- **Pricing, payment and traveler information.** Technological advances make trips using multiple services much easier and more seamless, whether travelers are getting from the transit station to their final destination or making connections to the regional and statewide rail network. Technology is also making it easier to get real-time information on what is happening on the ground at any given time. This helps agencies that operate highway or transit facilities to estimate the correct price to shift behavior and get that price information out to users, who can then use it to choose and purchase their mobility. Pricing is one of our strongest tools to balance supply and demand, shape travel choices and help achieve our sustainability goals. At a simpler level, technology is making it easier to offer multiple prices for transportation, such as off-peak transit fares or passes.
- **Autonomous and connected vehicles.** Autonomous or driverless vehicles could lead to a transformation in mobility and how roads are used. One possible impact is that autonomous vehicles may result in reduced car ownership. In cities, fleets of autonomous taxi services available at any time or location could create an affordable alternative to owning a car.[41] Such services are beginning to be tested in U.S. cities. Eventually, existing road lanes could accommodate significantly more vehicles: If cars can sense one another, they can safely travel more closely together. This increase in vehicle flow could be dramatic — equivalent to adding new road lanes.[42] However, the promise that wide deployment of autonomous vehicles will reduce congestion or the need for roads and parking spaces will not come to pass without other public policy interventions, such as pricing of road use and parking and the addition of buses and carpools, which would help avoid a scenario of autonomous car gridlock. This is because the increased efficiencies of vehicles carrying a few people are not enough to overcome the vastly higher efficiencies that are offered by buses and rail.

There are many scenarios for how these technologies might change urban and regional transportation in the Bay Area. Rather than making rail and transit less relevant, these technologies could usher in a new era of rail-oriented urban growth, where land previously used for traffic and parking is used for housing, jobs and public space, allowing transit to operate more efficiently. However, this future can only happen if we choose the right policies and investments today.

CASE STUDY

Switzerland's Taktfahrplan and Bahn-2000

Passengers on the concourse at the Zurich Hauptbahnhof train station, the largest railway station in Switzerland. The Bahn-2000 has been an unprecedented success.

Taktfahrplan: The "Pulse" Plan

Switzerland's highly praised railway system operates based on a *Taktfahrplan*, a public transport schedule that is organized around a repeating beat or pulse (*Takt*). Public transport vehicles arrive at a station at about the same time, passengers transfer between vehicles and the vehicles leave. The pattern repeats on a fixed interval, for example, every half-hour, all day long.

For passengers, a Taktfahrplan schedule is easy to remember and the system provides access to many more places than direct trains; short connection times and reliable service keep transfers from being a burden. For operators, a Taktfahrplan leads to more efficient service by using vehicles and infrastructure more intensively.

When Swiss National Railways began comprehensively implementing the Taktfahrplan in the mid-1980s, the idea was not new. Similar schedules were being operated in the Netherlands and other countries, and the approach of creating pulsed public transport systems had also been used for buses (timed transfers) and even airplanes (hub-and-spoke). The innovation was to implement the Taktfahrplan consistently on long-distance, regional and local trains throughout the country.

Switzerland's approach was very successful. Since 1970, the annual number of passenger-kilometers traveled has increased by 113 percent, compared to only 30 percent in the European Union as a whole. In Zurich, the Taktfahrplan schedule is partly responsible for an increase in ridership on the S-Bahn (similar to Caltrain or BART) by more than 160 percent since 1990.

Bahn-2000

In the 1970s Switzerland voted against building a national high-speed rail system between Zurich and Geneva. Voters opposed it because it would have only served a few cities and because it was already possible to travel the 171 miles between the two cities in about three hours.

Instead of the high-speed line, Swiss railway planners decided to create a supercharged Taktfahrplan with faster speeds on some lines and more connections at hubs. The goal became not to travel as fast as possible but rather as fast as necessary to make the Taktfahrplan work in the entire country. This would make it faster and easier to travel between all destinations in the country, rather than just between the cities on the high-speed rail line.

Applying the Taktfahrplan approach to Switzerland's vast railway network was complex. The main problems were station capacity (tracks for trains and space for people to transfer) and speed on specific line segments. (Some high-speed segments were needed to achieve the required less-than-one-hour travel times, for example, on the line between Zurich and Bern.)

The Bahn-2000 program was designed to build the new infrastructure needed to support the nationwide Taktfahrplan schedule. The program was completed in 2004 and has been an unprecedented success. Rail patronage has risen substantially, and revenues have increased.[49]

However, Switzerland's success is not without drawbacks. Today many parts of the network are overcrowded and capacity is strained. This is also true for other railways that have adopted Taktfahrplan approaches. Consequently, European railways are turning to new methods of strategic planning using information and communications technologies to help them solve the unintended challenges of their success.

Challenge: Caltrain is financially unstable, making it difficult to plan for the future.

While a large sum of funding has been assembled for the CalMod project, the ongoing funding for rail operations and system maintenance continues to be unstable because Caltrain, unlike all other major Bay Area transit agencies, lacks a dedicated source of funding, such as a dedicated parcel tax, sales tax or general fund transfer.

Today, outside of fare revenue (which accounts for nearly 71 percent of operating costs) and grant sources, Caltrain is largely funded through contributions from its joint powers board members (San Francisco, San Mateo and Santa Clara counties), each of which can elect to reduce or withdraw funding at any time — and when one county reduces its contribution, the other counties may also reduce their contributions.[43] This situation not only constrains planning but can also cause a funding crisis at any time, forcing immediate service cuts or project postponement.[44] As discussed above, electrification could change the economics and enable the railroad to have more revenue, but there would still be a need for significant funding to develop the projects outlined in this vision plan.

The lack of an ongoing revenue stream for Caltrain makes it difficult to plan for improved services, a new fleet and new capital projects. Despite clamors for more service today — and despite being located in one of the wealthiest corridors in the nation — Caltrain has not increased off-peak services and only plans for a small service increase with electrification, because the agency does not foresee having the funding to increase train operations. Caltrain's Strategic Plan calls for creating a more frequent, all-day train service that grows to meet demand.[45] However, Caltrain's Short Range Transit Plan, which is constrained by anticipated funding, only expects to increase daily service from 92 trains today to 114 trains a day in 2021, with no increases to follow.[46] (In comparison, currently 285 BART trains per day stop at the Embarcadero station, and BART plans to operate 30 trains each hour through the Transbay Tube in 2021.)[47]

Challenge: Transportation planning is done locally, for one mode at a time, instead of through an integrated, corridor-wide approach.

The sheer number of transportation planning and operating agencies serving this corridor, each with a different focus and geography, makes it hard to plan and implement solutions. Fragmentation in this transportation corridor is worse than in many others: The 47 miles of Caltrain between San Francisco and San Jose traverse 17 cities and involve 10 public transit operators (and a growing number of quasi-public shuttle operators), three county congestion management agencies, regional agencies and state agencies. All of these entities own transportation facilities, operate transportation services or have jurisdiction over transportation decisions.

Making matters worse, transportation jurisdictions typically follow county or city boundaries, but those boundaries don't correspond to how people live their lives. Because city, county and transit agencies all report to their own local boards, the needs of the corridor as a whole are not prioritized, and it can be unclear how corridor-wide projects fit with local plans. While reducing the number of agencies is one strategy to reduce fragmentation, there is also the opportunity for more corridor-scale collaboration on policymaking and infrastructure planning.

Challenge: Neighborhood impacts and policies make it harder to grow rail service.

The railroad has both positive and negative impacts for cities in the corridor — not unlike highways and roads. On the one hand, it provides a transportation service with many social, environmental and economic benefits. On the other hand, trains and related facilities have negative impacts on the surrounding land. As a result, the ability to add service can be hampered by the impacts of the service and infrastructure on neighboring communities. One major concern is safety and traffic around at-grade crossings, the places where the railroad crosses local roads. There are 42 such crossings in the corridor today, and they can affect motorists, pedestrians and cyclists who have to wait until a train has passed. For the past 20 years there has been an average of 13 deaths a year on the Caltrain right-of-way, the majority of which were caused by suicide.[48]

Other major neighborhood concerns are the noise, vibration and pollution from diesel engines. This was an impetus for the electrification project, which will reduce these effects (although locomotive horn noise will not be affected).

Despite these challenges, we can move forward in a unified direction to achieve our vision for the Caltrain Corridor. The next five chapters explain the policy choices, projects and programs that should be pursued across five aspects of transportation: rail, rail stations and connections, Highway 101, ferries and the transit passenger experience. Chapters 9 and 10 explain what the vision plan will cost and how we can fund it.

CHAPTER 4

Rail

Goal: Develop reliable, frequent all-day rail service between San Jose and downtown San Francisco, with enough capacity to meet demand.

Of the many transportation modes in the corridor, Caltrain presents the most exciting opportunities to move more people without more traffic and pollution. We recommend that Caltrain plan to grow its ridership to nearly four times what it is today by making the best possible use of the rail corridor, offering attractive local, express and high-speed rail trains, and extending the rail corridor to reach downtown San Francisco's large transit market.

RECOMMENDATION 1.

Adopt an integrated rail schedule that adds frequency all day at regular intervals, increases capacity to meet demand and attracts new riders.

Who: Peninsula Corridor Joint Powers Board (PCJPB), California High-Speed Rail Authority (CAHSRA), ACE, Capitol Corridor, Amtrak

Rail service in the corridor should have two main service goals:

- **Ensure access.** Provide a predictable minimum level of service at all stations that reliably connects with higher-speed (express) services and the rest of the system.
- **Ensure quality.** Offer travel times that are competitive with driving, especially for longer-distance trips where rail can average higher speeds.

The primary tension with developing a rail schedule is offering service at as many stations as possible (often described as "access" or "coverage" services) while also providing fast travel times. To a limited extent, both goals can be satisfied by providing some "slow" trains that offer more stops and some "fast" trains with fewer stops. For example, electrical multiple unit trains that serve all stops can traverse the corridor in approximately 75 minutes, whereas high-speed rail trains plan to traverse the corridor in 40 minutes, with just one stop in Millbrae. However, above certain service levels, slow and fast trains cannot coexist on the same corridor because fast trains catch up with the slow trains in front of them. For these higher levels of service, passing tracks, which allow fast trains to overtake slow trains, are necessary. An added scheduling challenge is to make sure that trains arrive and depart stations at regular intervals, such as every 10 minutes.

In the future, there will likely be more local trains, more express trains and also high-speed rail trains on the Caltrain tracks. This discussion builds upon the prototypical schedules explored in the 2012 Caltrain/HSR Blended Operations Analysis.[50] It focuses on blending Caltrain's local and express services with high-speed rail, although there are other train operators whose services should be integrated between Santa Clara and Diridon Station and points south.

Service South of Diridon

This vision plan covers the Caltrain Corridor between the future Transbay Transit Center in San Francisco and Diridon Station in San Jose because this is Caltrain's mainline system and is what the current service schedule is built around. However, Caltrain's service south of Diridon — to Tamien, Gilroy and Morgan Hill stations — also needs increased service. These stations currently have three northbound departures each morning and three southbound arrivals each evening. While the CalMod project will extend to Tamien Station, thanks to Caltrain ownership of the right-of-way, Union Pacific Railway owns the segment of rail south of Tamien that extends to Morgan Hill and Gilroy. The future Caltrain service structure will likely retain its focus on service between Diridon and San Francisco, with peak period service to Gilroy, but this has not yet been determined. Service between Tamien and Gilroy will be provided with a diesel shuttle train service. Further research should be done to evaluate options for increasing service south of Diridon.

RECOMMENDATION 2.

Adopt service planning guidelines to correlate future service levels with actual ridership and with ongoing local support for station-area development.

Who: PCJPB, Metropolitan Transportation Commission (MTC), cities along the corridor

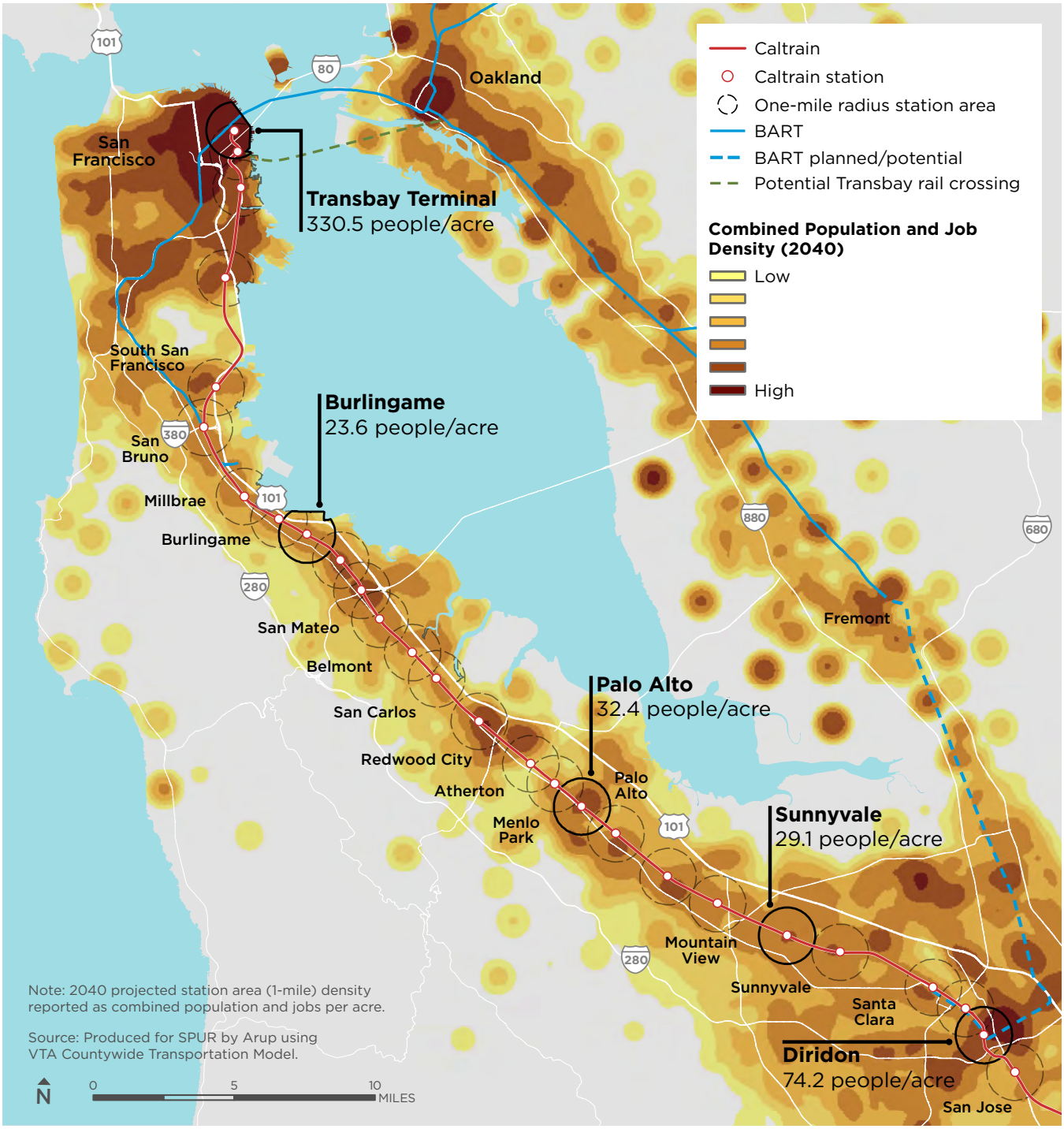
In practice, several factors must be considered when allocating transit service and developing a timetable within a certain operating budget: Which stations should get more express service? Which stations should be ensured a minimum amount of service?

One approach, increasingly used for bus services, is to use a portion of funds for "ridership" services (service where there are the most riders) and a portion of funds for "coverage" services (service at more stops, even when there is little demand), for example, 80 percent for ridership and 20 percent for coverage.[51] Actual land use and actual demand should be a primary consideration for ridership-based services. For example, Lawrence Station in Sunnyvale has historically been a low-density station area but is now being zoned for higher-density jobs and housing and therefore merits higher Caltrain service levels.[52] Stanford Research Park, near California Station, is a similar example.

FIGURE 11

Growing Station Areas Will Need More Caltrain Service

Plan Bay Area 2040 projects that between 2010 and 2040, employment will increase by 51 percent in San Francisco County, 37 percent in San Mateo County and 42 percent in Santa Clara County. The number of households in the three counties is projected to increase by 40 percent, 23 percent and 42 percent, respectively. A large part of this growth is expected within a mile of Caltrain stations (shown as circles).



How to Grow Rail Service in the Caltrain Corridor

In addition to Caltrain's planned increases in service, the vision plan includes three additional stages of increasing Caltrain service. We call them Rail Modernization 3.0, Rail Modernization 4.0 and Rail Modernization 5.0. Here we highlight the investments that will be needed at each phase in order to keep growing capacity and offering an attractive train schedule. High-speed rail capacity is described in the figure at right, however it is unknown at this time if seats on those trains will be available to meet demand for local trips between San Francisco and San Jose. See Appendix A for more detail. (Available at spur.org/caltraincorridor.)

Existing Plans

- **Today: 60,000 seats/day.** Caltrain currently operates 92 trains per day, with local, limited and Baby Bullet trains. There are approximately 5 miles of existing passing tracks.
- **Electrified Opening Day: 94,000 seats/day.** Electrification includes the train control system upgrade, installing catenary wires and buying 96 electric railcars. On opening day, electrified service can provide a daily line capacity of approximately 84,000 daily passengers. (This assumes a peak period schedule of six trains per hour composed of Baby Bullet and skip-stop trains.[61])
- **CalMod 2.0: 125,000 seats/day.** CalMod 2.0 can provide a daily line capacity of 110,000 passengers by lengthening platforms at 17 stations, operating eight-car trains and purchasing an additional 96 electric cars. Critical grade separations would likely need to be completed before increasing train frequency beyond this level.

Vision Plan

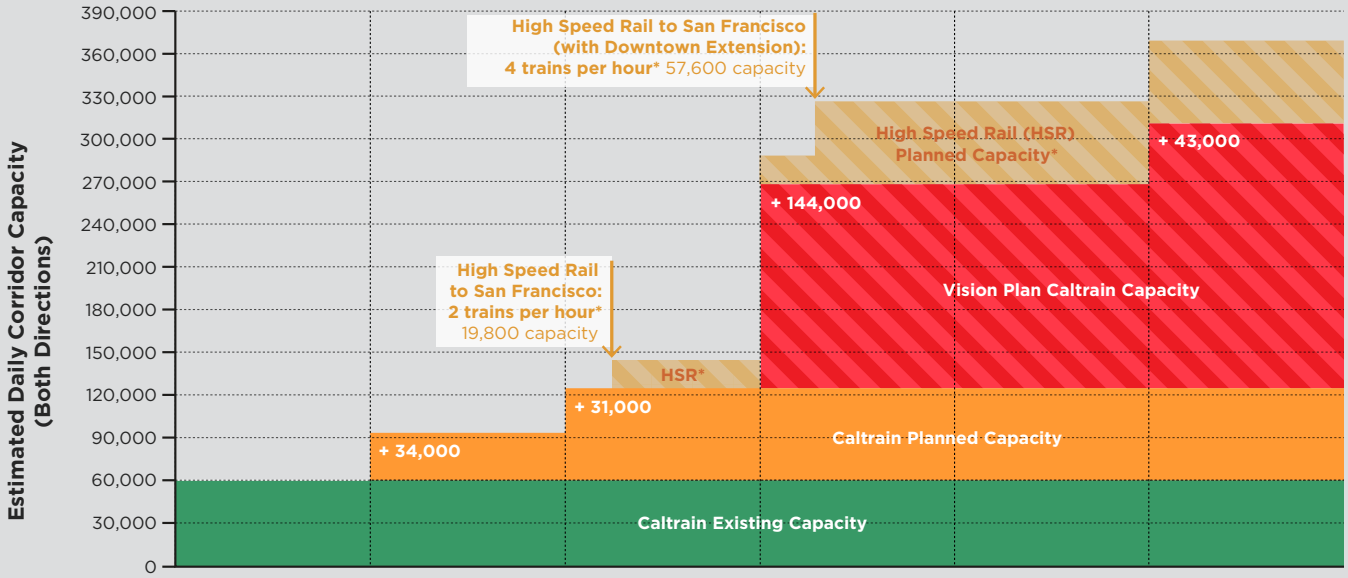
- **Rail Modernization 3.0: 269,000 seats/day.** Phase 3.0 is marked by the introduction of high-speed rail (four trains per hour, serving San Jose Diridon, Millbrae and San Francisco 4th and King). Caltrain can provide a daily line capacity of approximately 269,000 daily passengers at this point by increasing peak period service to eight trains per hour and operating on a skip-stop service pattern. This will require approximately 10 new miles of passing track and 65 additional electric railcars. Without the new passing track, high-speed rail trains would have significant impacts on Caltrain's schedule. Approximately five stations will need to be reconstructed. Critical grade separations need to be completed before increasing train frequency further.
- **Rail Modernization 4.0: 269,000 seats/day.** Phase 4.0 is marked by the opening of the Caltrain and high-speed rail extension to San Francisco's Transbay Transit Center. It also includes the construction of approximately 10 new miles of passing tracks. This new passing track will reduce the travel time of every Caltrain train (by approximately four minutes each between San Francisco and San Jose) by enabling high-speed rail to overtake Caltrain trains without delays, which is not possible under Rail Modernization 3.0. Approximately seven stations will need to be reconstructed during this phase. New capacity on Caltrain will be needed to accommodate the new riders that come with the opening of the extension to the Transbay Transit Center in 2025 (discussed in Recommendation 6).[62]
- **Rail Modernization 5.0: 312,000 seats/day.** At phase 5.0, there are two choices for increasing ridership and train frequency; both would require major policy changes. One is to completely separate the high-speed rail and Baby Bullet trains from slower trains and operate them on a new, separate pair of tracks. This requires four tracks for the length of the corridor — an additional 20 miles more than Rail Modernization 4.0. However, due to community concerns, legislation that has enabled implementation of the blended system currently precludes a four-track solution. (See further discussion in "Barriers to a Four-Track System" on page 28.) An alternate choice is to further optimize the use of the existing rail infrastructure, changing the operating conditions for local, express and high-speed services such that high-speed trains operate at the same speed as Baby Bullet trains. Potentially, high-speed trains could operate on a Baby Bullet-like schedule in the corridor. In either case, there are opportunities to increase ridership and service in the corridor, but the options will require addressing legislative and governance barriers to implementation as well as community and environmental concerns.

FIGURE 12

Keep Growing Rail Service in the Caltrain Corridor

The opportunity to offer attractive and coordinated local, express and high-speed rail service in the Caltrain Corridor depends on what investments and policy decisions are made. The addition of train cars, passing tracks and station modifications all support service growth.

Source: SPUR analysis.



Caltrain Service by Phase

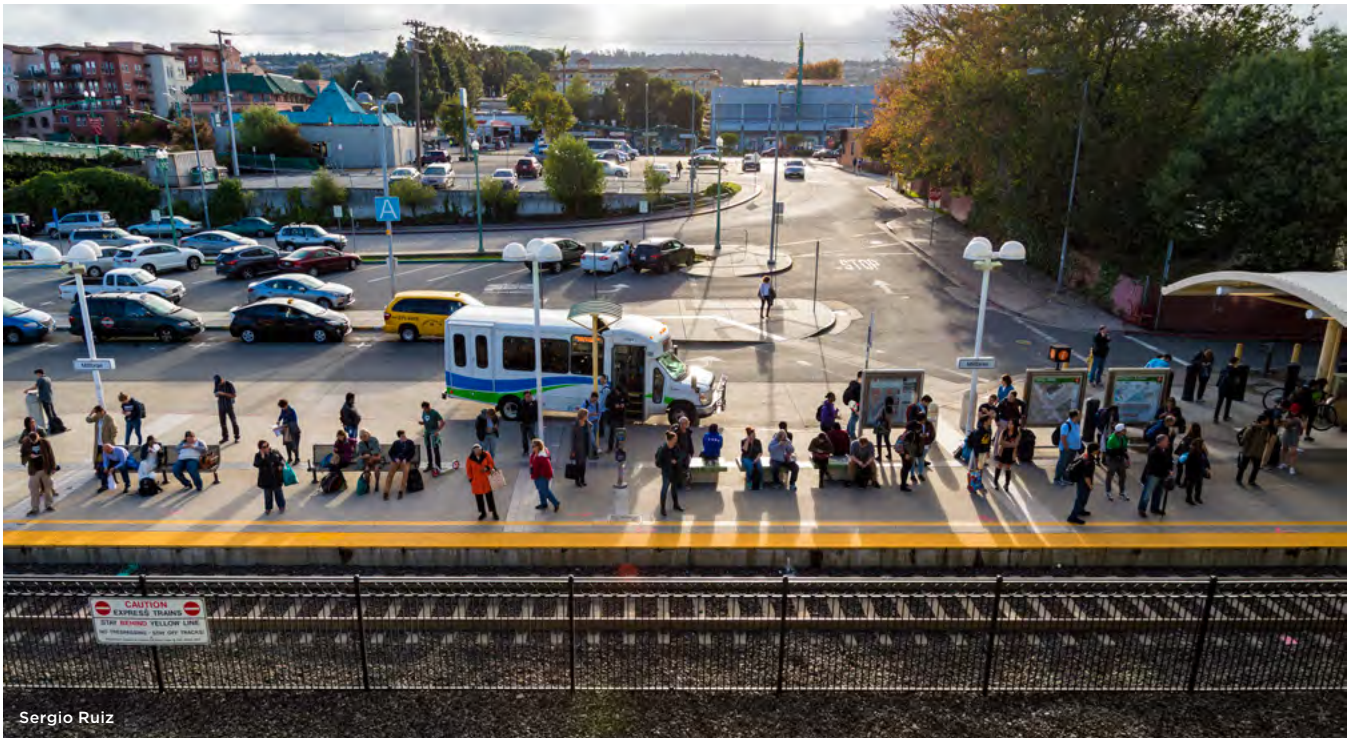
	Existing	CalMod	CalMod 2.0	Rail Modernization 3.0	Rail Modernization 4.0	Rail Modernization 5.0
Estimated timeframe	-	2021	2024	~2025	~2030	~2035
Estimated daily capacity	60,000	94,000	125,000	269,000	269,000	312,000
Peak-hour capacity per direction	3,250**	4,000	5,400	7,200	7,200	10,800
Off-peak capacity per direction	650-1,300	1,300	1,800	5,400	5,400	5,400
Trains per peak hour	5	6	6	8	8	12
Peak-hour station train frequency	12-36 minutes	10-30 minutes	10-30 minutes	7.5-15 minutes	7.5-15 minutes	5-15 minutes
Services patterns	Baby Bullet + Limited	Baby Bullet + Limited	Baby Bullet + Limited	A-B Skip-Stop	A-B Skip-Stop	Baby Bullet + A-B Skip-Stop
Vehicles	+ 16 diesel cars	+ 96 new electric cars	+ 96 new electric cars	+ 65 new electric cars	-	+ 80 new electric cars
Infrastructure	-	Train control, signal system	Longer platforms for 8-car trains	+10 mi passing tracks/stations grade separations	+10 mi passing tracks/stations grade separations	+20 mi passing tracks/stations grade separations

*Actual capacity for local trips on high-speed rail will likely be significantly less than total capacity due to long-haul riders.

** Does not include capacity gained by increasing from 5-car to 6-car trains. 6-car trains will have a 3,900-person capacity per hour per direction.

Note: New track mileage is four-track corridor mileage. Assumptions were made about off-peak service levels to arrive at daily capacity estimates. Ridership can exceed capacity because a single seat can serve multiple riders along the line.

Sources: Caltrain Modernization Program, California High-Speed Rail Authority Buisness Plan, May 2016, SPUR analysis



Sergio Ruiz

One way to ensure ridership and local support is for Caltrain to adopt service planning guidelines that suggest what levels of service to offer at what types of stations and also help guide the location of new stations or the decision to close stations. The policy would encourage local jurisdictions to include complementary transit-oriented development policies such as minimum densities, parking maximums, requiring transportation demand management or anti-displacement policies. The policy could also provide a way to factor in the availability of shuttles and other "first and last mile" connections to get travelers to and from transit stations. Other Bay Area transit operators have similar policies, such as VTA's Service Design Guidelines.[53] Caltrain can encourage station-area development that supports transit ridership by adopting transit-oriented development policies for Caltrain's properties and by participating in local station-area planning efforts.[54]

RECOMMENDATION 3.

Add system upgrades, infrastructure and new train cars strategically to increase frequency, add capacity, increase reliability and reduce travel times.

Who: PCJPB, CAHSRA, Transbay Joint Powers Authority, cities along the corridor

Specific system improvements will be needed to improve the operational flexibility and performance of the overall corridor. Figure 12 on page 25 explains how they can be used together to grow capacity over time. We recommend the following types of infrastructure and system upgrades:

Passing Tracks (Third and Fourth Tracks)

Most of the Caltrain Corridor still has only two tracks, with few opportunities for trains to overtake one another. The lack of passing tracks, where an additional track allows a faster train to pass a slower train, limits the flexibility of the train schedule. Installing passing tracks at the Bayshore and Lawrence stations allowed Caltrain to create the Baby Bullet service. There are two main types of passing tracks. One is rolling overtake tracks, which allow moving trains to overtake other moving trains. These are used today for the Baby Bullet service. The other is passing tracks at stations, which enable trains to pass stopped trains. Other types of tracks are pocket tracks (where a train pulls over and can be passed) and crossing tracks (where trains can switch between tracks).

On a two-track rail corridor, the service goals of speed, coverage and capacity are at cross-purposes; only two of these goals can be completely optimized in a given service pattern. Today, nearly all northbound trains use one track, and southbound trains use the other. In the peak period, to accommodate a mix of fast and slow trains (i.e., Baby Bullet and limited-stop trains), extra tracks are used at specific locations to allow fast trains to pass slower trains. Increasing the length of these existing passing tracks can improve schedule reliability.

Especially when high-speed rail operates on the Caltrain Corridor, having many opportunities for faster trains to pass slower trains will be critical to having an attractive train schedule.[55] The 2013 Caltrain/High-Speed Rail Blended Service Plan Operations Considerations Analysis investigates different passing track options for when high-speed rail and Caltrain operate together.[56]

New Train Cars and Configurations

The size of the fleet limits the amount of train service that can be operated, particularly in the peak hour. Additional train cars will allow more trains to be offered in the schedule. The configuration of seats and other facilities in train cars determines how many seated and standing passengers, as well as bicycles, can fit. As of 2016, the PCJPB has made policy decisions for the new electric train cars to have a seat-to-bike-space ratio of 8-to-1 (versus today's 9-to-1) and to have one restroom per six-car train set. Removing seats could further increase capacity, although some people may not be willing to stand on the train and will choose not to use the service.[57] Removing space for bikes would allow room for more passengers. Caltrain's short-range plan calls for new train cars, though funding needs to be identified. The next generation of train cars should be articulated cars, which add capacity and comfort.

Longer Platforms

Increasing train length is a cost-efficient way to add rail capacity. However, of the 27 stations that will get electrified service along the corridor, 18 are designed for today's six-car trains; the platforms are not long enough to accommodate longer trains. Some stations (such as California Avenue) have ample space to lengthen platforms while others (such as Mountain View) do not. An intermediate operational solution is to instruct passengers getting off at particular stations to move to a certain train car in order to disembark.

Upgraded Signaling System

Signal systems manage train movement. Sophisticated signal systems can help ensure safer train operations while shortening the required time between trains. This in turn makes it easier to schedule more trains per hour, increasing overall corridor capacity. Installing a new signaling system is part of the CalMod project. The Communication-Based Overlay Signal System Positive Train Control system, to be implemented by the end of 2017, brings federally mandated safety improvement to the corridor. The signal system will be overlaid on the existing train control system and will enable crossing gates to be down for shorter times, optimize train speeds and create safety improvements.

Further upgrades to the signal system may be warranted in order to operate trains more efficiently and could be a cost-effective investment, especially compared to new infrastructure. It's not uncommon to have train spacing of 90 seconds on rail systems in other regions; today Caltrain operates with five or more minutes between trains.

Maintenance, Support Facilities and State of Good Repair

As the size of the fleet increases, new maintenance facilities will be needed to store and repair trains, though their locations have yet to be determined.[58] As structures, facilities and vehicles progress through and exceed their useful lives, they require rehabilitation and replacement. State-of-good-repair investments and specific rehabilitation and maintenance activities are required to maintain Caltrain's existing and planned structures, facilities and train cars. Track rehabilitation, bridge replacement, station rehabilitation and diesel train rehabilitation are all examples of state-of-good-repair projects needed to keep growing rail capacity. Two related projects are improvements to North Terminal (4th and King rail yards) to improve operations and South Terminal (Gilroy) to increase operational flexibility.[59]

Level Boarding and ADA Access

Today Caltrain riders must use interior steps to board trains rather than stepping directly from the platform onto the train floor, known as level boarding. Level boarding makes it faster to board large numbers of people and offers easy boarding for people using wheelchairs (who have a very painstaking boarding process today). Faster boarding makes station stop times shorter and more predictable, which can shave several minutes off running times and help trains run closer together. Level boarding will be essential to achieving the high level of service that we envision for the corridor.

A related issue is platform sharing for high-speed rail and Caltrain, which would enable the two services to share tracks. This would make it easier for passengers to navigate the station and transfer between trains; it also makes more efficient station design possible. High-speed rail requires one platform height across the state, so Caltrain would have to use two different door heights on each train car until all 27 Caltrain stations are reconstructed with 50-inch-high platforms, the same as high-speed rail. During this transition time, passengers with disabilities and those with bikes would need time to move to different areas of cars, which they would not need to do with level boarding. Level boarding is also a solution for ADA access. The ADA goal is unassisted boarding for disabled passengers for any train. This can best be accomplished through level boarding with gap filling.[60] Otherwise, disabled passengers will continue to need crew assistance to board or alight.

Accelerating Rail Investments

Some projects can be accelerated and begin to offer benefits without requiring other projects to be completed. These include adding electric multiple unit railcars, grade separating tracks from roads, lengthening platforms, and modifying platforms to provide level boarding and reduce time stopped at stations. Many of these are planned as part of the CalMod 2.0 project, the next series of system investments planned after the initial modernization program. CalMod 2.0 elements include: acquiring electric train cars to allow the entire fleet operating between Tamien and San Francisco to be converted from diesel to electric (as planned, approximately 75 percent of the service operated by Caltrain would become electric on opening day of electrified service); expanding all electric multiple unit trains from six- to eight-car trains; implementing level boarding; and reconstructing platforms to accommodate eight-car trains. Seated, peak-hour capacity would increase 32 percent with CalMod 2.0; with electrification there will be a significant increase in comfortable standing room (approximately 40 percent in the peak hour) as the gallery cars are replaced with electric multiple units.

Station reconstruction does requires a comprehensive passing track strategy to understand which stations will require reconstruction and when. Locating new passing tracks will dictate which stations are reconstructed and when.

Barriers to a Four-Track System

As discussed on page 24, four-track segments would help run a higher-capacity and more reliable rail service in this corridor. Four-track segments would become especially important when high-speed rail and Caltrain operate together. Much of the Caltrain Corridor that is owned by the PCJPB is wide enough for four tracks of rail. (Seventy-five feet is the approximate width required for four tracks that include high-speed rail operations.[63]) To bring the entire corridor to a width appropriate for four tracks would require acquiring several hundred acres of land, many in places with structures or buildings that would need to be removed, such as buildings in downtown San Mateo and downtown Redwood City and tunnels in San Francisco. Unfortunately, these barriers exist in some of the locations that would be the most useful for passing tracks, such as the Palo Alto area.[64]

A *full* four-track rail system along the entire corridor would offer a high level of flexibility and reliability, such as the New York City subway system has. But this option is not under consideration for the Caltrain Corridor due to the agreements reached for the blended system in 2013. In 2009, the California High-Speed Rail Authority proposed a four-track system for the Caltrain Corridor. It would have been on grade-separated track, with portions on a viaduct, but this faced opposition due to visual impacts, plans to extend beyond the existing Caltrain right-of-way and an overall lack of investment in Caltrain. Ultimately, leaders agreed on the blended system project, which would remain substantially within the Caltrain right-of-way and be primarily a two-track system.

Each of the following policies would have to be revisited in order to develop beyond a primarily two-track system:

- **HSR Prop. 1A Legislation.** The legislation funding high-speed rail sets the maximum travel time between Los Angeles and San Francisco, and therefore establishes the average travel speed for the project. If high-speed trains are slowed in the Caltrain Corridor by not having enough dedicated tracks, the overall travel time between San Francisco and Los Angeles would be affected.
- **SB 1029.** This state bill, which provides $705 million of Prop. 1A bonds for Caltrain modernization, made it state law that Prop. 1A bond funding could not be used for a four-track system. SB 1029 states that "Any funds appropriated in this item for projects in the San Francisco to San Jose corridor consistent with the blended system strategy identified in the April 2012 California High-Speed Rail Program Revised 2012 Business Plan, shall not be used to expand the blended system to a dedicated four-track system."
- **2012 Nine-Party Memorandum of Understanding.** The 2012 nine-party MOU states that high-speed rail will operate primarily on a two-track system.

RECOMMENDATION 4.

Improve Caltrain service in the short term, before electrification.

Who: PCJPB

Caltrain faces funding constraints for both capital and operating costs. Funding available today is being used appropriately to support the delivery of Caltrain electrification. However, if those short-term funding constraints could be unlocked (see ideas in Chapter 9, "What the Vision Costs"), there is the potential to increase capacity and meet some long-term service goals earlier. Capacity improvements that could be made before electrification include:

Improvements that would not likely require additional funding:

- Add another train in the shoulder of the morning and evening peak hours (that is, the hour before and after the current peaks, for example, 9 a.m. to 10 a.m.).
- Introduce short-run trains (for example, shuttle service between San Francisco and mid-Peninsula stations).

Improvements that would require additional capital and operating funds:

- Purchase additional railcars. This would have the potential of adding capacity in the short term by making all trains longer (increasing from five to six cars) and by providing the flexibility to add more trains in the peak periods.
- Purchase or lease new diesel locomotives. One of the short-term constraints on Caltrain's current fleet is the age of the existing locomotives. Having additional locomotives would provide the flexibility to add additional trains during peak hours and throughout the day. While Caltrain is focusing on changing the fleet from diesel to electric, diesel locomotives will still be needed for the Gilroy service, so the investment would have a long-term return.

The period before electrified service is also a good time to experiment with fare policies and other strategies to manage demand and attract riders. Insights gained from these experiments can help design the best electrified service plan possible.

In broad terms, if capital and operating funding could be identified for short-term improvements, there is the opportunity to increase peak hour capacity by 20 percent before electrification and by 37 percent after electrification. Other opportunities exist to increase off-peak service, although construction of the electrification project will limit those opportunities and they will not be fully realized until the electrification project is complete.

In Berlin, rail grade separations are integrated with neighborhoods.

RECOMMENDATION 5.

Use a corridor-wide strategy to address the impact of at-grade rail crossings.

Who: PCJPB, CAHSRA, MTC, cities along corridor

Between San Francisco and San Jose, there are 42 at-grade crossings where the rail tracks cross a local road and traffic typically has to stop in order for a train to pass. (Grade-separated crossings, by contrast, put the road in a tunnel or the tracks on a viaduct.) Some of these crossings are adjacent to stations and some are between stations. We need a unified corridor-wide strategy that ensures the most critical crossings are addressed and funded first. The current practice is that municipalities initiate and fund grade-separation efforts. Consequently, grade separations take place where funding is available, not necessarily where they are most needed.

With a corridor-wide strategy, design, engineering and construction best practices can be shared; construction timing can be coordinated together with railroad projects; and grade crossings can be coordinated with station-area development.[65] Also, in places where a four-track grade separation will be needed in the long run, this could be considered early in the design process, together with the overall corridor service plan.

Grade separations are not required by law for any of the service scenarios proposed on pages 24–25.[66] However, higher train frequencies could impact local street circulation by requiring crossing gates to be down more often or for longer periods.[67] There are two primary solutions for eliminating at-grade crossings, both of which should be considered when looking to do what is most cost-effective and what does the most to improve the neighborhoods near stations:

- **Grade separation** is a physical separation of the rail from the local road, usually by raising the rail above the road or lowering the road beneath the rail. Grade separations involve the construction of bridges and/or tunnels and are therefore costly.
- **Closing the road to autos** avoids large grade separation projects and in some cases reduces the traffic on a road. The City of Mountain View has suggested closing Castro Street where it crosses the Caltrain tracks. Access for cyclists and pedestrians could be maintained with a tunnel or a bridge.

Freight Policies

Caltrain's agreement with Union Pacific Railroad gives Union Pacific the authority to operate freight trains on its tracks north of Tamien Station. South of Tamien Station, Union Pacific owns the tracks, and the PCJPB negotiates rights for Caltrain to use them.[68] Freight trains use capacity that could otherwise be available for passenger service, and their facility requirements differ from passenger trains, which affects grade separations. For example, freight trains are limited to about 1 percent grades while commuter trains and high-speed passenger trains can climb grades of 3 percent. Any rail grade separation that must accommodate freight trains' gradual grade requires longer retaining walls and approach ramps. And since freight trains are three feet taller than passenger trains, they also require a deeper trench.

The tradeoffs to passenger service, and to the areas around grade separations, should be considered when determining what type of freight trains use the corridor. Freight is an active piece of the local economy. In the very long run, if land use in the corridor continues to move away from manufacturing, it may be worth revisiting the role of freight on Peninsula rail.

The Transbay Transit Center in downtown San Francisco will connect Caltrain and high-speed rail with BART, SFMTA light rail and numerous bus lines.

RECOMMENDATION 6.

Connect Caltrain and high-speed rail to downtown San Francisco at the Transbay Transit Center.

Who: PCJPB, Transbay Joint Powers Authority, MTC, City and County of San Francisco, CAHSRA, San Francisco County Transportation Authority (SFCTA)

Extending Caltrain service to downtown San Francisco at the Transbay Transit Center has been a goal for decades. (Caltrain currently ends at San Francisco's 4th and King Station, one mile away from Market Street and the Financial District.) Bringing high-speed rail to the transit center is part of the Proposition 1A funding program for the high-speed rail project. When rail runs directly from downtown San Francisco through Silicon Valley cities to San Jose, the corridor can function as one economic cluster connected by rail. The area around the Transbay Transit Center will be the densest cluster of employment in the Bay Area, with 176,000 jobs within a half-mile walking radius.[69]

The Downtown Extension Project (DTX), an approved but unfunded project, would construct a 1.3-mile tunnel from 4th and King Station to the new Transbay Transit Center. At the transit center, rail would connect with BART and SFMTA light rail (via an underground pedestrian walkway), as well as a bus terminal that can serve 300 buses per hour — the equivalent passenger capacity of a BART station.[70]

We have learned from the BART system experience that reaching new markets through extensions requires a commensurate investment to increase capacity and frequency in the core part of the system: Today's crowded conditions in BART's Transbay Corridor are a case in point. In the case of the DTX, this means investment in Caltrain's main line.

The actual number of non-high-speed trains per hour that the DTX and Transbay Transit Center will accommodate has not been finalized and will depend on the design of the extension as well as how long trains will be stationed in the transit center for turnaround processes (cleaning trains, train startup, etc.). The shorter the turnaround times, the more trains can come in and out of the station. Many components of the DTX can still be revised to optimize overall operations: the number of Transbay Transit Center platforms and tracks assigned to Caltrain and high-speed rail; the layout of interlocking trackwork; the track layout where DTX interfaces with the existing approach to 4th and King Station; and the number and configuration of tracks between the existing 4th and King approach and the Transbay Transit Center. San Francisco is studying alternative alignments for the DTX project through the Railyard Alternatives and I-280 Boulevard Feasibility Study.

A business plan for Caltrain would identify ways to maximize service quality and ridership while also maximizing revenue. One aspect would be an examination of all possible revenue sources, including real estate, parking, concessions and railroad tenants.

RECOMMENDATION 7.

Develop a business plan for Caltrain.

Who: PCJPB, CAHSRA

Public transit is a business that provides a public service. There are sources of revenue and there are costs, and in order to best serve the public and sustain transit for the long run, it's important to approach the operation of the railroad with a business plan.

One aspect of the business plan should be a business case analysis, a tool to compare the benefits of different types of investments. Investment options can be compared across a spectrum, such as costs to benefits; value for public investment; environmental, economic and social benefits; impacts on communities and alignment with social goals.

Business planning should be an ongoing practice. There are many ways to improve rail capacity, including changing the train schedule, adding new rail cars, upgrading systems and adding new infrastructure. In practice, funding arrives incrementally so there are many opportunities to reprioritize. All rail investments should be compared against one another at each point in time: There may be more than one way to decrease travel times or better ensure that trains meet at transfer points at the correct time — all at very different costs. (For example, shortening stopping times at stations may be as effective as buying new train cars.) Similarly, it might be more cost-efficient to attract new riders with investments in the railroad instead of funding more first- and last-mile solutions (or vice versa).

Another aspect of the business plan is an examination of all possible revenue sources, including real estate, parking, concessions and railroad tenants. Finally, a business plan enables us to benchmark the Caltrain system against other comparable rail systems.

New Rail Services: Concepts for the Future

The projects in the vision plan are not the full extent of what will be needed in the future: We should continue to grow the rail network as population grows. This means looking at adding local routes that connect with Caltrain (possibly types of transit other than rail), creating major transit corridors that connect with Caltrain and considering entirely new alignments within the Caltrain Corridor.

Local Connections

Some places are growing dense enough that a new transit line might be the best first- and last-mile solution. For example, the Mountain View Shoreline Boulevard Study is contemplating various technologies and pathways to connect the Mountain View Transit Center Caltrain station with the North Bayshore neighborhood.[71] Another example is an automated train (people mover) connection between San Francisco International Airport and the San Bruno BART station (similar to the existing automated train at SFO) or between Mineta San Jose International Airport and Santa Clara or Diridon stations. Similarly, bus rapid transit routes to Bayshore Station and the Transbay Transit Center are also being studied. While these projects are not included in this vision plan, they are a key part of the transportation network that must be considered for the future.

Major Connecting Corridors

During the vision plan timeline, the Caltrain Corridor should become well connected with the rest of the regional and statewide rail network. (See Figure 9 on page 17.) The following three rail corridors are complements to the vision plan, and those responsible for rail in the Caltrain Corridor should treat them as extensions of their own work and goals.

Transit in the Dumbarton Rail Corridor. SamTrans purchased the old Dumbarton freight rail bridge and corridor (which runs from Menlo Park to Redwood City) in 1994. There have been several studies of how to turn this into a bus or rail corridor, and it is included in the Regional Rail Plan.[72] However, regional funding for this project has been used for other purposes, and today there is a peak-hour bus service (Dumbarton Express) on the Dumbarton roadway bridge (Highway 84). An efficient transit service — one that is separated from traffic to offer travel-time savings and well connected with destinations on both sides of the Bay — could move many people who would otherwise need to drive on the crowded Dumbarton and San Mateo bridges. The system could be designed so that trains that operate on the Dumbarton freight rail bridge could share tracks with Caltrain. A study of transit options will be completed in 2017. Decisions for this corridor are made by a consortium of transportation agencies called the Dumbarton Rail Policy Advisory Committee.

BART Silicon Valley connection to Caltrain. The extension of BART from the East Bay to Silicon Valley is a project of VTA. Phase I of the project, which extends BART from Fremont to stations at Milpitas and Berryessa in San Jose, is scheduled to be completed in 2018. Phase II will continue BART from Berryessa Station and connect it with Caltrain and high-speed rail at Diridon Station using a 5-mile tunnel under downtown San Jose. Until Phase II is completed (funding and environmental review are nearly completed), there is no all-day rail connection between Silicon Valley/San Jose and the East Bay.[73]

A second transbay rail crossing. The existing Transbay Tube, which carries BART under the Bay between San Francisco and Oakland, is not well connected with Caltrain or the Peninsula. Additionally, it's operating at capacity and is in need of major rehabilitation. A second transbay crossing has been contemplated for decades and would provide significant opportunities for the Caltrain Corridor. The foremost opportunity may be the chance to have tracks that would accommodate conventional rail trains, such as Caltrain and high-speed rail, rather than just BART trains. Even rubber-tired vehicles and light-rail vehicles are under consideration.

Rail service across the Bay could connect people directly to the Caltrain main line (rather than requiring a transfer between the BART and Caltrain systems) through a connection at the Transbay Transit Center or in the Mission Bay area. A rail connection across the Bay also creates the opportunity to move rail maintenance or storage facilities to other parts of the region. Furthermore, it could also increase the capacity on the main Caltrain line by allow trains at the Transbay Transit Center to continue across the Bay rather than making the transit center into a terminal where trains must turn around. A second transbay crossing is under consideration as part of local planning in San Francisco and Oakland, in the MTC Core Capacity Transit Study, and is part of the 2018 Statewide Rail Plan.[74]

New Alignments in the Caltrain Corridor

If growth continues in this corridor, it's worth thinking innovatively about how to keep people moving by adding new rail alignments. Given the potential for growth at locations east of Highway 101 that are not near existing rail stations, one possibility is a new rail branch through this area. This rail line could branch off from the Caltrain Corridor between Redwood City and Santa Clara, serving new potential markets in the cities of East Palo Alto, Mountain View, Sunnyvale and Santa Clara. Representative new stations on a new Bayshore branch alignment could include Bayfront/Menlo Park, East Palo Alto, North Bayshore, Moffett, Great America Parkway and Levi's Stadium.

Although the estimated costs of a new rail alignment are very high — between $8 billion and $13 billion — the benefits could be great: increasing rail service, bringing high-speed and local train service closer to growing destinations and opening up capacity on the main line for local trains.[75] The infrastructure could even double as sea level rise or bayshore protection. A significant amount of growth would be required in this corridor, particularly at station areas, in order to justify such an investment.

If high-speed rail proves popular enough to justify its own right-of-way, another very long-term idea worthy of consideration is to create a high-speed rail structure in the middle of Highway 101.

CHAPTER 5

Rail Stations and Last-Mile Connections

Goal: Offer quick and intuitive connections at modern, high-amenity stations.

Sergio Ruiz

Historic Palo Alto Station is one of Caltrain's highest-ridership stations thanks to a multitude of ways to get to and from the station.

Growing Caltrain to accommodate increased demand for transit along the Peninsula requires the stations to grow along with the service. Stations are the portals where people begin and end their trips. Well-designed stations help people understand the transportation system and make it easier to use. Improving Caltrain for the future means not just improving and expanding the physical spaces but also enhancing the passenger experience of the station.

The trip to or from a station is known as the "first mile" or "last mile" of a passenger's trip, although actual distances vary greatly. Passengers may use a variety of modes to complete their trip, including bike, car, scooter, bus, train, their own feet or a combination of these. Most trips extend beyond the jurisdiction of Caltrain or high-speed rail: Surrounding streets are usually operated by cities, and shuttles or local transit are usually run by a different transit agency. But to make Caltrain a more attractive choice — one that carries far more people than it does today — decision makers need to consider a rail passenger's entire trip.[76]

RECOMMENDATION 8.

Upgrade stations to attract and accommodate more riders.

Who: PCJPB, CAHSRA, cities along the corridor, VTA, SMCTD, San Mateo County Transportation Authority (SMCTA), SFMTA, SFCTA

Because stations are the physical gateway to transit, the way people experience them can greatly affect whether they choose transit over other transportation options. No two stations are the same, and the unique characteristics of the community each station sits within play a role in how it functions. Local Caltrain stations like Bayshore receive fewer trains per hour during the morning peak hour than larger stations such as Palo Alto. Consequently, station services should be scaled differently to reflect passenger demand.

Caltrain stations are generally open structures with no walls or ticket gates. They typically have amenities such as ticket vending machines, system maps, public telephones, benches, electronic panels with real-time information and portable lifters for wheelchairs, since platforms are not at the same level as train floors. Some station buildings have historical significance and are protected.

Caltrain stations currently accommodate a mix of first- and last-mile modes, though not always with an organizing principle. Stations

typically have bicycle parking options (racks and lockers), bus and/or shuttle stops (which may include benches and shelters) and parking lots or garage buildings for vehicles. Drop-off areas and taxi stops are located close to the platform area. In some cases, parking areas and bus stops have larger structures to accommodate the integration of multiple kinds of buses and shuttles.

We recommend the creation of a Station Modernization and Access Program, a pot of funds to modernize Caltrain stations. The following upgrades would make stations more convenient and more comfortable:

- A staffed concierge area to provide information and security. Besides providing typical transit information and services, this area can also be a gathering place for information and/or other services from the surrounding community.
- A mobile app that integrates fare collection, real-time travel information, parking availability and trip-making information.
- Charging stations for electric vehicles, bicycles, scooters, etc.
- Sufficient and comfortable waiting areas and platform spaces; improved lighting and wayfinding signage.

The challenge for growing Caltrain ridership will be to move more passengers away from driving as their primary way to get to train stations.

RECOMMENDATION 9.

Improve station access for sustainable and space-efficient modes of travel.

Who: PCJPB, CAHSRA, cities along the corridor, VTA, SMCTD, SFMTA

Today, 50 percent of Caltrain riders get to stations by means other than driving. That's a good start, given that the majority of stations sit within suburban environments, but there's room for improvement. (By way of comparison, less than 15 percent of LA Metro's riders use cars to access rail and bus rapid transit stations.)[77] The challenge for growing ridership in the future will be to move an even higher percentage of arriving passengers away from driving. This means providing sufficient services and access conditions for other travel modes.

The principal modes of access to Caltrain stations are:

- **Walking.** The most important factor for encouraging walking is the neighborhood context where the station is located, including the types of land uses (industrial, commercial, residential), the population density, safety (in terms of both injuries/collisions and crime) and the connectivity of the street network within a quarter mile of the station. Stations located in industrial areas with poor connections to the surrounding neighborhood or in unsafe circumstances are less attractive for pedestrians.
- **Bicycling.** The decision to bike requires conditions similar to walking but on a larger scale. Elements such as bicycle lanes and protected bikeways improve safety and make biking a more attractive alternative. The availability of bicycle parking and bike-sharing services also increases the percentage of passengers arriving by bike. All Caltrain stations except College Park, Atherton and San Martin provide bicycle parking. Across the stations that do provide parking, a total of 655 bicycle parking spots are available; the Palo Alto station provides the most bicycle parking with 178 spaces.[78] Because they often live and/or work far from train stations, many Caltrain passengers bring their bikes on board; Caltrain was one of the first train lines in the United States to allow bicycles on trains, beginning in 1992. Over the years, Caltrain cars have been retrofitted to accommodate more bikes, making it one of the most bike-accessible rail systems in the country. Bike space has in turn become a constraint to adding passenger capacity.
- **Transit.** Whether train passengers arrive by transit depends on the reliability and frequency of transit service, the length of travel time and where the routes go. Because buses and light rail can bring passengers from a much larger area than walking or biking, providing good transit service to stations is essential to reducing the percentage of passengers who drive. VTA, SamTrans and SFMTA all have routes that serve Caltrain stations. Caltrain offers connecting shuttles, and Commute.org operates shuttles to and from BART and Caltrain stations. Many private employers and office parks offer shuttle connections to stations. Cities are also growing their connections: Palo Alto and San Jose both operate local circulator buses in their downtowns. In the future, we anticipate many more private transit services, some of which are very small and offered on-demand, also known as microtransit. Eventually, we expect autonomous or driverless buses.

FIGURE 13

How Riders Get to and From Caltrain Stations Today

Stations sit within communities that run the gamut from dense urban environments to low-density suburban areas. To expand access, each station type will require different solutions.

*Includes carpool, motorcycle, etc.

Source: Caltrain, based on 2014 MTC On-Board Survey. Includes trips to and from each station.

Station	Park and Ride	Drop Off / Pick Up	Taxi	Bike	Transit	Walk	Other*
4th and King	0%	7%	13%	14%	29%	36%	0%
22nd Street	18%	8%	4%	22%	12%	35%	2%
Bayshore	27%	11%	0%	15%	31%	16%	0%
South San Francisco	9%	19%	2%	24%	4%	42%	1%
San Bruno	14%	26%	7%	13%	7%	32%	0%
Millbrae	10%	11%	3%	4%	59%	12%	0%
Burlingame	2%	13%	1%	17%	7%	60%	0%
San Mateo	7%	15%	2%	17%	4%	54%	1%
Hayward Park	4%	6%	1%	30%	1%	51%	7%
Hillsdale	18%	15%	2%	15%	8%	41%	1%
Belmont	10%	15%	4%	15%	7%	49%	0%
San Carlos	14%	19%	1%	15%	6%	46%	0%
Redwood City	8%	20%	2%	18%	10%	43%	0%
Menlo Park	4%	20%	3%	21%	11%	39%	1%
Palo Alto	4%	15%	2%	20%	23%	36%	0%
California Ave	7%	16%	3%	22%	3%	45%	3%
San Antonio	11%	17%	2%	17%	2%	51%	1%
Mountain View	14%	21%	5%	17%	16%	27%	1%
Sunnyvale	26%	21%	3%	14%	6%	27%	2%
Lawrence	23%	24%	1%	15%	5%	32%	0%
Santa Clara	18%	24%	9%	13%	11%	25%	1%
College Park	0%	0%	6%	5%	10%	80%	0%
San Jose Diridon	14%	26%	4%	10%	28%	15%	2%
Tamien	54%	11%	0%	10%	15%	10%	0%
Capitol	58%	0%	0%	42%	0%	0%	0%
Blossom Hill	34%	36%	0%	9%	0%	21%	0%
Morgan Hill	51%	19%	0%	9%	0%	21%	0%
San Martin	79%	16%	0%	0%	0%	4%	0%
Gilroy	79%	6%	0%	14%	0%	0%	0%
Systemwide	**10%**	**15%**	**6%**	**15%**	**21%**	**33%**	**1%**

- **Driving.** Getting to the train station by car is typically a choice for passengers who don't live within walking distance (or in walkable areas), don't have a good transit option for getting to the station and/or don't have the benefit of free or low-cost parking at their final destination. All Caltrain stations except for San Francisco, 22nd Street and College Park stations offer parking. A total of 7,597 parking spots are available across Caltrain stations; Diridon offers the most parking (581 spots) and Bayshore the least (38 spots).[79] Driving may also become the first choice in cases when transit service is available but is not a reliable option. Driving also includes passenger drop-off, which is growing in popularity with the availability of ride-hailing services such as Lyft and Uber.

In the future, getting to and from a Caltrain station should be easier than it is today, and we should prioritize sustainable travel modes that support station-area growth. This implies a strategy of not expanding existing parking, leveraging new technology to augment traditional first- and last-mile services (such as shuttles) and promoting the use of personal mobility options such as electric bicycles, scooters, skates and tricycles. Accomplishing this will require the right street, parking and pricing policies — especially as on-demand car services and autonomous vehicles become a greater part of the picture. To discourage single-occupancy autonomous vehicles in cities, pricing will be an important way to ensure that priority is given to either higher-occupancy vehicles — buses, shuttles and lower-impact vehicles — or traditional and electric bikes. Street design improvements will need to extend well beyond the station to at least a half-mile distance for those who walk and even farther for those using other modes.

A technology-driven transportation paradigm shift is underway (see page 18), and while it's still in its infancy, the impact on station access could be big. To date, alternatives to driving alone have focused on ride-sharing services such as carpools and vanpools. Technology, together with the right policies, could enable a dramatic reduction in the need to own a private car, resulting in considerably lower demand for parking spaces and more choices for first- and last-mile connections, such as bike-share systems, electric bicycles and autonomous vehicles.

In the future, we expect that the main modes for accessing stations will be transit — including fixed-route buses, shuttles, carpooling, ride hailing and microtransit — together with bicycles (both pedal and electric), scooters and other portable transportation devices. To accommodate these modes, the Station Modernization and Access Program could fund station improvements such as safety and surveillance systems, wi-fi, wayfinding signage, passenger drop-off areas and bicycle parking. A new First- and Last-Mile Program could fund buses, shuttles and other transit services. In practice, station access improvements and first- and last-mile services should be integrated with the surrounding land uses and transit-oriented development plans around stations. The First- and Last-Mile Program could provide resources to increase access services by supporting the best local solutions for each station, leaving flexibility with respect to the operator and business model.

Sergio Ruiz

RECOMMENDATION 10.

Proactively manage station access and first- and last-mile connections at each rail station.

Who: PCJPB, CAHSRA, VTA, SMCTA, SFCTA, SMCTD, SFMTA, cities along the corridor

Today, first- and last-mile connections at rail stations are haphazard: Sometimes they're easy to find and use, sometimes they're not, depending on the station and available services. This patchwork of responsibility will not be sufficient to grow Caltrain ridership to two, three or four times today's level.

One way to resolve this is to designate a responsible party to actively manage access at each station. A single party should be responsible for making sure that station access options are sufficient, easy to understand and well run. Active management could focus on a performance goal. For example, travelers should be able to make first- and last-mile connections in five minutes or less during peak hours.

The responsible party could be Caltrain, other transportation agencies or third-party organizations, perhaps acting on Caltrain's behalf. Each station or group of stations in the corridor would be assigned to a party that would actively manage all the different options for station access. This party would also coordinate with local jurisdictions on access projects such as bike lanes, transit lanes or pedestrian paths.

In the future, if rail runs on a predictable clock-face schedule it would be possible to time first- and last-mile connections more easily — especially services that are not operated by Caltrain.

Rotterdam Centraal Station in the Netherlands is accessible by multiple modes. The station is surrounded by commercial buildings and welcoming public spaces.

RECOMMENDATION 11.

Build stations with seamless connections between Caltrain and high-speed rail.

Who: PCJPB, CAHSRA, MTC, City of San Jose, City of Millbrae, City and County of San Francisco, California State Transportation Agency (CalSTA), BART, TJPA, VTA, SMCTA, SFCTA

This vision plan does not detail the impacts that the arrival of high-speed rail may have on the corridor and the stations. The potential implications for stations include significantly larger passenger facilities for ticketing and baggage claim; access amenities such as bus bays, pick-up/drop-off curbs or rental car facilities; and food and drink concessions.

Eventually, high-speed rail will stop at four stations in the Caltrain Corridor. Each of these stations requires special attention both to ensure efficient train operations and to prioritize the passenger experience:

- **Diridon Station** will be a rail transfer point for Northern California with more than 1,500 trains and buses serving the station on an average weekday. The Diridon Station Area Plan envisions dense land uses, and the City of San Jose is planning a connection to Mineta San Jose International Airport so that airport passengers will have direct access to the statewide rail network.
- **Millbrae Station** will be the connection to SFO and BART. If the station and its amenities are designed correctly, a traveler could land at SFO and access the statewide rail network. It could even be possible to check luggage through from a high-speed rail station to one's final destination, a service available in other countries.
- **4th and King Station** may be used as a temporary high-speed rail terminal until the extension to the Transbay Transit Center is completed. Some additional investments will be needed to make that station ready for high-speed rail. Station access is particularly constrained at this station, with a chaotic and crowded mix of those walking, bicycling, riding transit and driving.
- **Transbay Transit Center** is largely constructed, and the bus terminal will open in 2018. The rail connection from 4th and King Station to the transit center is planned for completion in 2025, in time to receive high-speed rail service. (See Recommendation 6.)

We recommend that these Caltrain/high-speed rail stations be carefully planned based on global best practices for high-speed rail and that new governing and operating structures be developed to ensure the best possible passenger experience and transportation operations. Ownership of the station should resolved. For example, the historic Diridon Station in San Jose is owned by PCJPB, but it is not clear who would own and operate a new expanded station including more operators (BART and high-speed rail), expanded passenger facilities and retail.

CHAPTER 6

Highway 101

Goal: Move more people on Highway 101, with less delay.

Highway 101 is known for its recurring congestion, which affects both motorists and people taking transit. Traditional approaches to reducing highway congestion focus on building additional lanes, which temporarily reduces congestion but also induces more auto travel — eventually leading to even greater congestion.[80] Rethinking how we use highways isn't only about congestion — it's also critical to reducing the impact of driving on climate change and to reducing traffic on local streets and in neighborhoods.

Newer models for freeway use are emerging all over the country: Highways can be "priced" to reduce demand at peak hours. Charging a toll manages the demand on a highway by encouraging people to switch to a different mode of transportation or travel at a different time of day. Toll payers reduce congestion in mixed flow lanes as they shift over to toll lanes. Raising passenger occupancy requirements in carpool lanes improves performance but could add to congestion in other lanes unless other strategies are used (see the high occupancy/toll lane description below).

Highways can also be places that support transit and not just private cars, particularly when the highway is parallel to a transit line, as Highway 101 is.[81] New approaches actively encourage the use of highway lanes by vehicles that carry more people in less space, such as buses, shuttles, carpools and other forms of microtransit. A notable new opportunity is the explosion of ways to create carpools or use buses, including private employer shuttles, privately operated transit (Bridj, RidePal), carpooling platforms (Scoop, Waze Carpool) and ride hailing (Uber, Lyft). Policies and information are also supporting carpools and bus use. These include real-time information on highways, smartphone apps, parking pricing and variable tolls to shift how and when people travel. Filling or eliminating empty seats (both on transit and in private cars) is the most cost-effective way to address congestion while moving more people, shifting the focus to the throughput of people rather than the throughput of vehicles.

In the past, transit lines have competed directly with freeways for long-haul corridor trips and have served mainly to relieve highway congestion. But in the new landscape of distinct, separated and optimized travel markets for each mode, Highway 101 and rail can work together in the Caltrain Corridor in a way that better matches transportation options in the cities where travelers begin and end their trips.

There are three main strategies for managing a highway lane:[82]

- **Pricing:** Charging a toll to use the lane. On many highways, including the westbound direction on the Bay Bridge, all lanes are tolled, which makes it possible to shape how many vehicles (and what types) are on the highway at one time.
- **Vehicle eligibility:** Allowing or restricting certain vehicles. Minimum passenger occupancy is an example of an eligibility restriction. In California, vehicles with "Clean Air Vehicle" decals are eligible to use most carpool lanes.
- **Access control:** Allowing access to the lane in limited locations. For example, the Highway 237 Express Lane in Santa Clara County can only be accessed at specific places.

"Managed lanes" describes a more sophisticated approach that allows the flexibility to combine or change strategies in response to changing highway conditions or to support policy goals such as regulating demand, separating traffic streams or using available capacity. Ideally, all lanes on a highway are managed to move more people with less delay. The proposal here focuses on first managing one lane and then expanding to more lanes.

Within the existing Highway 101 right-of-way, there are three primary lane management approaches that are applicable:[83]

Adding new highway lanes typically results in more traffic — which also leads to more traffic on local streets.

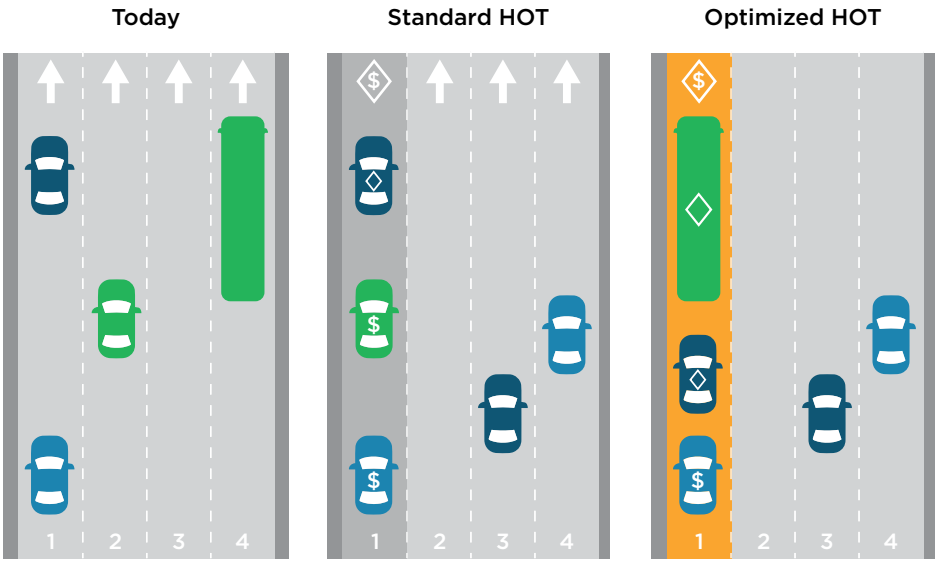
Sergio Ruiz

FIGURE 14

How Managed Lanes Work

Changing how lanes are used can move more people. An optimized high-occupancy toll lane designates one lane to be free for carpools and buses and usable by others for a fee. The price is set to keep the lane moving at 45 mph, and revenue can be used to subsidize increased public transit, which can take advantage of the lane.

Source: Produced for SPUR by Arup



- **High-occupancy vehicle (HOV) lanes:** This approach restricts one or more lanes of traffic during peak hours. The vehicles that are allowed to travel in HOV lanes vary by corridor. Most HOV lanes in the Bay Area allow carpools with two or more people (HOV-2) to use the lane, along with buses, shuttles, motorcycles and clean air vehicles. In some highly congested corridors, such as the Bay Bridge, only vehicles with three or more people (HOV-3) are allowed. On Highway 101, modeling by MTC has demonstrated that an HOV-2 lane would be congested as soon as it opened and therefore is not a feasible option. On the other hand, the possibility of an HOV-3 lane raises concerns that, at least initially, there would be insufficient carpools, shuttles and buses to fill the lane. This would result in unused capacity in the carpool lane while congestion in the other lanes continued to increase. Low- or zero-emission vehicles, currently allowed to use HOV lanes, could also fill this space in lieu of high-occupancy vehicles (which suggests a state policy change to not allow that to happen).
- **High-occupancy/toll (HOT) lanes:** This variation of the HOV lane concept allows solo drivers to travel in the carpool lane if they pay a toll. For example, a HOT-3+ lane would allow buses, shuttles and cars with three or more occupants to use the HOT lane for free and charge a price to vehicles with one or two occupants. HOT lanes allow excess capacity in the carpool lane to be used during peak congested periods. The lane is managed to keep traffic at free-flowing speeds at all times, usually by charging increasingly higher tolls as more people begin to use the lane, so that it does not become congested. (This tool, known as dynamic pricing, allows prices to be updated as often as every few minutes.) Tolled lanes have been proven to be effective at changing travel behavior. Solo drivers who do not wish to pay the toll seek other travel choices or choose to travel at other times. This minimizes pressure on the road network and enables a more reliable journey for those who pay the toll. HOT lanes are generally developed in one of two ways: an existing carpool lane is converted to a HOT lane by adding tolling infrastructure; or an entirely new lane is planned, designed and built. HOV-to-HOT conversions are generally far less expensive and can be built more quickly than a new lane. Also, because toll revenues are often used to pay off construction loans, the lower price tag of HOV-to-HOT conversions frees up more toll revenues for other purposes, such as transit, more quickly. However, HOV-to-HOT conversions are only possible where there is an existing carpool lane. There are carpool lanes on 101 in Santa Clara County (from Palo Alto to San Jose) that could be converted to HOT; however, there are no carpool lanes in the northern half of the corridor, from the Whipple Avenue exit in Redwood City to San Francisco.
- **Optimized HOT lanes:** An optimized HOT lane is a HOT lane with heavy investment in transit and carpooling incentives to minimize added congestion in the remaining general-purpose lanes.[84] For Highway 101, a preliminary analysis by MTC showed that such an approach would be possible and would require using several strategies in synergy: reinstating and expanding regional express bus service; expanding private shuttle bus services; increasing carpools; and providing more park-and-ride and first- and last-mile services.[85]

Estimating the Benefit of a Continuous HOT Lane

A HOT lane on Highway 101 could move more people with more reliable travel times and fewer delays due to congestion. Figure 15 on page 40 compares three scenarios for how designating a lane for high-occupancy vehicles can move more people, assuming sufficient transit riders are using the lane. This is a sketch analysis; more detailed modeling would be required to validate these results and to help optimize policy choices.

A recent analysis of the optimized HOT model found that the number of people moved in a single lane could triple from 1,780 people per hour to as many as 5,680 people per hour.[86]

FIGURE 15

Scenarios for Moving More People in a Managed Lane

Lane management can shift an existing highway lane from moving 1,780 people per hour to as many as 5,680 people per hour. This assumes heavy use of the lane by buses (both publicly and privately operated), vanpools and carpools.
Source: *TransForm Innovation Required*, 2014, http://www.transformca.org/sites/default/files/final_hot_101_paper.12.16.2013-1_revised_acknowledgement_0.pdf

Lane Management Scenario	Number of vehicles per hour	Number of people moved per hour
Existing Conditions	1,370	1,780
Planned HOV[87]	700	3,200
HOT without added transit/carpools	1,410	4,040
Optimized HOT with added transit/carpools	1,320	5,680

RECOMMENDATION 12.

Manage a lane of Highway 101 as a high-occupancy toll lane along the entire corridor.

Who: VTA, San Mateo City/County Association of Governments (C/CAG), SFCTA, Caltrans, MTC, CalSTA

Bay Area transportation agencies are planning a 550-mile network of managed lanes, the majority of which are HOT "express" lanes, that will be completed in 2035. Express lanes are already open on Highway 580 in the Tri-Valley area and on Highway 680 from Pleasanton to Milpitas, as well as on State Route 237 between Milpitas and San Jose.[88] Highway 101 should also become a part of the region's managed lane network. Each of the three counties in the Caltrain Corridor (San Francisco, San Mateo and Santa Clara) is developing a strategy to manage its section of 101. In each case, the solution is being driven by local policy goals and working with existing opportunities and constraints. VTA has approved two side-by-side Highway 101 express lanes that begin in Morgan Hill and reach Palo Alto. San Mateo County and San Francisco County are each now studying options for managed lanes on Highway 101 through those two counties.

We recommend using one policy framework for Highway 101 lane management across the corridor, and across county lines, so that congestion can be solved more systematically and the highway can operate with one set of goals. Specifically, we recommend that the three counties work together to create a continuous HOT lane, with dynamic pricing, on Highway 101 between the Central Freeway/Interstate 80 in San Francisco and Interstate 880 in San Jose. A continuous HOT-3+ lane running the length of Highway 101 would support the creation of a regional express bus network serving job centers up and down the Peninsula from San Francisco to San Jose. It would also offer significant time savings to transit and carpools, as well as solo drivers who are able and willing to pay the toll when there is capacity to sell.[89]

It is also important that buses and high-occupancy vehicles using the highway be given priority on streets and roads that connect with the highway, to give them a travel-time advantage over private vehicles. This is a way to connect highway management with local goals to reduce solo driving. For example the Mountain View Shoreline Boulevard Corridor Study is proposing a transit lane at the 101 interchange, and San Francisco is currently exploring converting street lanes into carpool lanes during peak hours.

Preferred Option: Using an Existing Lane

Converting an existing lane to a HOT lane is the less expensive and faster way to add a managed lane through the corridor.[90] Where present, existing HOV lanes along Highway 101 could be converted to HOT lanes. Elsewhere, one general-purpose lane in each direction could be converted to a HOT lane. Converting an existing lane has benefits over new construction as it would cost far less and could be completed more quickly. It would require less environmental review and less traffic disruption. Lane conversion would also avoid physically widening Highway 101, which would be extremely expensive and would impact adjacent private property, surface roads and habitats. Particularly in the section of 101 nearest to San Francisco, widening the highway would be costly and difficult because many stretches are narrow, elevated and/or tightly abutted by retaining walls, piers or sensitive bay and marsh habitat.

Converting a lane to HOT-3+ and filling the lane with high-occupancy vehicles instead of single-occupancy vehicles would increase the overall passenger throughput of the freeway corridor, moving more people in the same amount of space. This is consistent with California's and the Bay Area's goals to reduce per-capita emissions and the number of vehicle miles traveled. It will further reduce vehicle miles and improve social equity by generating future toll revenues that can be invested in transit in the corridor. This approach would require state and federal legislation to allow the conversion of a general-purpose lane to a HOT lane.[91]

An immediate option is simply to convert the left-most lane to an HOV-3 carpool lane as a pilot project, which could be done with inexpensive new signage and striping on the highway. An HOV-3 lane could quickly incentivize the use of casual carpool (similar to the successful East Bay/Bay Bridge casual carpool), thereby moving far more people in that lane, particularly during peak periods. This would also allow the usage of casual carpool apps (both where passengers pay and where they don't), which have yet to succeed on the Peninsula because carpooling does not save enough time to attract participants. If, during this experiment, the lane is saturated (and there are no time savings), this would be evidence that a HOT-3+ lane could succeed. If the lane isn't full, the pilot could be ended.

Alternate Option: Adding a Lane

An alternative to using an existing lane is to connect auxiliary lanes into one continuous new lane. (An auxiliary lane is an extra highway lane that connects interchanges, giving drivers more time to merge in or out.) There are currently 14 miles of auxiliary lanes on 101. However, turning an auxiliary lane into a general-purpose lane is a major capital project that could degrade the remaining lanes as merging becomes more difficult. In some cases, this would also require the renovation of bridges and overpasses that are not currently wide enough to

accommodate an additional lane. In areas without auxiliary lanes, such as San Francisco and northern San Mateo County, existing general-purpose lanes would need to be converted. In these areas, lane conversion would require roadway restriping, installing tolling equipment and adding new signage.

RECOMMENDATION 13.

Adopt equity policies and programs for HOT lanes.

Who: MTC, SFCTA, SMCTA, VTA, C/CAG, Caltrans

HOT lanes increase the price of travel for solo drivers who choose to use the managed lanes. This raises concerns about equity and fairness, because not everyone can afford to pay tolls — especially during times of day when demand for the managed lane is greatest and therefore the tolls are highest. Managed-lane policies should evaluate the equity impacts of each alternative, consider the local context and identify strategies to ensure that HOT lanes are a net benefit to low-income travelers.

Several studies have evaluated the impact of HOT lanes on low-income commuters. A study of Highway 85 HOT lanes in Atlanta looked at license plate data from more than 17,000 HOT users and found that, on average, about 50 percent more high-income drivers than low-income drivers use the HOT lanes. In contrast, the study found roughly equal numbers of high- and low-income drivers in the general-purpose lanes.[92] A study of State Route 91 HOT lanes in Orange County found similar results.[93]

Both studies also found that low-income and very-low income groups do use the HOT lanes, albeit less frequently, concluding that the lanes do provide value to low-income drivers. Indeed, blue-collar and service workers often have less flexible schedules than white-collar professionals, and they are more likely to lose their job if they are late to work. Because HOT lanes allow for a faster and more predictable travel time than congested general-purpose lanes, their value to low-income commuters may be quite high, even if low-income commuters don't use them as often as high-income commuters do.

Strategies to make HOT lanes accessible to those who may not otherwise be able to afford them include:

- Offer prodigious public transit services, which can use the lane for free.
- Set aside a portion of toll revenues for providing quality transit options along the corridor, such as express buses that use the HOT lanes and serve low-income neighborhoods.
- Provide discounts to low-income drivers. Both this and the strategy above to set aside toll revenues are used on express lanes on Highway 110 and Highway 10 in Los Angeles. (See "Los Angeles Express Lanes" case study on page 43.)
- Integrate tolls with transit policy by giving toll credits to transit passengers once they've taken a certain number of rides on transit (for example, 10 bus rides). This recognizes that not everyone needs to make the same trip in the same way each day and rewards those who choose to travel on transit regularly but occasionally need to drive.
- Cap the HOT toll amount charged per car. If the toll reaches a specified level, the lane reverts back to an HOV lane.

Further coordination and planning would be required to extend and connect HOT lanes on 101 to those on other corridors such as Highways 880 and 680. Drivers could connect with other HOV/HOT facilities using existing general-purpose ramps or future direct HOT connector ramps — ramps whose sole purpose is to connect two HOT lanes on different highways, such as those on Highways 680 and 237 in the East Bay.[94]

Addressing Congestion in Managed Lanes

On heavily traveled corridors like 101, it is easy to imagine a time when the demand for a HOT lane would exceed the supply, leading to congestion and delays in the HOT lane itself. Other HOT lane managers across the Bay Area and the country are now developing strategies to manage growing congestion in HOT lanes. Excess demand for a Highway 101 HOT lane should be managed in several ways:

- **Increasing enforcement.** Solo drivers illegally using the managed lanes can be a problem. Greater enforcement, including video surveillance and restricting the ability of drivers to weave in and out of the HOT lane, can help reduce toll violators and decrease congestion.
- **Increasing tolls and expanding transit.** Adjusting toll prices in response to congestion can help keep speeds moving. In Miami, toll managers have responded to increased demand by raising tolls and reinvesting the additional revenue in express buses.[95]
- **Restricting solo drivers.** When speeds drop too low on a HOT lane, the number of solo drivers that are allowed to use the lanes is restricted. In California, when HOT lane speeds fall below 45 mph, single-occupancy vehicles are not authorized to use a HOT lane until speeds increase. HOVs and buses can continue to use the lane freely during these congested periods.
- **Managing clean air vehicles.** California's clean air vehicle program gives stickers to qualifying vehicles (such as hybrid or electric cars) that allow them to use HOT and HOV lanes for free, even as solo drivers. As these vehicles gain in popularity, they make up an increasingly large share of managed-lane users. For example, VTA estimates that clean air vehicles account for 31 to 38 percent of users of State Route 237 HOT lanes during peak hours. California policymakers may need to further reduce the use of clean air vehicle stickers in managed lanes whose purpose is to reduce car use.
- **Adding more HOT lanes.** As managed lanes grow in popularity, a second managed lane can be added or converted, if feasible. This can either be a second HOT lane or, to further increase efficiency, a bus-only lane. The effect on the remaining general-purpose lanes should be considered and mitigated with added transit and carpool choices.

Interstate 280

Interstate 280 also plays a role in moving vehicles up and down the Caltrain Corridor, but it is not close to most cities and major destinations. Nonetheless, it can be a conduit for more transit vehicles and could also be a good facility for piloting autonomous vehicles in the future, due to the lower levels of traffic and lower number of entrances and exits. Lanes on Interstate 280 can be managed in order to create a delay-free lane for transit and high-occupancy vehicles. San Francisco is evaluating the potential for managed lanes on 280 in the city as part of its Freeway Corridor Management Study. In particular, the segment of 280 from downtown San Francisco to the 101 interchange may be an especially good candidate for express lanes because it could provide a continuous managed lane from downtown San Francisco to 101.

Local Streets

When planning improvements to the highway, it's important to do so within the context of local streets and roads, which may not have the capacity to absorb increased traffic volumes. New intelligent transportation system tools such as adaptive ramp metering and signal timing can recognize changing traffic conditions and adapt in real time. Such tools not only benefit freeway users but can also improve traffic conditions on local streets adjacent to 101.

RECOMMENDATION 14.

Use revenue from pricing Highway 101 to add more public transit service.

Who: VTA, SMCTA, C/CAG, SFCTA, MTC, Caltrans

Revenue collected from pricing a lane is typically used to pay off construction and management costs for the lane. Once these costs are paid, there may be a revenue stream that can be used to advance the goal of moving more people in the corridor if policies are adopted to enable this. While this revenue stream is not the primary objective of road pricing, it's an added benefit. The funding is not meant to replace other revenue streams but instead add to them. An added benefit of converting an existing lane rather than building a new lane is that more toll revenue can be used for transit in the near term because conversion is far less expensive than highway widening.

A regional toll policy for the three counties in the Caltrain Corridor, or for the Bay Area as a whole, would be another way to connect the region's express lanes and help them function as one system.

An analysis of eight HOT lane facilities in the western United States found that, on average, they generated between $110,000 and $800,000 per lane-mile per year in toll revenue (an average of $290,000). However, revenue varies widely by region depending on population, employment and congestion. Assuming the average revenue rate observed from precedent projects described in Figure 16, the preferred concept for the Highway 101 freeway corridor could generate approximately $29 million in annual toll revenues. This figure is a conservative estimate because 101 is a more economically important and congested corridor than most.

FIGURE 16

Revenues and Operating Costs of High-Occupancy/Toll Lanes

On average, HOT lanes generate between $80,000 and $800,000 per lane-mile per year in toll revenue.

* Figures not publicly available at time of analysis.

Source: Produced for SPUR by Arup

Project	Lane-Miles	Annual Revenue ($M)	Annual Operating Costs ($M)	Annual Revenue per Lane-Mile ($)
Los Angeles Express Lanes	78	$ 62.2	$ 42.2	$ 800,000
I-405 Express Toll Lanes (Washington State)	50	$18.4	$ 3.0	$ 370,000
I-25 HOV Express Lanes (Denver)	14	$ 3.6	*	$ 250,000
I-680 Express Lanes (Alameda County)	14	$ 1.9	*	$ 140,000
SR-237 Express Lanes Phase I (Santa Clara County)	11	$ 1.2	$ 0.9	$ 110,000
I-15 Express Lanes (San Diego)	80	$ 6.0	$ 5.2	$ 80,000
AVERAGE				$ 290,000

RECOMMENDATION 15.

Grow regional express bus services.

Who: VTA, C/CAG, SFCTA, Caltrans, MTC, SMCTD, SFMTA

Improvements to Highway 101 present an opportunity to fully implement the express bus transit service concept in a corridor where it can succeed. Express bus service uses the freeway or highway network to provide longer-distance trips, extending transit past the end of a rail line, supplementing or linking rail lines and serving markets far from rail. A benefit of buses is their scalability: Service can be decreased or increased as needed (although it needs to conform with restrictions on funding — public bus services receiving federal funding must meet equity standards). New bus routes can also be implemented as pilots.

Unlike in San Francisco and the East Bay, land use in the Peninsula and South Bay is characterized by relatively low residential densities and dispersed campus-style job centers that are connected by wide arterial roads, expressways and freeways. This type of land use is well served by express buses when those buses are able to bypass traffic through dedicated lanes, such as those proposed on 101.

Markets for Express Buses

The following characteristics distinguish express bus service from local or limited bus service:

- Longer total route length, often with end points in both urban and suburban areas
- Greater spacing between stops, at least along trunkline segments
- Significantly higher frequency at peak times, or operating only at peak times
- Fixed schedules to serve more uniform demand from routine commuters
- Portions of routes on freeways or other limited-access highways
- Different vehicle configurations, often with more seating and only one door
- Higher fares from local and limited tickets or passes
- Certain stops designated as only for receiving or discharging passengers
- Permission to travel in freeway carpool lanes, on designated access ramps or on shoulders
- Connections available to local and limited bus lines at certain key stops

Examples of express bus services in the Bay Area include Dumbarton Express and SamTrans Route KX, which supplement or link one or more rail lines; WestCAT Express Routes and VTA Route 181, which extend a rail line; and Golden Gate Transit, WestCAT LYNX and AC Transit transbay buses, which serve markets far from rail. SamTrans cut express bus service beginning in 2010 and again in 2014, leading to a drop in express bus ridership from more than 6,000 boardings per day to fewer than 1,000 boardings per day.[96]

In the Caltrain Corridor, markets for express buses include:

- **Employment centers not near Caltrain.** Today, the employer shuttles that connect San Francisco and Oakland with the campuses of Google, Facebook, Apple and other tech firms are growing, but they face an uncertain future due to increasing regulation and high costs. These markets may be a match for public express buses serving similar destinations, if funding can be made available. Replacing or supplementing certain private commuter shuttles with public express buses could also present a longer-term opportunity for public-private partnership. Smaller employers, office parks and transportation management associations could use express buses to move workers along Highway 101. Express bus services could also run from the Peninsula to San Francisco making one or more stops, most likely terminating at the Transbay Transit Center.

CASE STUDY

Los Angeles Express Lanes

In 2012, the Los Angeles County Metropolitan Transportation Authority (Metro) opened express lanes on the 110 and 10 freeways — important commute corridors connecting downtown and the harbor area to surrounding cities — by converting previous carpool lanes. Metro's innovative approach to these lanes, which integrate express bus service, carpool incentives and discounts for low-income drivers, has won accolades nationwide.

As part of the express lanes project, Metro upgraded existing bus services that use the carpool lanes, increasing service frequency, installing signals that offer priority to buses at key intersections, improving lighting and security, and renovating bus stations and platforms. The service, now called the Silver Line, runs every four minutes at peak hours. Toll revenues from the HOT lanes subsidize the Silver Line, and HOT drivers can earn free toll credits by riding the bus. As a result of these investments, ridership on the Silver Line has steadily grown from 7,300 weekday riders in 2010 to an estimated 16,500 weekday riders in 2016, even as system-wide transit ridership has decreased.

LA's express lanes also provide important incentives for carpooling. Studies have found that when a carpool lane is converted to a HOT lane, carpooling declines by an average of 30 percent.[97] In order to keep carpools going, LA's express lanes provide financial incentives for carpooling. Not only do carpool drivers continue to use the lanes for free, they also receive gift cards and win prizes. Other metro areas, such as Atlanta, pay new carpoolers $1 per day to encourage them to carpool.

Metro considered the needs of low-income commuters in planning the express lanes. In addition to considerably improving peak-hour bus service along the corridor, the agency uses toll revenues to provide weekend and late-night bus service. Low-income drivers are also eligible to waive registration and equipment fees. For those who lack credit cards and internet access, Metro offers cash payments and pay-as-you-go memberships for tolls.

- **Weekend service from Caltrain stations.** Since 2005, weekday trains have bypassed both the Broadway and Atherton stations in order to allow through passage of Baby Bullet express service. The five-minute-long Broadway–Millbrae shuttle ride, with 10 weekday morning departures, offers passengers timed transfers to nine northbound trains. A similar shuttle connected Atherton passengers to the Redwood City station but closed in 2007 due to low ridership, perhaps related to the inconvenience of transfers. Weekday express bus routes could revive direct San Francisco service at these and other stations with low service levels.
- **The Fremont ACE station.** Although one AC Transit line (the U) connects this station to Stanford University, an express bus that crossed the Dumbarton Bridge and continued into San Francisco could significantly reduce travel times for ACE passengers bound for San Francisco from the Central Valley. Currently, they must transfer to Caltrain at San Jose (another 37 minutes south of Fremont) and backtrack up the Peninsula. While AC Transit's U line does connect the Fremont BART and ACE stations, non-transbay riders may not board it (to reserve capacity for the longer transbay trips).[98]
- **Mineta San Jose International Airport.** While the local VTA 10 bus makes a circular route between airport terminals, Caltrain and VTA light rail, an express bus could serve airport passengers bound either for downtown San Francisco or connecting to flights at SFO.

Express bus services in this corridor require coordinated and regional service planning; no one existing transit agency has the ability to serve all of these markets, and the use of buses can be optimized only if there is a shared approach to the service. Three ways to deliver regional bus services include: growing the role of existing regional agencies to deliver cross-county services; developing new consortiums to run regional services (for example, the Dumbarton Express bus is operated by AC Transit and funded by SamTrans and VTA together with regional toll revenue); and changing state legislation or memorandums of understanding so that the rules don't limit services from crossing county lines. This would enable local operators to respond to cross-county demand instead of ending service at transit transfer facilities on the county line and forcing riders to transfer. Any new regional bus service should aim to make more efficient use of the region's existing bus fleet, maintenance yards and other facilities.

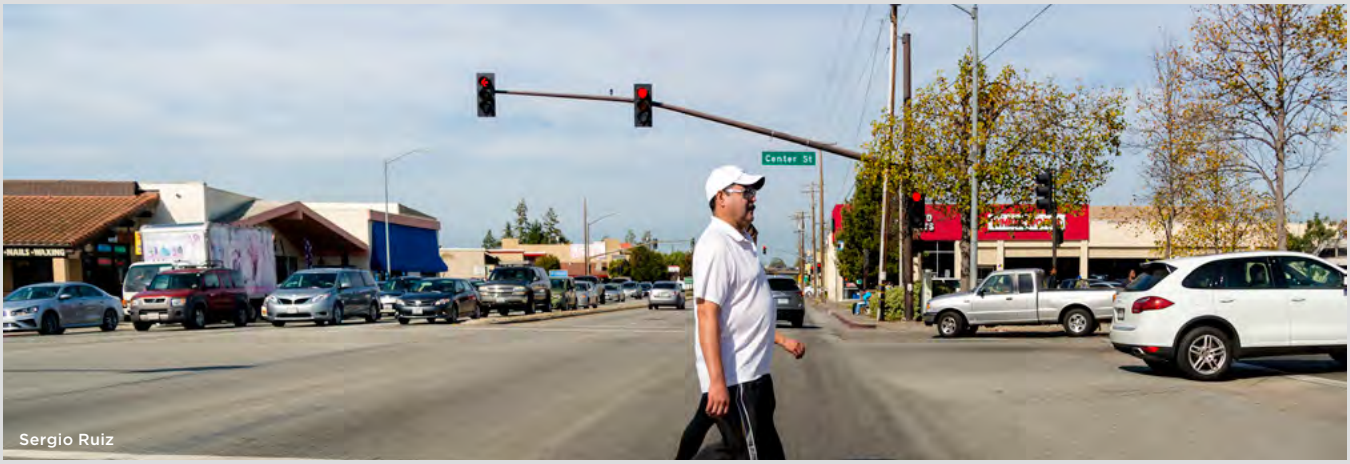
Before launching any express bus service in the Caltrain Corridor, one question to ask is whether it's serving places or markets that Caltrain is unable to serve and what a Caltrain- or rail-focused alternative could be. This would ensure investment in the best long-distance solutions. Another decision is whether a premium bus service (coaches, wi-fi, etc.) is needed to serve the market.

Reducing Demand for Driving

The projects and programs proposed for Highway 101 are major investments. If we do not also properly manage parallel and connecting roads, the investment in 101 will be underutilized. If the costs of driving and polluting continue to be low (compared to other places and compared to the societal costs), we will continue to experience overuse of our roads and limited demand for transit.[99] If parking at final destinations is still free, we will have to use further subsidies and incentives to move people onto transit.[100] And if all connecting highways do not have managed lanes, the managed lane on Highway 101 may go underutilized.

Transportation demand management policies and programs can support the formation of carpools and private transit. Park-and-ride locations, casual carpool pickup and drop-off locations, support for apps and shuttle bus stops, and employer transportation demand management programs will all help facilitate the full use of a HOT lane by high-occupancy vehicles. While not the focus of this study, addressing demand through data-driven and research-based strategies is a critical part of keeping the Caltrain Corridor moving.

El Camino Real: Re-Thinking the Caltrain Corridor's Main Street



El Camino Real is a critical artery and place. As the corridor grows, improving transit here will be necessary.

While El Camino Real is not a focus of this vision plan, as a route that connects the Caltrain Corridor it needs to be rethought. For much of the road's 52 miles between San Jose and San Francisco, Caltrain runs directly adjacent, and Highways 101 and 280 parallel it on either side, between one and four miles away.

El Camino Real's current roadway width ranges from two to three lanes in each direction, and most of the corridor also contains on-street parking. Five transit agencies (excluding first- and last-mile shuttles) serve the El Camino Real corridor: BART, Caltrain, SamTrans, VTA and SFMTA. Since 2013, SamTrans has offered one main bus service, Route ECR, which merged and replaced the corridor's former Routes 390 and 391. Route ECR runs from the Daly City BART station to the Palo Alto Transit Center every 15 minutes on weekdays and every 20 minutes on weekends, stopping at four BART stations and six Caltrain stations in between. From the Palo Alto Transit Center, riders may continue southbound on VTA; Lines 22 and 522 both run from there to the Eastridge Transit Center in eastern San Jose. Route 522 currently operates as a limited-stop bus with two or more buses per hour, while Route 22 serves all local stops along the same path with at least one bus per hour. While multiple transit lines operate within the corridor, 70 percent of workers along El Camino Real still access their jobs by driving alone.

Grand Boulevard Initiative

In response to new development and densification along El Camino Real, 19 cities, counties and public agencies jointly introduced the Grand Boulevard Initiative, a collaboration of stakeholders dedicated to making the outdated El Camino Real corridor from Daly City to San Jose safer, more pleasant and more efficient. A Grand Boulevard Task Force, currently numbering 41 members and two chairs from public and private institutions, is evaluating opportunities for housing and urban development along El Camino Real that could accommodate an appropriate mix of cars, pedestrians, bicycles and transit. Specifically, the Grand Boulevard Initiative guiding principles include fewer cars on the road, less congestion, and cleaner air based on the underlying premise that public transportation will become faster and more convenient.[101]

Bus Rapid Transit

Faced with increasing congestion and population, both VTA and SamTrans are concurrently but independently planning upgrades to portions of the El Camino Real corridor; the two agencies have proposed converting Routes 522 and ECR into bus rapid transit (BRT), a rapid bus system whose frequency, speed and comfort can be compared to a modern light rail system. These two bus services would still meet and terminate at the Palo Alto Transit Center but would arrive there on dedicated lanes, likely in the median of El Camino Real. BRT would be a locally focused service along this parallel corridor with greater speed and efficiency than a standard local bus route.

Without accounting for annual operations and maintenance expenses, VTA's BRT line is estimated to cost up to $233 million, while the SamTrans BRT capital cost estimate is $177 million. Both studies favored BRT operations along the center of El Camino Real; for most of its length, a landscaped or painted median currently separates bidirectional traffic. Repurposing El Camino Real's innermost two travel lanes to contain a BRT right-of-way for either VTA or SamTrans would, combined with the existing median width, afford enough space for BRT stations. The VTA BRT project schedule indicates completion in 2020. However, a few of the cities in the corridor have not yet voted to support the project, mostly due to concerns about what would happen to travel time for cars. SamTrans also evaluated a range of less expensive and more immediately implementable service concepts. The SamTrans proposal is awaiting funding to move forward.

Ideas for the Future

One possibility to advance the idea of BRT is to enable private buses or even carpools to use the BRT lanes, which increases their use while moving more people. This kind of integration would require technology and policy innovations. In the long term, the BRT lane could also be a guide way for autonomous (driverless) buses, which would run more frequently through the corridor and be synchronized with traffic signals.

CHAPTER 7

Ferries

Goal: Establish public ferry service for Peninsula travelers.

U.S. Army Corp of Engineers

Before the advent of railroads and bridges, ferries were commonly used to move people around the Bay, particularly between San Francisco and Oakland. Today, ferries play a very small role in the region's transit system, comprising only 16,000 out of 1.7 million daily transit trips in 2015.

In order to be a reliable transit option, ferries would need to run more frequently and offer more routes. But adding public ferry service raises concerns about pollution, high fares, the availability of appropriate terminal locations and the challenge of first- and last-mile connections, among other issues.

Technology could change these dynamics. The new plug-in technologies that ports are using for freight and cruise ships could eliminate emissions while ferries idle at dock. Advances are also being made in solar- and battery-powered ferries. Operating subsidies can enable services to be incubated while ridership grows.[102] One advantage of ferries over rail or highways is that for the most part, capital costs are relatively small: All that's needed is a terminal and boats.

RECOMMENDATION 16.

Create a ferry terminal at the Port of Redwood City.

Who: Water Emergency Transportation Authority (WETA), MTC, Port of Redwood City, Redwood City, SMCTA

Ferries can add valuable redundancy to the transportation system in the Caltrain Corridor, offering another option when highways or rail are not available, perhaps due to a collision or earthquake.[103] Ferries can also provide a way to serve markets that are difficult to reach with rail, such as the North Bay or East Bay. For these reasons, the state envisioned a ferry facility at the Port of Redwood City when it created the Water Emergency Transportation Authority (WETA) in 2007.[104] WETA has included Redwood City in its 20-year strategic plan, and $15 million was allocated to Redwood City for ferry terminal development in 2004's San Mateo County Measure A.[105] This ferry terminal would consist of several elements: terminal buildings to accommodate passengers and staff (indoor or outdoor waiting areas, ticketing area, restrooms and other amenities); enclosed and climate-controlled support structures to house electrical, IT, security and other maintenance equipment; parking and drop-off spaces for buses, cars, bicycles and other modes; and signage and wayfinding for passengers.

Funding is a key reason that this project has not been built. Costs to complete the project are included in the cost estimates for the vision (see Chapter 9). Following through on this planned project is a necessary first step toward better using water transit in the Caltrain Corridor.

RECOMMENDATION 17.

Expand ferry services to include Peninsula stops.

Who: WETA, Port of Redwood City, MTC

Both public and private operators can provide ferry transit services. WETA and the Golden Gate Bridge Highway and Transportation District are the main public ferry operators today in the Bay Area. Private ferry operators already offer service on small boats to the South San Francisco and Redwood City terminals. Some private operators are looking to provide public services where anyone could pay to ride a privately operated ferry.

WETA will require operating subsidies in order to begin service to a future terminal at the Port of Redwood City or to grow service to the South San Francisco terminal.[106] Most ferry terminals on the Bay begin as origin points for trips to downtown San Francisco due to the great number of jobs near the San Francisco ferry terminal. It is plausible that Peninsula service could be more of a two-way service, just as Caltrain has a bidirectional ridership, between the Peninsula and San Francisco. It could also include two-way service between the Peninsula and the East Bay or, possibly, a ring around the Bay that could serve different types of riders than just commuters.

However, a significant challenge facing ferry riders to the Port of Redwood City is the availability of connections to and from the ferry. (Few Bay Area ferry terminals are surrounded by communities, and half of their surroundings are water.) The Redwood City terminal is located on Seaport Boulevard, almost two miles from Highway 101 and even farther from most nearby job centers and commercial areas. This can be overcome with a combination of private shuttles, on-demand services like ride sharing and bike sharing, or — where there is enough demand — a public shuttle bus. The First- and Last-Mile Program proposed in Recommendation 10 can be expanded to include ferry terminals.[107] There is also the possibility of transit-oriented development around terminals.[108]

Assuming that each new WETA ferry boat would carry about 400 passengers, adding two public boats per hour adds 800 new seats. At a level of four private ferry boats per hour, another 1,000 passengers could use the new ferry terminal.

CHAPTER 8

A Seamless Transit Experience

Goal: Create a coordinated and convenient transportation network.

To unify the transit experience for passengers, Caltrain, BART and high-speed rail can coordinate their schedules and present unified maps, information and payment systems.

Growing transit use means making the transit experience convenient and attractive. With so many different transit services and agencies in one corridor, special attention must be paid to coordinating them all to function together as one network. SPUR's 2015 report *Seamless Transit* identified five types of transit coordination needs: information, fares, payment, service planning and capital planning. The following three recommendations encompass these categories.

RECOMMENDATION 18.

Integrate information and payment across mobility services.

Who: PCJPB, CAHSRA, MTC, VTA, SMCTD, SFMTA, transit operators, Clipper 2.0 Board, BART, CalSTA

Unlike driving, many transit trips can require a variety of connecting services to get from one place to another. Door-to-door information on when and where services run and the ability to pay for your whole trip at once are essential. In other parts of the world, transit riders can use smartphones and other mobile devices to plan, book and manage their trips — and to pay fares and obtain real-time travel information en route in order to make more productive use of their time. Clipper, the region's transit fare payment system, should offer the same kind of functionality. Silicon Valley has created the tools and standards that we need to make this all happen; now Clipper should put them into practice.

An advanced example of seamless payment is Germany's Deutsche Bahn Touch&Travel system, which uses electronic travel cards that work on both high-speed and local rail. The Touch&Travel system uses GPS to automatically charge a fare when a passenger walks through the fare gates, much like FasTrak charges vehicles as they pass through toll booths. Travelers using Switzerland's SwissPass can use a single card to pay for rail as well as car sharing, bike sharing, a mobile phone service, ferries, streetcars and services to recreational areas.

In tandem with planning for high-speed rail and the 2018 Statewide Rail Plan, California is developing a network integration program whose philosophy is that all types of rail in California should have integrated schedules and fare payment, leading to a more efficient use of resources and a more convenient passenger experience.

Highway 101 and Caltrain should also be integrated to manage demand and improve the customer experience. Because Caltrain faces crowded conditions — which may continue even after electrification due to expected increases in demand — Caltrain and its corridor partners (SMCTA, C/CAG, SFCTA and VTA) could monitor Caltrain together with transit on Highway 101 and balance ridership across the two modes using incentives such as fare and toll pricing.

RECOMMENDATION 19

Operate BART, Caltrain and high-speed rail as one system from the rider's perspective.

Who: BART, PCJPB, CAHSRA, MTC, Clipper 2.0 Board

BART is the region's largest rail system, both in miles and riders. Today BART connects with Caltrain at Millbrae Station; in the future, the two services will also connect at San Jose's Diridon Station, Santa Clara Station and the Transbay Transit Center in downtown San Francisco. High-speed rail will connect with Caltrain and BART at Diridon Station, Millbrae Station and the Transbay Transit Center (and possibly one other station in the corridor).

Today, the BART–Caltrain connection is not timed, is physically inconvenient and requires passengers to pay a separate fare. The same could be true of high-speed rail when it opens. In order to achieve the ring around the Bay that transportation planners have aspired to for decades, a few steps will need to be taken. The first is to time transfers between Caltrain and BART so that passengers don't have long waits for connecting services. The same care should be taken with planning high-speed rail schedules. Each station where the three services meet should be considered a major transfer point, and each system's train schedule should be designed to make that transfer happen within just a few minutes (like the Swiss "pulse" system, described in the sidebar on page 20). Higher-frequency service can also help make connections seamless for the rider. One way to increase BART's frequency to Millbrae is to introduce an additional express BART service between Millbrae/SFO and Daly City, as described in BART's Metro Study.[109]

A fare payment system and fare structure that works across all three services (plus others), as well as shared maps and information, will make our transportation network truly feel like rail that rings the Bay. BART's distance-based fares and Caltrain's zone-based fares should be harmonized into one fare scheme that is seamless for riders. Maps and rider tools such as smartphone apps are another area where BART and Caltrain should collaborate to unify the rider experience. Because this corridor will be part of California's high-speed rail network, there is also a statewide need to integrate the passenger experience across rail operators.

RECOMMENDATION 20.

Use fare subsidies and fare policies to improve transit affordability and make transit work for more people.

Who: MTC, PCJPB, SFCTA, SMCTA, VTA, transit operators, Clipper 2.0 Board

There are many reasons to change transit fare policies. Foremost, improved fare policies can eliminate unintended penalties for simply transferring between vehicles, transportation modes or providers. When set appropriately, fare policies can also encourage people to choose transit more often. And they provide a way to help distribute transit demand better across times of day and service types.

We recommend keeping transit fares at a level that the market will support while also providing effective discounts and means-based programs. At Caltrain and other transit agencies, the policy has been to keep fares low so that they're affordable for lower-income passengers, in effect subsidizing both the lower-income and the higher-income passengers. This policy hurts overall system resources, especially when the great majority of Caltrain passengers have the financial capacity to pay more.

There is a tension between fare revenue, equity and increasing the number of people who take transit. A focus on increasing fares without addressing equity issues leaves lower-income travelers unable to use transit. We recommended developing a fare subsidy program that expands access to transit to more of those people for whom cost may be a barrier. This would likely include youth, seniors and lower-income residents and workers. This program should apply to both rail and bus transit and to local and regional trips.[110] Another way to address these issues in a balanced way would be to make discount transit passes (particularly rail passes) available to businesses districts or groups of employers, helping them get into the hands of lower-income workers. In addition to providing discount passes to employers, a more robust discount pass program could be made available through social service agencies, colleges and schools.

International regions offer many examples of universal fare cards and strategic pricing. For example, SwissRail offers a half-price fare card for 120 francs ($122) per month that anyone can use on rail, boats, buses and trams. This type of loyalty pass encourages discretionary use of transit all over the country.[111] On Germany's Touch&Travel system, a local public pass (BahnCard City-Ticket) entitles passengers to free transit to and from the railway station when making a trip of more than 100 kilometers (62 miles).[112]

Research shows that universal passes and monthly passes lead to greater use of transit. Transit passes, particularly when combined with off-peak pricing, help transit agencies fill unused seats. Populations such as students, tourists and seniors can benefit from the lower fare options and more leisurely travel.[113]

RECOMMENDATION 21.

Conduct short-range and long-range transportation planning as a corridor.

Who: CAHSRA, MTC, SFMTA, SMCTD, SFCTA, C/CAG, SMCTA, VTA, Caltrain, BART, Caltrans, WETA, transit operators

A low level of transit coordination in this corridor has led to both delays in addressing transportation needs and inefficient use of assets. Informal coordination among agencies is a powerful tool to address a fragmented user experience and is increasingly how regions plan and operate transportation (as opposed to consolidating transit agencies). The preceding recommendations can only be addressed through formal and informal coordination between transportation agencies, cities, institutions, business and civic leaders, and others in the Caltrain Corridor.[114]

A fully integrated payment system could allow travelers to use a single card to pay for rail, bus, car-sharing, bike-sharing and ferry services.

Where operators share riders or service areas, such as VTA and SamTrans buses, it makes sense to coordinate service planning. The benefits include more rational routes, better use of vehicles and higher ridership. Riders can experience expanded options and more frequent service. The existing Short-Range Transit Planning process, which MTC requires, could expand to integrate individual plans or to focus on county or subregion plans. These short-range transit plans could include performance metrics or targets, institutional goals and timelines. New data sources such as Clipper usage or mobile data can now improve the joint service planning process by providing insights on how people travel and how they respond to service or fare changes.

In particular, regular meetings of transit service planners and long-range transportation planners (at both cities and transportation agencies) must begin. Some areas where coordination is needed are:

- **Bus routes.** Travel paths that cross county lines might benefit from new public transit, but there's no clear way to create those services when many transit operators' coverage areas stop at the county line. (See discussion of express buses on page 43.)
- **Capital projects.** In the Bay Area, local agencies develop regional projects. As a consequence, large capital projects are often not in the places with the most demand, and the places with the most need for new capital projects don't have them. An example of this problem is North Bayshore in Mountain View, which sits at the edge of two counties and draws a growing number of regional trips.
- **Highway management.** As discussed earlier, the three counties that manage Highway 101 have developed their management and investment plans for the highway independently, making it unlikely that the best solution for efficiencies or cost will be implemented. Conducting shared planning, and even shared environmental review, would improve outcomes. The vision plan recommends that road pricing be used across the three counties, which will require a corridor-level body to manage the highway.

CHAPTER 9

What the Vision Costs

The vision plan will cost about $600 million for vehicles, between $9.9 and $14.3 billion for capital projects and between $6.2 billion and $6.8 billion for operations and maintenance. (See Figure 17.)

Cost Methodology, Risks and Considerations for Megaprojects

The following cost estimates are based on existing estimates for projects in the Caltrain Corridor and, where those are not available, on costs of similar projects and programs. These costs focus on increasing capacity and availability of transit on rail, Highway 101 and ferries. We have not researched investments related to protecting the infrastructure from disasters or hazards such as sea level rise. Similarly, costs for local improvements that extend beyond the station area, or for upgrading local transit systems, are not included.

In practice, costs can vary greatly depending on the quality and complexity of project designs, the cost of labor, the availability of needed expertise and construction teams, legal challenges and many other factors. Across the world, there are repeated examples of challenges with delivering "megaprojects," large-scale, complex ventures that typically cost a billion dollars or more, take many years to develop and build, involve multiple public and private stakeholders, are transformational and impact millions of people.[115] The new eastern span of the Bay Bridge is a well-known example of a megaproject that experienced challenges; the Transbay Transit Center and CalMod project are also examples. While not a subject of this research, there are best practices for how megaprojects should be managed in order to avoid major cost overruns. See Appendix C for further details. (Available at spur.org/caltraincorridor.)

The costs outlined here do not include transaction costs such as financing costs, potential lawsuits, environmental mitigation or public outreach. Nor do they include an allowance for unusually complicated components or technology. As a next step, more complete plans and cost estimates should be developed. Similarly, sufficient staffing needs to plan and deliver these projects must be estimated as soon as possible. In addition to a business plan, ongoing risk analysis and independent oversight/peer review should be adopted early on for all major projects. These critical actions often come too late in the process, as they did for the Bay Bridge.

Comparing Costs and Benefits in the Corridor

Our research for the vision plan did not include a cost–benefit comparison for the named projects. Instead, we sought to understand what types of projects and programs would increase transit convenience, connectivity, capacity, community and climate protection.

A cost–benefit analysis or business plan specific to Caltrain would be a logical follow-up to this vision plan. (See Recommendation 7.) For the entire corridor, it will be useful to compare the investments, particularly those needed to add increased capacity only at peak hours, such as an additional ferry boat, train or express bus. The benefits measured should include not only new riders or decreases in travel times but also environmental and social benefits.

Plan Bay Area's performance assessment of transportation projects in the region does compare projects and programs of a minimum size against a wide range of performance targets that have been set by the Metropolitan Transportation Commission and by state laws. While this serves as a screening against less-effective investment, it is not a proactive, iterative tool with which to develop the most beneficial projects in the Caltrain Corridor.

FIGURE 17

Caltrain Corridor Vision Plan Complete Cost Estimate

Totaling the estimates from each section of recommendations, the vision plan will cost between $17 billion and $21 billion. Operating costs are over the life of the vision plan (through 2035). All numbers are in 2016 dollars. See Appendix B for details. (Available at spur.org/caltraincorridor.)
Source: SPUR analysis

	Project or Program	Fleet	Capital	Operations and Maintenace
Rail				
	Caltrain short-term (2017–2021)	n/a	n/a	$600 million*
	Caltrain Modernization (2021–2023)	n/a	n/a	$700 million
	Caltrain Modernization 2.0 (2024)	$400 million	$30 million	$350 million
	Rail Modernization 3.0 (2025–2029)	$36 million	$460 million	$660 million
	Rail Modernization 4.0 (2030–2034)	n/a	$120-$130 million	$1.32 billion
	Rail Modernization 5.0 (2035)	$44 million	$600-$620 million	$1.32 billion
	Rail grade separations	n/a	$2-$6 billion	n/a
	Downtown SF Rail Extension	n/a	$4.5 billion	n/a
	Caltrain maintenace facility	n/a	$164 million	n/a
	Caltrain terminal improvements	n/a	$250 million	n/a
	Caltrain level boarding	n/a	$160 million	n/a
	Rail Total	**$480 million**	**$8.2 - $12.3 billion**	**$4.95 billion**
Stations and Last-Mile Connections				
	Station Modernization and Station Access Program	n/a	$260 - $279 million	$80 million
	First- and Last-Mile Program	n/a	n/a	$610 million
	Diridon Station upgrade	n/a	$820 million	n/a
	Millbrae Station upgrade	n/a	$500 million	n/a
	4th and King Station upgrade	n/a	$100 - $200 million	n/a
	Stations and Last-Mile Connections Total		**$1.7-$1.8 billion**	**$690 million**
Highway 101				
	Highway 101 managed lane	n/a	$20-$150 million	$10-$15 million
	Regional bus service	$40 million	n/a	$200–$720 million
	Highway 101 Total	**$40 million**	**$20-$150 million**	**$210-$735 million**
Ferries				
	New vessels	$80 million	n/a	n/a
	Ferry operations	n/a	n/a	$260 million
	Port of Redwood City ferry landing		$40 million	
	Ferry Total	**$80 million**	**$40 million**	**$260 million**
Seamless Transit Experience				
	Integrated trip planning and payment	n/a	$15 million	$10-$20 million
	Targeted fare subsidies	n/a	n/a	$100 million
	Coordinated long-range planning	n/a	n/a	$30 million
	Coordinated Transit Total		**$15 million**	**$140 - $150 million**
Total		**$600 million**	**$9.9 - $14.3 billion**	**$6.2 - $6.8 billion**

*$600 million is for current levels of service. Increased levels of service prior to Caltrain Modernization would require additional funding.

CHAPTER 10

How Do We Fund the Vision?

What Are the Most Promising Funding Sources?

This level of investment will require many funding sources, developed over time. However, transportation agencies are experiencing growing shortfalls to fund maintenance and expansion, particularly better transit. Despite overall growth in transit investment over the past few decades, current levels of investment are not sufficient to maintain facilities in acceptable condition, sustain current levels of performance, and expand systems and services to serve growing travel demand. To make matters even more challenging, funding transportation expansion has increasingly fallen on local and regional revenue sources rather than federal sources.[116] On the other hand, there are many ways to fund transportation projects and operations, as shown in Figure 18.

Most discretionary revenue sources have already been fully committed to local and regional transportation projects. Moving projects in this vision plan forward will require efforts to elevate each project's priority within existing funding streams, as well as establishing new and innovative revenue sources. Some new sources have not yet been applied to the types of projects in the vision. Others will require legislative and/or voter approval to be implemented. Figure 19 proposes a plan to fund the vision using some existing sources while also creating new sources of revenue. See Appendix B for more details. (Available at spur.org/caltraincorridor.)

FUNDING STRATEGY 1

Advocate for anticipated regional, state and federal revenue: **$3 billion**

Who: PCJPB, CAHSRA, all cities and public agencies in the corridor, MTC, Transbay Joint Powers Authority, Port of Redwood City, WETA, transit operators, civic leaders

Many projects in the vision plan are already identified in the Regional Transportation Plan (RTP). The RTP, developed by MTC in cooperation with local agencies every four years, sets the stage for all major capital and operating programs within the Bay Area. RTP projects are reprioritized every two years during the update process (most recently in 2016). While the funding is largely allocated based on formulas and existing agreements, advocacy on the part of agencies and business and civic leaders could lead projects in the vision plan to be prioritized and funded sooner.

The RTP also assumes that there will be some new regional funding sources that will add new revenue — for example, Regional Measure 3 for bridge tolls, a new regional gas tax and congestion pricing projects (user fees for motorists). For this reason, these are not included as new revenue sources in this proposal. However, the creation of these new funding pots is essential to maximize available RTP funding and therefore maximize vision plan project funding.

FIGURE 18

Types of Transportation Funding

Transportation projects and services are funded in a number of ways. One way to categorize funding types is to look at who the primary payer is: the public or business community (such as a sales tax), users (such as a transit fare), beneficiaries or districts (such as developer impact fees) or the private sector (such as concession contract or grant).

Source: SPUR analysis

General public or business community pays	Sales taxes Parcel taxes Gross receipts taxes Business taxes
User pays	Tolls Road user charges Fares and transit passes Vehicle registration fees Parking taxes
Beneficiary/district pays	Property-based business improvement districts SB 142/public transit assessment districts Business-based business improvement districts Community facilities (Mello-Roos) districts Developer impact fees Enhanced infrastructure finance districts
Private sector pays	Private grants Public-private partnerships

FIGURE 19

Sources of Funding for the Caltrain Corridor Vision

The following combination of sources could fund the proposed fleet, capital and operating expenditures identified in the vision plan over the next 20 years.
Source: SPUR analysis

Funding Source	Anticipated Revenue
Anticipated regional, state and federal revenue	$3 billion
Transit fares and highway tolls	$5 billion
Countywide sales tax	$2 billion
Corridor parcel tax	$2.5 billion
Local property-based and business-based funding	$3 billion
New regional and state funding	$3 billion
Public-private partnerships	TBD
Total	$18.5 billion+

FUNDING STRATEGY 2

Use fares and tolls to cover transit operating costs: **$5 billion**

Who: PCJPB, CAHSRA, SFCTA, SMCTA, VTA, SMCTD, SFMTA, Caltrans, civic leaders

User fees such as transit fares and road tolls are a logical funding source for transportation projects and should play a larger role. The costs to run efficient electric rail systems are low enough that it's common for fares to cover operating costs — and even throw off additional funds that can be reinvested in capital programs.

This assumes today's average fares (approximately $6 per passenger) and enough demand to match the capacity proposed in the vision plan. For example, at the Rail Modernization 3.0 phase, after $6.8 billion of investment (the majority of which is the DTX and grade separations, averaged at $600 million per year), annual fare revenue would be almost $400 million.

FUNDING STRATEGY 3

Dedicate funds from county sales taxes: **$2 billion**

Who: SFCTA, SMCTA, VTA, civic leaders

In California, county sales taxes are commonly used to raise new funds for transportation and are increasingly standing in for federal funding. In the Bay Area, county sales taxes are used for highway projects, transit projects, transit operations, streets, bicycle facilities and many other transportation-related uses (eight out of nine Bay Area counties have transportation sales taxes). Based on previous experience in the Bay Area, it appears feasible to fund $2 billion in projects and programs in the Caltrain Corridor over the next 15 to 20 years, through sales taxes in Santa Clara, San Mateo and San Francisco counties.[117] Sales taxes for general funds require 50 percent plus one votes to pass, while dedicated sales taxes (tied to an expenditure plan) require two-thirds of voter approval to pass.

Santa Clara County's successful 2016 sales tax ball measure included $700 million for grade separations and $300 million for CalMod 2.0 capacity upgrades.

FUNDING STRATEGY 4

Pass a new parcel tax, possibly through a transit district: **$2.5 billion**

Who: PCJPB, SFCTA, SMCTA, VTA, civic leaders

A parcel tax is levied on each parcel (such as by home, by square foot or by acre), rather than on the assessed value of a property. Parcel taxes are commonly used for transit operations (BART and AC Transit have dedicated parcel taxes) and for other public services such as libraries and schools. A parcel tax provides a steady revenue stream that is not tied to a specific expenditure plan. Parcel taxes, because they are special taxes, require two-thirds voter approval to pass and can be applied to both residential and commercial parcels.

Creating a parcel tax offers the opportunity to create a transit district; districts can accept more state and federal funds for transit. In the case of Caltrain, it would mean creating a new district or joining an existing transit district (such as the BART district). One opportunity with a parcel tax is the ability to create taxing district boundaries that correlate with the most significant users or beneficiaries of the investment. A district could be confined to an area that has a direct relationship to Caltrain, such as within a few miles of the rail corridor.

FUNDING STRATEGY 5

Develop local matching funds, especially for stations and grade separations: **$3 billion**

Who: Cities in the corridor, VTA, SMCTA, SFCTA, civic leaders

Local funding is a key piece of the vision plan. It's a logical source for matching funds for grade separations and station improvements and to augment first- and last-mile services because the benefits are accrued locally and because these projects have a close nexus with local land use and transportation goals.

Local funding is often, but not always, property based. Some local funding mechanisms are public transit assessment districts (governed by SB 142, enabling assessments within a half-mile of transit stations), community facilities or Mello-Roos districts (self-imposed taxes on property owners to finance public services and improvements), business-based improvement districts (which levy a tax on participating businesses within a district) and property-based business improvement districts (a self-governed district to augment services). For example, the Transbay Transit Center Program is a Mello-Roos district that is contributing funds for the construction of the Transbay Transit Center.

Developer impact fees can be collected by a city or county to fund capital expenses such as bike and pedestrian projects, traffic signals or transit-related projects. Parking taxes or revenue

can also be used to fund transit-related infrastructure. Cities in the Caltrain Corridor are increasingly looking at business taxes to fund transportation and other infrastructure. Rather than using this tool city by city, a shared business tax scheme, where business across several jurisdictions are taxed as part of one district or assessment area, could be a more efficient solution. Income taxes and payroll taxes are another type of business tax that should be explored, as they can be progressive and raise significant funding.

FUNDING STRATEGY 6

Develop innovative sources for remaining capital need: **$3 billion**

Who: All cities and public agencies in the corridor, MTC, civic leaders, CalSTA

Existing state and federal funding streams combined with local funding will not be sufficient to develop the model corridor that we envision. We propose pursuing entirely new funding streams to grow funding for the Caltrain Corridor. The options are:

1. Pass a new regional transportation revenue measure: $2 billion. This could be based on a tax or fee and could include major regional transportation investments, similar to Los Angeles County Measure M (2016) or Seattle's Sound Transit series of parcel taxes.
2. Expand regional and state proposals to price driving and carbon: $500 million. Key state opportunities are a carbon tax and a vehicle-miles-traveled tax. Adding to the cost of driving has an additional benefit of creating new demand for transit.
3. Work at the state level to create a new or augmented revenue source similar to cap-and-trade: $500 million.

FUNDING STRATEGY 7

Identify elements that would be attractive for private investment: **TBD**

Who: PCJPB, CAHSRA, MTC, all cities and public agencies in the corridor, private sector leaders

This vision will not become a reality with public funding alone. Opportunities for private investment such as concessions and public-private partnerships need to be identified and pursued. Project sponsors such as PCJPB should develop a concerted action plan to identify and carve out portions of the vision plan that could be turned over to the private sector for investment, project delivery, operations or all three.

Selected elements of the vision could be accomplished via a public-private partnership (P3), an agreement between a government agency and a private sector entity that participates in delivering a public sector project. Contrasted with traditional models, the private sector assumes a greater role in the planning, financing, design, construction, operation and maintenance of public facilities. P3s transfer risks to the private sector and can reduce costs, increase certainty of execution, accelerate funding and accelerate project completion. While P3s are still emerging in California and the United States, they are increasingly common around the world. A local example is San Francisco's project to replace Doyle Drive with the Presidio Parkway, where a concessionaire was brought on to design, build, finance, operate and maintain the project for 30 years.

Some P3s could be strictly concessions. For example, WETA could build a series of ferry terminals with public funding and invite the private sector to submit proposals to provide the ferries and operate the service. Other options could include concessions to operate bus lines, shuttles, ferries, rail lines or toll lanes. The possibilities are many and should be explored. This effort would include private sector outreach by agencies and civic leaders to help identify which portions of the vision could be delivered with private participation and investment, as well as the type of arrangement that would be the most appropriate in each case.

Private grants, or cost-sharing agreements, are another way that private funds could help pay for vision plan elements. A potential upside of private funding is that it can be less restrictive than public funding.

CONCLUSION

Next Steps

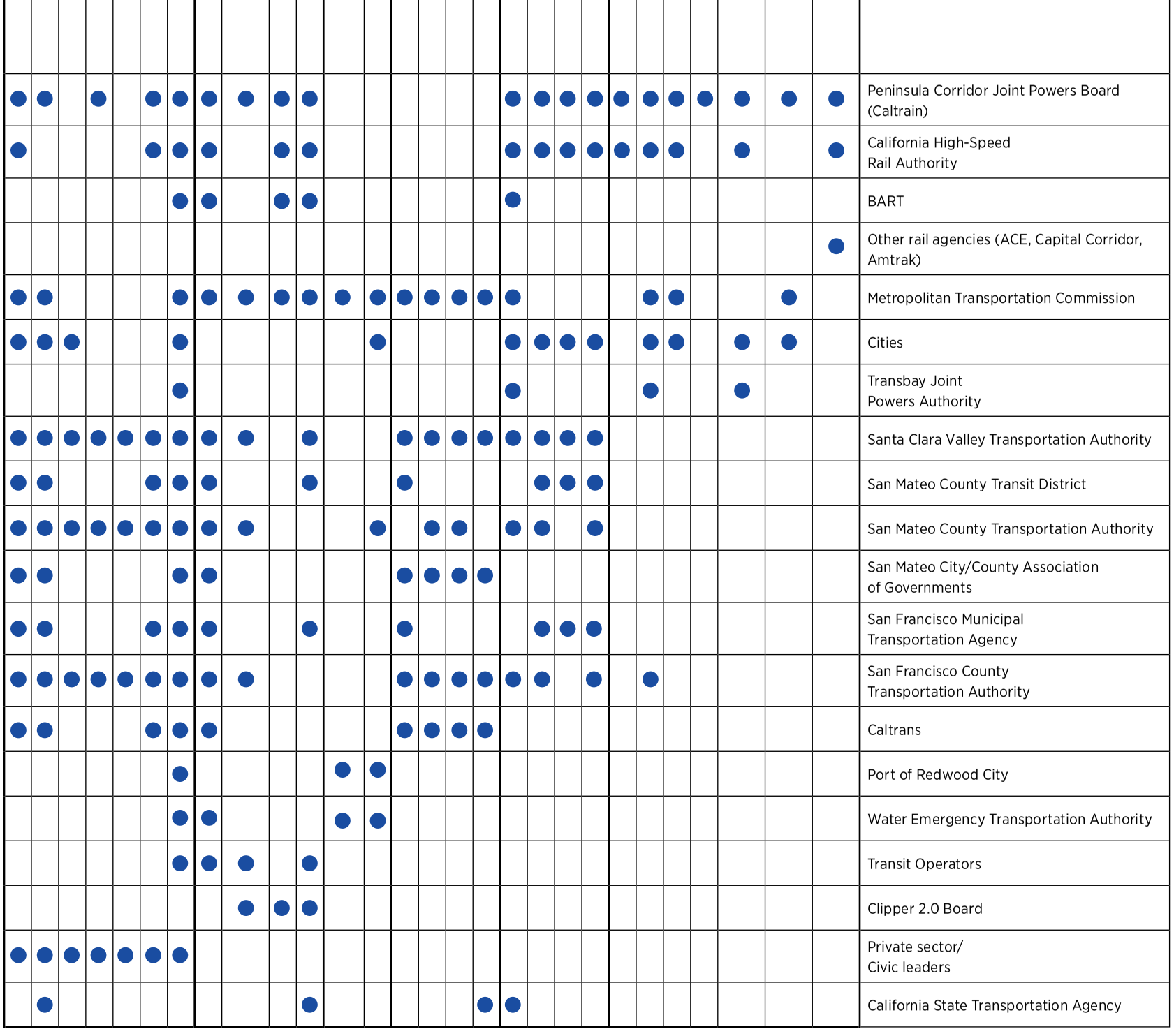
The projects and programs in the vision plan can and should be funded and completed in 20 years or less. Many of them need to be completed before Caltrain's electrified service begins or before high-speed rail service begins. Where moving forward gets complicated, creative problem-solving and learning from international precedents will help us find solutions.

Upcoming policy decisions in the Caltrain Corridor will require close cooperation among multiple agencies that have historically managed and designed their transportation systems independently. Working across the public and private sectors, we can develop both the resources and the leadership needed to work together and make the vision a reality, in a timely manner.

The plan of action that follows summarizes the vision plan recommendations.

Plan of Action

Rail: Develop reliable, frequent all-day rail service with enough capacity to meet demand.	**Recommendation 1:** Adopt an integrated rail schedule that adds frequency all day at regular times, increases capacity to meet demand and attracts new riders.
	Recommendation 2: Adopt service planning guidelines to correlate future service levels with actual ridership and with ongoing local support for station area development.
	Recommendation 3: Add system upgrades, infrastructure and new train cars strategically to increase frequency, add capacity, increase reliability and reduce travel times.
	Recommendation 4: Improve Caltrain service in the short term, before electrification.
	Recommendation 5: Use a corridor-wide strategy to address the impact of at-grade rail crossings.
	Recommendation 6: Connect Caltrain and high-speed rail to downtown San Francisco at the Transbay Transit Center.
	Recommendation 7: Develop a business plan for Caltrain.
Rail Stations and Last-Mile Connections: Offer quick and intuitive connections at modern, high-amenity stations.	**Recommendation 8:** Upgrade stations to attract and accommodate more riders.
	Recommendation 9: Improve station access for sustainable and space-efficient modes of travel.
	Recommendation 10: Proactively manage station access and first- and last-mile connections at each rail station.
	Recommendation 11: Build stations with seamless connections between Caltrain and high-speed rail.
Highway 101: Move more people on Highway 101, with less delay.	**Recommendation 12:** Manage a lane of Highway 101 as a high-occupancy toll lane along the entire corridor.
	Recommendation 13: Adopt equity policies and programs for HOT lanes.
	Recommendation 14: Use revenue from pricing Highway 101 to add more public transit service.
	Recommendation 15: Grow regional express bus services.
Ferries: Establish public ferry service for Peninsula travelers.	**Recommendation 16:** Create a ferry terminal at the Port of Redwood City.
	Recommendation 17: Expand ferry services to include Peninsula stops.
A Seamless Transit Experience: Create a coordinated and convenient transportation network.	**Recommendation 18:** Integrate information and payment across mobility services.
	Recommendation 19: Operate BART, Caltrain and high-speed rail as one system from the rider's perspective.
	Recommendation 20: Use fare subsidies and fare policies to improve transit affordablility and make transit work for more people.
	Recommendation 21: Conduct short-range and long-range transportation planning as a corridor.
Funding the Caltrain Corridor Vision	**Funding Strategy 1:** Advocate for anticipated regional, state and federal revenue.
	Funding Strategy 2: Use fares and tolls to cover transit operating costs.
	Funding Strategy 3: Dedicate funds from county sales taxes.
	Funding Strategy 4: Pass a new parcel tax, possibly through a transit district.
	Funding Strategy 5: Develop local matching funds, especially for stations and grade separations.
	Funding Strategy 6: Develop innovative sources for remaining capital need.
	Funding Strategy 7: Identify elements that would be attractive for private investment.


Peninsula Corridor Joint Powers Board (Caltrain)
California High-Speed Rail Authority
BART
Other rail agencies (ACE, Capital Corridor, Amtrak)
Metropolitan Transportation Commission
Cities
Transbay Joint Powers Authority
Santa Clara Valley Transportation Authority
San Mateo County Transit District
San Mateo County Transportation Authority
San Mateo City/County Association of Governments
San Francisco Municipal Transportation Agency
San Francisco County Transportation Authority
Caltrans
Port of Redwood City
Water Emergency Transportation Authority
Transit Operators
Clipper 2.0 Board
Private sector/ Civic leaders
California State Transportation Agency

Endnotes

[1] Roads and bridges that connect with Highway 101— the San Mateo and Dumbarton bridges, Highway 280, Highway 85, Highway 87 and Highway 237 — all have their own congestion and management needs. Because most destinations are located near Highway 101, and because it parallels Caltrain, Highway 101 is a focus of this vision plan.

[2] Population numbers from Metropolitan Transportation Commission/Association of Bay Area Governments, see: MTC/ABAG, Plan Bay Area, 2013, http://files.mtc.ca.gov.s3.amazonaws.com/pdf/Plan_Bay_Area_FINAL/pbafinal/index.html

[3] Noreen McDonald, "Are Millennials Really the 'Go-Nowhere' Generation," Journal of the American Planning Association, 81, 2015, page 90, http://www.tandfonline.com/doi/full/10.1080/01944363.2015.1057196

[4] Kenneth A. Small and Erik. T. Verhoef, "The Economics of Urban Transportation," Routledge, 2007, http://library.magistersipil.janabadra.ac.id/wp-content/uploads/2015/05/The-Economics-of-Urban-Transportation.pdf

[5] Laura Tam and Sarah Jo Szambelan, Fossil-Free Bay Area, SPUR, 2016, page 8, https://www.spur.org/sites/default/files/publications_pdfs/SPUR_Fossil_Free_Bay_Area.pdf

[6] Janet McGovern, Caltrain and the Peninsula Commute Service, California Arcadia Publishing, 2012.

[7] There were multiple trains to Los Angeles including the Coast Daylight, a daytime train that survived until 1971. At that point Amtrak's Coast Starlight, which travels from Seattle to Los Angeles via Oakland, replaced the Coast Daylight, leaving the commuter service as the only rail service between San Jose and San Francisco.

[8] Steve Miller, The Peninsula Commute Story, 1987.

[9] Louise A. Mozingo, Pastoral Capitalism, MIT Press, 2011.

[10] Chris Brittle et al., Peninsula Mass Transit Study, Metropolitan Transportation Commission, 1985, http://bayrailalliance.org/files/library/Peninsula_mass_transit_study.pdf

[11] Andrew Nash, "Caltrain Rapid Rail Plan," Transportation Research Record 1677, 1999, pages 31-39, https://www.researchgate.net/publication/245558937

[12] Caltrain 2016 Annual Passenger Counts, http://www.caltrain.com/Assets/__Agendas+and+Minutes/JPB/Board+of+Directors/Presentations/2016/2016-05-05+Annual+Counts.pdf

[13] Today, Caltrain operates a weekday schedule with 92 trains per day (46 northbound and 46 southbound). Trains are operated as one of three designated services: local, which makes all station stops; limited-stop, which makes approximately half of the total station stops; and Baby Bullet, which makes at most six of the total station stops.

[14] Seated capacity refers to the total number of seats available per train. To calculate seated capacity per train, the total number of passengers on a train at a given time is divided by the total number of seats available per train.

[15] Caltrain 2015 Caltrain Annual Passenger Count, http://www.caltrain.com/Assets/_Marketing/pdf/2015+Annual+Passenger+Counts.pdf

[16] MTC data collected in San Mateo County in 2015. MTC presentation available at http://www.transformca.org/sites/default/files/062515%20San%20Mateo%20101%20Corridor%20Strategies.pdf

[17] MTC's 2012–2014 Shuttle Census found that at least 765 private buses operated each day in the region in 2014. With 9.6 million annual boardings, the shuttles in aggregate are the equivalent to the region's sixth largest transit operator. The total number of public transit boardings annually in the region was approximately 531 million. Shuttle buses play an outsize role in the Caltrain Corridor, particularly during peak hours, due to the amount of buses provided by employers here. See: http://mtc.ca.gov/sites/default/files/2016%20Bay%20Area%20Shuttle%20Census.pdf and http://mtc.ca.gov/sites/default/files/Statistical_Summary_2015.pdf

[18] Todd Littman, The Hidden Traffic Safety Solution: Public Transportation, American Public Transportation Association, 2016, https://www.apta.com/resources/reportsandpublications/Documents/APTA-Hidden-Traffic-Safety-Solution-Public-Transportation.pdf

[19] Caltrain and MTC, Caltrain 2014 On-Board Transit Survey: Final Report, 2014, http://www.caltrain.com/Assets/_MarketDevelopment/pdf/Caltrain+Origin+$!26+Destination+Survey+2014.pdf

[20] Caltrain, Fares, 2016, http://www.caltrain.com/Fares.html

[21] Ibid.

[22] Caltrain, Using a Wheelchair, http://www.caltrain.com/riderinfo/Accessibility/wheelchair.html

[23] U.S. Census Bureau, 2010 and 2015 population estimates, https://www.census.gov/en.html; State of California Employment Development Department, Labor Market Information, http://www.labormarketinfo.edd.ca.gov/geography/metropolitan-areas.html. The number of people crossing the boundaries of the nine-county Bay Area increased by 78 percent between 1990 and 2013. See: Jeff Bellisario, Micah Weinberg and Camila Mena, The Northern California Megaregion: Innovative, Connected, Growing, Bay Area Council Economic Institute, 2016.

[24] MTC/ABAG, Plan Bay Area 2040, 2016, http://planbayarea.org/pdf/final_supplemental_reports/FINAL_PBA_Forecast_of_Jobs_Population_and_Housing.pdf

[25] City of San Jose, Memorandum, 2011, https://www.sanjoseca.gov/DocumentCenter/Home/View/643; Draft Environmental Impact Report: North Bayshore Precise Plan, State Clearinghouse #2013082088, 2014, http://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=13791; Transbay Transit Center, Transbay Neighborhood, http://transbaycenter.org/project/redevelopment-plan

[26] Shoreline Boulevard Corridor Study, City of Mountain View, 2014, http://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=15441

[27] Robert Lang, Edgeless Cities: Exploring the Elusive Metropolis, Brookings Institution Press, 2003. By way of contrast, "edge cities" are more planned, higher-density, more mixed-use places located at the edges of regions.

[28] San José International Airport Master Plan Update Project, January 2011, http://www.flysanjose.com/fl/about/improve/overview/Jan_Add_2011.pdf

[29] California Transportation Plan 2040, http://www.dot.ca.gov/hq/tpp/californiatransportationplan2040/2040.html. These concepts are being further developed through the 2018 California State Rail Plan.

[30] Passenger vehicles are the Bay Area's largest single source of climate pollution, contributing 32 percent of our greenhouse gas emissions. Public transit emits far less greenhouse emissions than autos, and the electrification of Caltrain will further reduce the emissions from that system. Walking or biking emits virtually no greenhouse gases. See: SPUR analysis in Fossil-Free Bay Area, http://www.spur.org/publications/spur-report/2016-09-21/fossil-free-bay-area, with data from Bay Area Air Quality Management District. The estimated reduction from electrified Caltrain service is 176,000 metric tons of CO2 per year (assumes service to Transbay Transit Center, through 2040). See Caltrain Modernization Program, http://www.caltrain.com/projectsplans/CaltrainModernization/Modernization/Caltrain_Modernization_InfoGraphic.html

[31] The draft 2016 plan places all growth in the existing urban footprint of the region. The result is an estimated 18 percent reduction in per capita C02 emissions and a 3 percent increase in non-auto mode share by 2040. Plan Bay Area is the implementation of several policies: The Sustainable Communities and Climate Protection Act of 2008, also known as Senate Bill 375, is a State of California law targeting greenhouse gas emissions from passenger vehicles. The Global Warming Solutions Act of 2006 (AB 32) sets goals for the reduction of statewide greenhouse gas emissions. Passenger vehicles are the single largest source of greenhouse gas emissions statewide, accounting for 30 percent of total emissions. SB 375 therefore provides key support to achieve the goals of AB 32. SB 375 instructs the California Air Resources Board to set regional emissions reduction targets from passenger vehicles. The Metropolitan Planning Organization for each region (in the Bay Area this is the Metropolitan Transportation Commission) must then develop a Sustainable Communities Strategy that integrates transportation, land-use and housing policies to plan for achievement of the emissions target for their region.

[32] The CalMod project has a funding plan and work on the project has commenced. The first part is electrifying the 51.4 miles of track between San Francisco's 4th and King and San Jose's Tamien stations ($704 million) and replacing 75 percent of Caltrain's diesel fleet with electric trains ($618 million). The second piece is a new, $230 million train control system, known as Communications-Based Overlay Signal System Positive Train Control system, which will allow trains to run more precisely and closer together, making increased frequency possible. More important, positive train control increases safety because the system can control train movement in the event of human error.

[33] For a detailed discussion of sharing tracks between different types of rails, see Nash, Andrew, Best Practices in Shared-Use High-Speed Rail Systems, 2003, http://transweb.sjsu.edu/MTIportal/research/publications/documents/02-02.pdf

[34] California High-Speed Rail Authority, Draft 2016 Business Plan, 2016, http://www.hsr.ca.gov/About/Business_Plans/Draft_2016_Business_Plan.html

[35] Ibid.

[36] MTC's 2012-2014 Shuttle Census shows that, together, these shuttles were the region's sixth largest transit operator in FY 2014-15. See: http://mtc.ca.gov/sites/default/files/2016%20Bay%20Area%20Shuttle%20Census.pdf

[37] Stanford University's trip cap was a pioneering public policy/land use regulation approach to managing auto trips in and out of a particular area. See: http://govcr.stanford.edu/wp-content/uploads/2015/10/general-use-permit.pdf

[38] There are many other trip caps in the corridor. Mountain View's North Bayshore Trip Cap requires a 30 to 45 percent single-occupancy vehicle (SOV) mode share target, depending on the density of employment within buildings. See: North Bayshore Transportation Demand Management Plan Guidelines Final, 2015, http://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=15164. Sunnyvale's Central and Wolfe Trip Cap requires about a 50 percent SOV mode share target (a 35 percent reduction from ~76 percent). See: Central & Wolfe TDM Plan, http://bit.ly/1NSV0Vd. Menlo Park's East of 101 Trip Cap requires about ~56 percent SOV (25 percent reduction), with a $50 penalty/trip/day. See: Menlo Park 2013 Facebook West Campus Trip Cap, pages 40-46, http://www.menlopark.org/DocumentCenter/View/2342

[39] Palo Alto TMA, http://www.paloaltotma.org/app_pages/view/19

[40] Joint Venture Silicon Valley, a regional collaborative forum, has been developing the concept of mobility as a service for the Caltrain Corridor by exploring pilot projects in partnership with institutions, cities and other stakeholders aiming for near-term implementation.

[41] Todd Littman, "Autonomous Vehicle Implementation Predictions," Victoria Transport Policy Institute, December 10, 2015, pages 6-7, http://slidepapers.in/wp-content/uploads/2016/03/Autonomous-Predictions-Vehicle-Implementations.pdf

[42] National Association of City Transportation Officials (NACTO), NACTO Policy Statement on Automated Vehicles, 2016, http://nacto.org/wp-content/uploads/2016/06/NACTO-Policy-Automated-Vehicles-201606.pdf

[43] Caltrain's 2016 operating budget anticipates approximately $84 million in fare revenue and $117 million in operating expenses. See: http://www.caltrain.com/Assets/_Finance/BUDGETS/JPB/FY2016+JPB+Adopted+operating+budget.pdf

[44] A budget crisis emerged in late 2010, when San Mateo County experienced a significant budget shortfall and elected to reduce its funding for Caltrain by two-thirds, from $14.7 million to $4.9 million. San Francisco and Santa Clara counties also proposed reducing their contributions. Had this happened, Caltrain's annual operating budget of $100 million would have been suddenly reduced by 24 percent, to $76 million. This would have required drastic cuts in service, including virtually all midday and late-night service, all weekend service and all service to certain stations. While drastic cuts were averted by a one-time transfer from San Mateo County's Measure A Sales Tax Revenue, such a crisis could arise at any time should any of the three member counties again face a budget shortfall.

[45] Caltrain Strategic Plan FY2015-2024, September 2014, http://www.caltrain.com/Assets/Caltrain+Modernization+Program/Documents/Strategic+Plan+Final+Doc.pdf

[46] Caltrain Short Range Transit Plan 2015-2024, October 2015, http://www.caltrain.com/projectsplans/Plans/Short_Range_Transit_Plan.html. The CalMod 2.0 project anticipates operating eight-car trains, rather than today's six-car trains, although the actual operating scheme has not been determined. It may also be beneficial to take advantage of the electric multiple units and operate shorter trains with more frequency or for shorter routes.

[47] Embarcadero Station Schedule http://www.bart.gov/stations/embr/schedule

[48] Caltrain Partners with San Mateo County on Suicide Prevention Forum, 2015, http://www.caltrain.com/about/MediaRelations/news/Caltrain_Partners_with_San_Mateo_County_on_Suicide_Prevention_Forum.html

[49] Swiss Federal Railway, Facts and Figures, http://sbb.ch/zahlen-und-fakten

[50] The 2012 Caltrain/HSR Blended Operations Analysis indicates that Caltrain and high-speed rail can operate together, without substantial additional rail infrastructure, for a combination of up to six Caltrain trains and four high-speed rail trains per hour. While this combination of services is feasible with only a small amount of new rail infrastructure, it would probably force an uneven Caltrain timetable: A group of three Caltrain trains depart from each terminal station within 10 minutes of one another, and then 20 minutes must pass before the next group of Caltrain trains can depart. See: http://www.caltrain.com/projectsplans/CaltrainModernization/BlendedSystem/BlendedSystemPlanningProcess/Caltrain_HSR_Blended_Service_Plan_Operations_Analysis.html

[51] Jarrett Walker, Human Transit, Island Press, 2011, pages 117-34.

[52] For more discussion of station-area development for rail, see: SPUR, Beyond the Tracks: The Potential of High-Speed Rail to Reshape California's Growth, 2011, https://www.spur.org/sites/default/files/publications_pdfs/SPUR_Beyond_the_Tracks.pdf

[53] VTA, Service Design Guidelines, 2007, http://www.vta.org/sfc/servlet.shepherd/version/download/068A0000001Fb8j

[54] For example transit agency transit-oriented development guidelines, see BART's Transit-Oriented Development Policy, https://www.bart.gov/sites/default/files/docs/BART%20Board%20-%20TOD%20Policy%20Draft%206-9-16%20Adopted%20FINAL_0.pdf and Metro's Transit-Oriented Development Program, http://www.oregonmetro.gov/tools-partners/grants-and-resources/transit-oriented-development-program

[55] Passing tracks for the two opposite directions of travel can either be constructed in the same locations on the corridor (resulting in some four-track corridor segments) or in different locations (resulting in, at most, three-track corridor segments). The four-track approach reduces the length of the corridor impacted by new track construction but requires greater width. The three-track approach reduces the maximum corridor cross-section to three tracks but brings construction impacts (including station reconstructions) to a greater length of the corridor.

[56] For more information, see: http://www.caltrain.com/projectsplans/CaltrainModernization/BlendedSystem/BlendedSystemPlanningProcess/Caltrain_HSR_Blended_Service_Plan_Operations_Analysis.html

[57] A bigger move to increase train car capacity is to use articulated trains, or train cars that are open to the next train car. (Articulated buses can be found today in several Bay Area communities.) Articulated trains increase capacity by approximately 10 to 25 percent because they increase the amount of usable space and spread passengers more evenly through a train. Although no U.S. passenger rail operators have chosen articulated rail cars, they are used today in Paris, Shanghai and Munich (a recent survey showed 75 percent of non-U.S. metro systems use articulated trains). Using articulated trains on the Caltrain Corridor would be subject to regulatory approvals and safety laws, retrofitting of maintenance facilities, as well as a train car design that works with the catenary wire system.

[58] CAHSRA is evaluating light maintenance facility locations in Brisbane and Gilroy.

[59] These state of good repair and system enhancement projects are described in the Caltrain Short Range Transit Plan 2015-2024. See: http://www.caltrain.com/projectsplans/Plans/Short_Range_Transit_Plan.html

[60] Because high-speed rail trains move so fast, they need additional clearance between the track and platform. This creates a gap between platforms and trains that is wider than the three-inch ADA maximum for unassisted boarding. To provide unassisted boarding without bridge plates, the gap can be bridged automatically by a moving step that extends from the train. The step is key to unassisted boarding for wheelchair users.

[61] The daily train schedule for the new electrified service has not yet been developed. The expected increase in seated, peak-hour capacity with the CalMod project (2021 service) is approximately 11 percent, although the new train car design is not yet finalized.

[62] An estimated 33,000 Caltrain riders will use the Transbay Transit Center station. See: http://transbaycenter.org/project/faqs

[63] The 2009 environmental impact review (EIR) for California high-speed rail evaluated options for high-speed rail to operate on dedicated tracks through the Peninsula, different from the blended system being developed today. The four-track

project options can be found here in the EIR for the high-speed rail project, see: http://www.hsr.ca.gov/docs/programs/bay_area_eir/BayCValley10_EIR_vol1_complete.pdf. A recent high-level analysis showed that 94 percent of the corridor is 75 feet or wider (the width needed for four tracks with high-speed rail), and 68 percent of the corridor is 100 feet or wider, see: http://www.cahsrblog.com/2013/09/four-track-hsr-on-peninsula-just-got-harder-but-not-impossible/

[64] A detailed analysis of the Joint Powers Board Right of Way can be found in the California High Speed Rail Authority environmental documents of 2009, more easily viewed at: http://caltrain-hsr.blogspot.com/2009/01/caltrain-right-of-way-maps.html.

[65] San Mateo County created a $350 grade separation program through its 2004 Measure A sales tax, most of which has been spent. San Francisco County does not have a grade separation program, and Santa Clara County funded $700 million grade separations in its November 2016 sales tax measure. See: http://www.smcta.com/Assets/SMCTA/Documents/2009-2033+Transportation+Expenditure+Plan.pdf. The California Public Utilities Commission maintains a priority list of highway-rail grade separation projects that may qualify for state and federal funding. See: http://www.cpuc.ca.gov/General.aspx?id=2891

[66] The Federal Railroad Administration's trigger for fully grade separating would be at 125 mph, which is faster than high-speed rail will run on the Caltrain Corridor. New and reconstructed stations identified in the cost estimates in this section are assumed to include grade-separated crossings to/from platforms for passengers.

[67] The Caltrain electrification EIR evaluated grade crossings using a service plan with six Caltrain and four high-speed rail trains per hour, for a total of 10 trains per hour. The scenarios presented in this section further increase trains per hour.

[68] More background on freight operations can be in found in Caltrain electrification EIR. See: http://www.caltrain.com/Assets/Caltrain+Modernization+Program/FEIR/3.14+Transportation.pdf

[69] Today, the Market Street/Financial District area is connected with Caltrain via the BART line to SFO. The BART travel time between Millbrae station and Montgomery station is 30 minutes (not including time to get to Millbrae station and wait for a connecting train) and includes 10 stops and payment of a new fare. When Caltrain is extended to downtown San Francisco, the Caltrain travel time from Millbrae to the Transbay Transit Center will be approximately 20 minutes, depending on the exact stopping pattern of the train between the two stations. See: Peninsula Corridor Electrification Project Environmental Impact Report, Appendix I – Ridership Technical Memorandum, Caltrain, 2014.

[70] The SF Planning Department Railyards and 280 Boulevard Feasibility study is considering how the DTX, high-speed rail and other infrastructure in SoMa, Mission Bay and Showplace Square/Lower Potrero Hill neighborhoods can be organized differently to improve transportation and land use outcomes. Options under consideration include a change in the alignment of the DTX project. See: http://sf-planning.org/railyard-alternatives-and-i-280-boulevard-feasibility-study-rab.

[71] Shoreline Boulevard Corridor Study, 2014, http://www.mountainview.gov/civicax/filebank/blobdload.aspx?BlobID=15441

[72] See: Dumbarton Rail Corridor Alternatives Study, 2011, http://www.smcta.com/Assets/Dumbarton+Rail+Corridor/documentation/Dumbarton_Rail_Corridor_Alternative_Study-2010.pdf A new Dumbarton corridor study is underway. See: http://www.samtrans.com/Planning/Planning_and_Research/DumbartonTransportationCorridorStudy.html

[73] For more information on VTA's BART Silicon Valley Phase II project, see: http://www.vta.org/bart/stations

[74] For further discussion of second transbay crossing, see: SPUR, Designing the Bay Area's Second Transbay Rail Crossing, 2016, http://www.spur.org/sites/default/files/publications_pdfs/SPUR_Designing_the_Bay_Area's_Second_Transbay_Rail_Crossing.pdf

[75] SPUR/Arup analysis. For the purposes of cost estimation, we used a sample alignment that maximizes the use of existing rights-of-way (to minimize construction impacts to communities) and, wherever it would be possible without community impacts, assumes trains would run at grade. Along Highway 101, we considered aerial alignments alongside the freeway to be feasible. Wherever at-grade and aerial alignments were not feasible (e.g., through East Palo Alto), we assumed below-grade/tunneled alignments.

[76] For a robust discussion of the first/last mile to transit and a methodology for improving station access across jurisdictions, see: Los Angeles County Metropolitan Transportation Authority, First Last Mile Strategic Plan and Planning Guidelines, 2014, http://media.metro.net/docs/sustainability_path_design_guidelines.pdf

[77] Ibid.

[78] SRTP, 2015, http://www.caltrain.com/Assets/_Planning/Strategic+Plan/Strategic+Plan+FY2015+-+FY2024/Caltrain+Short+Range+Transit+Plan+-+FY2015-FY2024+-+Final.pdf

[79] Ibid.

[80] Duranton Gilles and Matthew A. Turner, "The Fundamental Law of Road Congestion: Evidence from US Cities," American Economic Review, 101, 2011, pages 2616-52.

[81] Transit Cooperative Research Program, TCRP Report 145: Reinventing the Urban Interstate: A New Paradigm for Multimodal Corridors, 2011, http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_145.pdf

[82] U.S. Department of Transportation Federal Highway Administration, Managed Lanes: A Primer, 2015, http://ops.fhwa.dot.gov/publications/managelanes_primer/

[83] At the time of this study, there is a state-led collaboration across the Highway 101 corridor. The collaboration is working on a shared policy approach for the corridor and a more integrated project development process.

[84] TransForm, Innovation Required, 2014, http://www.transformca.org/sites/default/files/final_hot_101_paper.12.16.2013-1_revised_acknowledgement_0.pdf

[85] MTC presentation available at http://www.transformca.org/sites/default/files/062515%20San%20Mateo%20101%20Corridor%20Strategies.pdf

[86] A disadvantage of any HOT (or HOV) facility on the innermost lanes of a freeway is that cars and buses entering the HOT facility (after entering the freeway from an on-ramp) must cross leftward across several general-purpose lanes. Similarly, cars and buses in the HOT facility must cross rightward across several general-purpose lanes to exit. This action of a traffic stream crossing other traffic streams creates a "weaving conflict." The effect of the weaving conflict is reduced, however, if users of the HOT lane have longer average trip lengths (i.e., large volumes of traffic are not entering or exiting along most of the freeway corridor). In specific cases, direct access ramps (to/from arterials) or direct connector ramps (to/from other HOT/HOV or freeway facilities) may be warranted to mitigate weaving conflicts.

[87] Figures based on the current focus of planning for Highway 101 in San Mateo County, which is to create an HOV lane by widening some portions of the highway and using existing auxiliary lanes in other places. See: http://www.transformca.org/sites/default/files/final_hot_101_paper.12.16.2013-1_revised_acknowledgement_0.pdf

[88] MTC Express Lanes, 2016, http://mtc.ca.gov/our-work/plans-projects/major-regional-projects/mtc-express-lanes

[89] Several studies, by both public agencies and advocacy organizations, have been conducted recently to identify potential improvements for the Highway 101 freeway corridor, see: San Mateo – 101 HOV Lane Feasibility Study; Dowling/Kittelson & Associates, 2012; San Mateo 101, HOV Lane Analysis, Final Mainline Report; Kittelson & Associates, 2012; Staged HOV Lane Analysis (from Whipple Avenue to I-380). See also Kittelson & Associates, 2012; Innovation Required: Moving More People with Less Traffic. TransForm, 2013; Project Study Report: US 101 HOV Project Development Support (PSR-PDS); San Mateo County Transportation Authority (SMCTA), City/County Association of Governments of San Mateo County, California Department of Transportation (Caltrans), 2015; San Mateo 101 Corridor Strategies: An Innovative Partnership in the Making; Metropolitan Transportation Commission, 2015; San Francisco Freeway Corridor Management Study; San Francisco County Transportation Authority, study underway.

[90] TransForm, Innovation Required, 2014, http://www.transformca.org/sites/default/files/final_hot_101_paper.12.16.2013-1_revised_acknowledgement_0.pdf

[91] AB 798, passed in 2009, prohibits converting an existing nontolled general-purpose lane to a tolled lane, although conversions of HOV lanes are allowed. California legislature could allow a limited number of demonstration projects to test the optimized HOT lane scenario; these demonstration projects would be allowed to convert existing nontolled general-purpose lanes to HOT if the project includes a simultaneous increase in transit, vanpools and other transportation choices along the same corridor. These projects should have initial time limitations and require detailed studies before being made permanent. For more information, see: http://www.transformca.org/resource/innovation-required-moving-more-people-less-traffic

[92] Sara Khoeini and Randall Guensler, "Using Vehicle Value as a Proxy for Income: A Case Study on Atlanta's I-85 HOT Lane," Research in Transportation Economics 44, no. 6, 2014, pages 33-42.

[93] Edward Sullivan and Mark Burris, "Benefit-Cost Analysis of Variable Pricing Projects: SR-91 Express Lanes," Journal of Transportation Engineering 132, no. 32006, pages 191-98.

[94] Highway connections to this corridor include the following. State Route 92 to/from the San Mateo–Hayward Bridge: HOV lanes currently exist at the westbound toll plaza east of the bridge in Hayward but not on the bridge itself. State Route 84 to/from the Dumbarton Bridge: HOV lanes currently exist at the westbound toll plaza east of the bridge in Fremont but not on the bridge itself. There is currently no freeway connection from 101 to the west end of the Dumbarton Bridge. State Route 237 (Southbay Freeway): HOV lanes currently exist from 101 to First Street. As part of Phase 2 of the SR-237 express lanes project, these HOV lanes are planned to be converted to HOT lanes by 2018. State Route 87 (Guadalupe Freeway): HOV lanes currently exist from 101 to State Route 85. Several expressways in Santa Clara County (such as the Lawrence Expressway, the Montague Expressway and the San Tomas Expressway) have HOV lanes in effect during peak periods.

[95] For more information see: http://www.miamidade.gov/transit/express-buses.asp

[96] MTC presentation available at http://www.transformca.org/sites/default/files/062515%20San%20Mateo%20101%20Corridor%20Strategies.pdf

[97] Mark Burris et al., "The Impact of HOT Lanes on Carpools," Research in Transportation Economics 4, no. 1, pages 43–51, http://doi.org/10.1016/j.retrec.2014.04.004

[98] Update to the initial Dumbarton Corridor Study being managed by SamTrans. See: http://www.samtrans.com/Planning/Planning_and_Research/DumbartonTransportationCorridorStudy.html

[99] Frontier Group, A New Way Forward: Envisioning a Transportation System Without Carbon Pollution, 2016, http://www.frontiergroup.org/reports/fg/new-way-forward

[100] California Transportation Plan 2040 explains that the pricing of driving is critical to reducing greenhouse gas emissions and increasing usage of transit and other sustainable modes. See: http://www.dot.ca.gov/hq/tpp/californiatransportationplan2040/index.shtml

[101] Grand Boulevard Initiative Vision, October 2006, http://www.grandboulevard.net/images/stories/documents/visionchallengegps.pdf

[102] As an example, Treasure Island Development Authority is planning for ferry service to Treasure Island, anticipating 45 trips per day with service every 15 minutes during peak hours, subsidized by revenue from congestion pricing tolls to get on the island. For more information, see: http://sftreasureisland.org/transportation%20

[103] See: SPUR, On Solid Ground: Rebuilding Our Transportation Infrastructure, 2013, http://www.spur.org/sites/default/files/publications_pdfs/SPUR_Rebuilding_Our_Transportation_Infrastructure.pdf

[104] The San Francisco Bay Area Water Emergency Transportation Authority (WETA) was established by SB 976 and replaced the WTA (Water Transit Authority). The intention of SB 976 is to improve the ability of ferries to respond in an emergency and to consolidate several regional ferry services.

[105] Measure A includes $30 million for "cost-effective ferry service to South San Francisco and Redwood City"; $8 million from this measure was used to develop the South San Francisco ferry service. See: http://www.smcta.com/Assets/SMCTA/Documents/2009-2033+Transportation+Expenditure+Plan.pdf

[106] WETA's System Expansion Policy defines conditions that warrant ferry services and anticipates a 10-year period for ridership to develop, during which operating subsidies should be available. See: http://sanfranciscobayferry.com/sites/default/files/weta/currentprojects/ProposedRoutes/SystemExpansionPolicy.pdf

[107] Development around ferry terminals is also a consideration. MTC's Resolution 3434 TOD expansion policy includes a discussion of ferry-oriented communities. See: http://ctod.org/pdfs/2005MTCTODPolicy.pdf

[108] MTC's Resolution 3434 Transit-Oriented Development policy, which conditions regional funding for transit expansions, includes a ridership threshold for ferries: minimum 750 housing units per ferry terminal station area.

[109] BART Sustainable Communities Operations Analysis, 2013, http://www.bart.gov/sites/default/files/docs/BART%20SCOA%20Final%20Report%20June%202013.pdf. See page 56.

[110] MTC is completing a need-based fare study, whose recommendations may be used to develop a regional need-based fare subsidy/pass program. If this program increases access to rail and bus transit on the Peninsula to those for whom cost is a barrier, that would help move the vision plan forward. For more information, see: http://mtc.ca.gov/our-work/plans-projects/other-plans/means-based-fare-study

[111] SBB Half-Fare Travel card, https://www.sbb.ch/en/travelcards-and-tickets/railpasses/half-fare-travelcard.html?WT.ac=keyvisual-hta-en

[112] Deutsche Bahn, Touch&Travel App, https://www.bahn.com/i/view/USA/en/prices/mobile/touch-and-travel.shtml

[113] See: Jeffrey Brown, Daniel Baldwin Hess and Donald Shoup, "Unlimited Access," Transportation 28, no. 3, 2001, pages 233-67, http://shoup.bol.ucla.edu/UnlimitedAccessUCLA.pdf; Cornelius Nuworsoo, Discounting Transit Passes, Access, 2005, http://www.uctc.net/access/26/Access%2026%20-%2005%20-%20Discounting%20Transit%20Passes.pdf

[114] Donald Chisholm, Coordination Without Hierarchy: Informal Structures in Multiorganizational Systems, University of California Press, 1992; TCRP Report 173: Improving Transit Integration Among Multiple Providers, Volume I: Transit Integration Manual, Transit Cooperative Research Program, 2014, http://www.trb.org/main/Blurbs/171934.aspx

[115] Bent Flyvbjerg, "What You Should Know About Megaprojects and Why: An Overview," Project Management Journal, 2014, pages 6-19, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2424835

[116] Transit Cooperative Research Program, TCRP Report 129: Local and Regional Funding Mechanisms for Public Transportation, 2009, http://www.trb.org/Publications/Blurbs/160356.aspx

[117] There is a state sales tax ceiling that applies to each of these three counties. Through state legislation, San Mateo County (and other counties) has received an exemption from the 2 percent cap on city and county sales taxes; increasing the local ceiling from 2 percent to 3 percent results in a 10.5 percent sales tax ceiling (the state sales tax is 7.5 percent).

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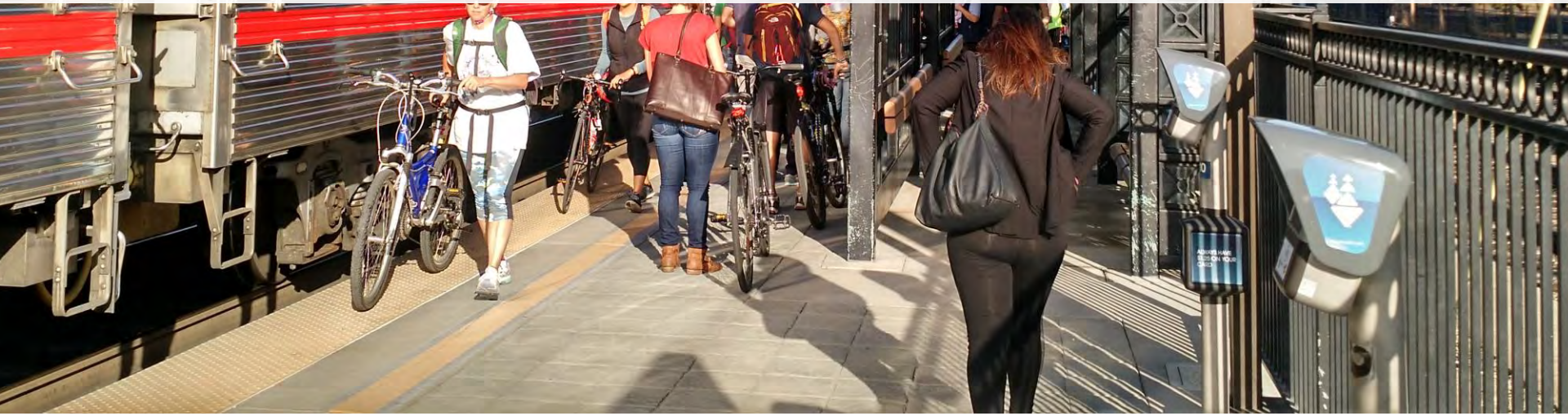
Attachment R

Rail Corridor Circulation Challenges

May 20, 2017



CITY OF PALO ALTO

Why Are We Here?

CITY OF PALO ALTO

CONNECTING PALO ALTO

DESIGNING OUR RAIL CORRIDOR FOR THE FUTURE

Rail Program Community Workshop #1

- Safety for all modes of transportation
- East/ west connectivity across the rail corridor
- Traffic disruptions
- Bicycle and pedestrian access
- Noise and visual impacts
- Future growth

CITY OF PALO ALTO

Regional Context – Santa Clara County

VTA Measure B

- $700 million for Grade Separation projects
- 8 projects in 3 cities in Santa Clara County:
  - Palo Alto
  - Mountain View
  - Sunnyvale
- Guidelines currently being drafted

CITY OF PALO ALTO

Regional Context – Caltrain Corridor

Grade Separation Projects Under Development

City	Project	Cost Estimate *
Mountain View	Castro/Moffet St	
Mountain View	Rengstorff Ave	$120M
Sunnyvale	Bernardo Ave	
Sunnyvale	Mary Ave	
Menlo Park	Ravenswood Ave	$140M-$380M
San Jose	Auzerais Ave	
Burlingame	Broadway	$250M
San Mateo	25th Ave	$180M

* Planning level cost estimates

CITY OF PALO ALTO

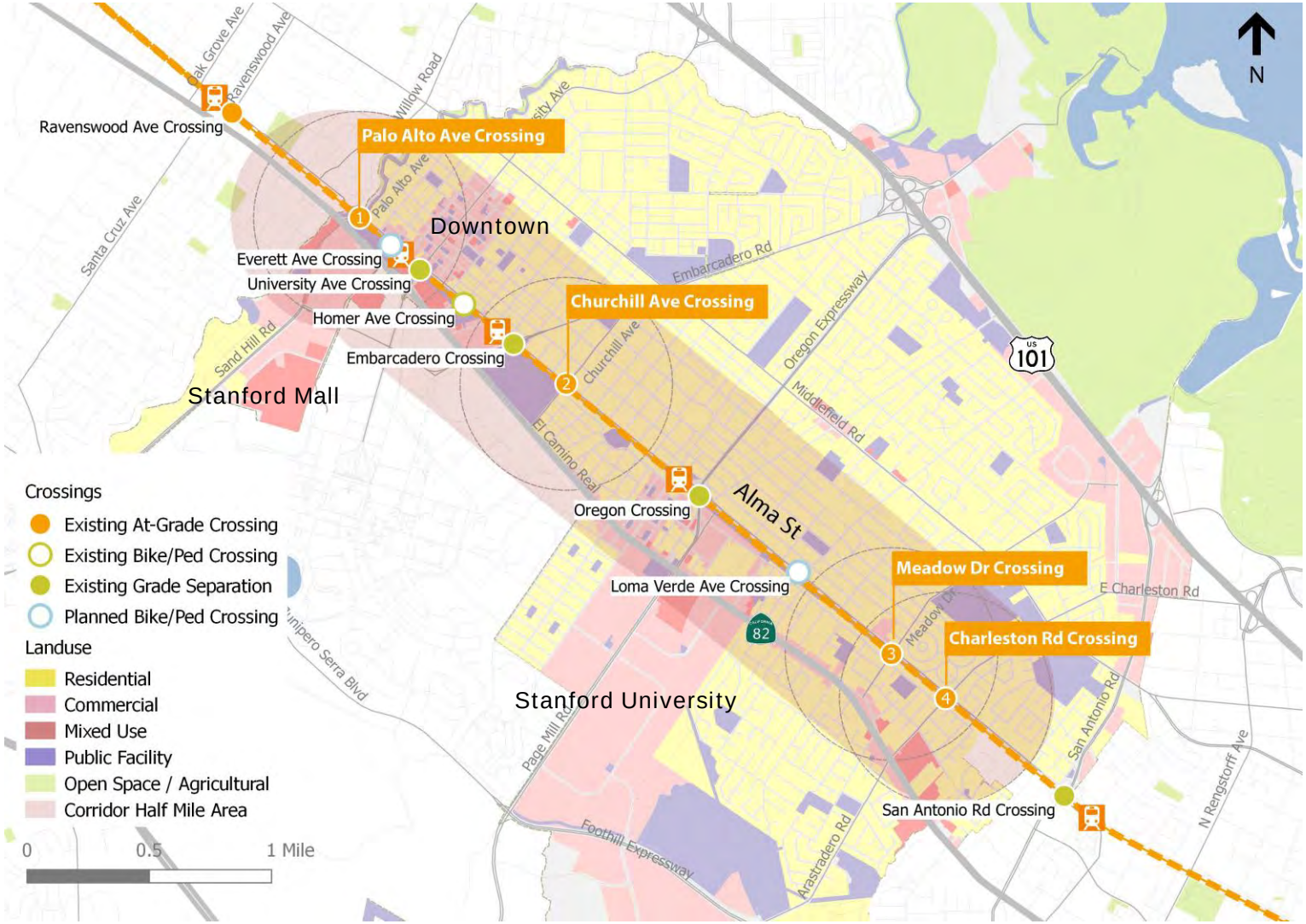
Previous Studies

- **Our Palo Alto 2030: Comprehensive Plan (2017)**
  - Currently being updated
  - Transportation Infrastructure Investments:
    - ✓ Full grade separations for automobiles, pedestrians, and bicyclists at Caltrain crossings
    - ✓ Retrofit / improvements to existing grade separated Caltrain crossings for pedestrians and bicyclists at California Ave and University Ave
    - ✓ Construction of new pedestrian and bicycle grade separated crossing of Caltrain in South Palo Alto and in North Palo Alto
- **Palo Alto Grade Separation and Trenching Study (2014)**
  - Conceptual engineering analyses for:
    - ✓ Undercrossing at Churchill Ave, Meadow Dr, and Charleston Rd
    - ✓ Rail trench under Meadow Dr and Charleston Rd

Previous Studies (continued)

- **Rail Corridor Plan in Palo Alto (2013)**
  - Recommended goals for inclusion in Comprehensive Plan Update:
    - ✓ **Goal 1**: Rail improvements should be constructed in a **below-grade trench**.
    - ✓ **Goal 2**: Ensure the **highest possible safety at all rail crossings** and mitigate rail impacts on neighborhoods, public facilities, schools and mixed-use centers.
    - ✓ **Goal 3**: **Connect the east and west portions** of the City through an improved circulation network that binds the City together in all directions.
    - ✓ **Goal 4**: **Provide improved access** to parks, recreation facilities and schools and assess future needs for these facilities.
    - ✓ **Goal 5**: Infrastructure should **keep pace with development**.

Study Area Map



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At-Grade Crossing Comparison

	Palo Alto Ave	Churchill Ave	Meadow Dr	Charleston St
Traffic ADT	14,700	11,400	9,300	16,000
Bicycle	550	1020	900	240
Pedestrian	300	270	180	140
Road Transit/Bus	33	7	11	45
School Bus	0	64	48	20
Heavy Truck	190	127	47	20
Gate Down (Secs)	43 (25-75)	39 (30-78)	39 (20-74)	40 (22-76)
Collisions (2011-13)	0	13	13	11
Max Queue (Veh per EB/WB)	11/21	20+/1	15/0	25+/0
Emergency Vehicle	15	30	18	8

CITY OF PALO ALTO

Circulation Issues - Safety

Collisions

- 37 auto collisions in 3 years
- 14 bicycle collisions in 5 years
- 3 pedestrian collisions in 5 years
- 6 bicycle collisions at Churchill in 5 years (among City's highest)

Emergency Access

- 70+ emergency vehicle trips cross per weekday

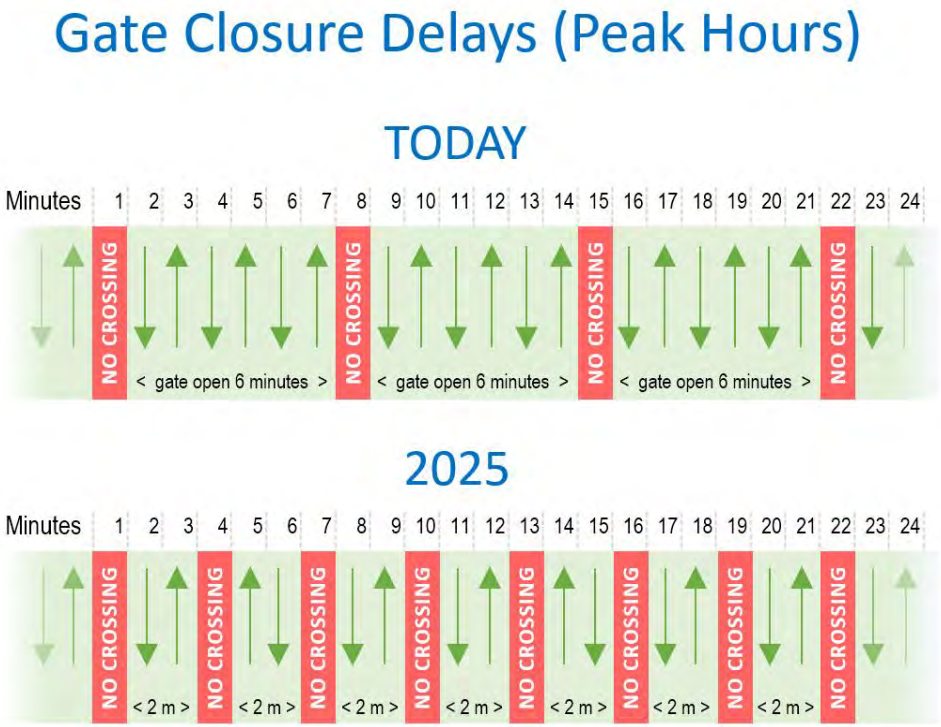
Suicides

- Caltrain suicides mostly take place between Burlingame & Sunnyvale
- 41% happen within 0.1 mile of a grade crossing

CITY OF PALO ALTO

Circulation Issues – Traffic

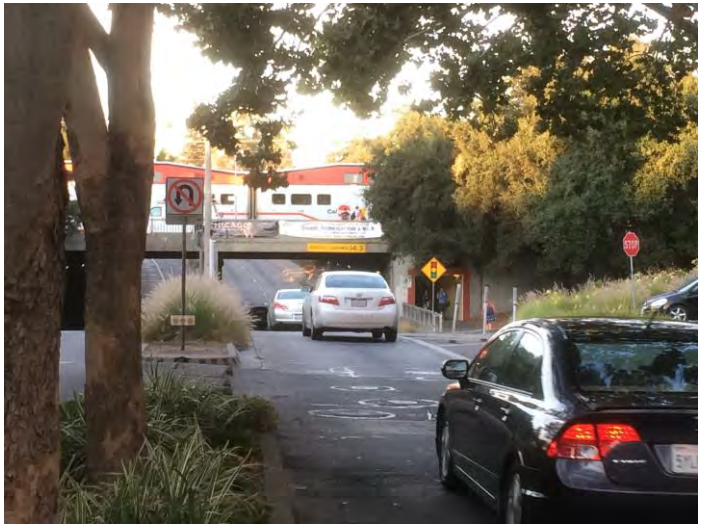
- Today, 8-10 trains/ peak hour/ both directions
- By 2025, **20 trains/ peak hour/ both directions**
- Currently, maximum queues reach 25+ vehicles
- Traffic capacity reductions caused by gate downtime will **more than triple**
- Over 51,000 vehicles use the at-grade crossings today during average weekday
- Traffic demand is likely to **grow at 1%+ per year**

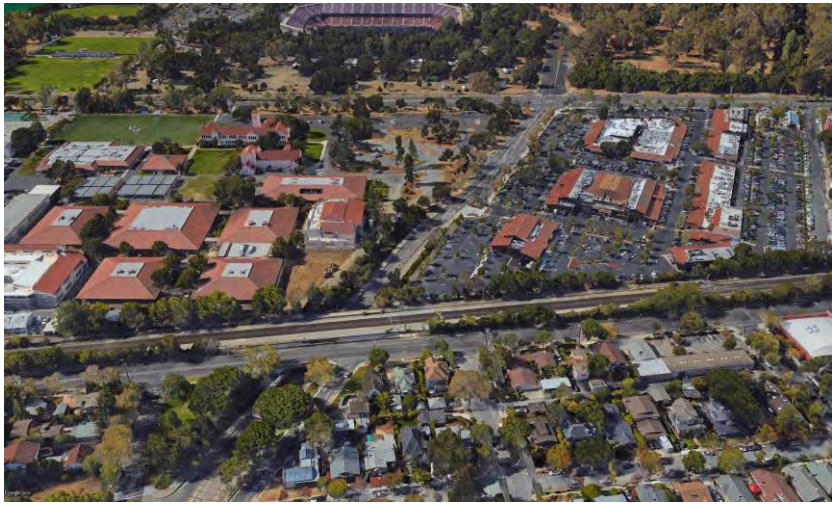


CITY OF PALO ALTO

Circulation Issues – Traffic

- There are **4 at-grade crossings** and **5 grade separations** (1 of them is bike/ped only) in Palo Alto
- Increased delays at grade crossings could **cause traffic to divert** to grade separated routes
- Newly grade separated routes could attract additional traffic
- Impact on changes to the crossing might affect more than immediate area





CITY OF PALO ALTO

Circulation Issues - Bicycle & Pedestrian Access

- Palo Alto is among the **most bike-friendly cities** in the U.S.
- **9% of commute trips** are by bicycle today; 15% by 2020
- **2,700+ bicycle trips** are made at the crossings every weekday; 4,500 by 2020
- 3 out of 4 at-grade crossings are within walking distance of a school
- **50% and 40% of students** (middle and high school) walk or bike to school
- **900 pedestrians** use at-grade crossings every weekday

CITY OF PALO ALTO

Circulation Issues – Noise & Visual Impacts

Noise

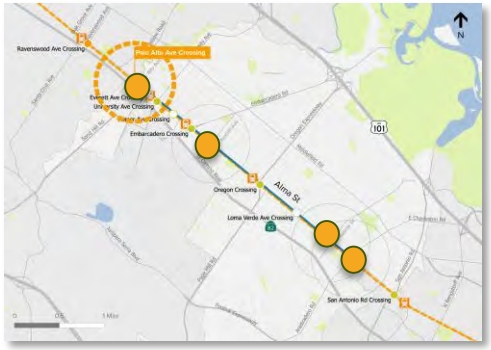
- Per Caltrain Modernization EIR process:
  - Palo Alto Mitigation Measure — not more than 36 dBA
  - Menlo Park & Mountain View Mitigation Measures— not more than 60 dBA
- Quiet Zones

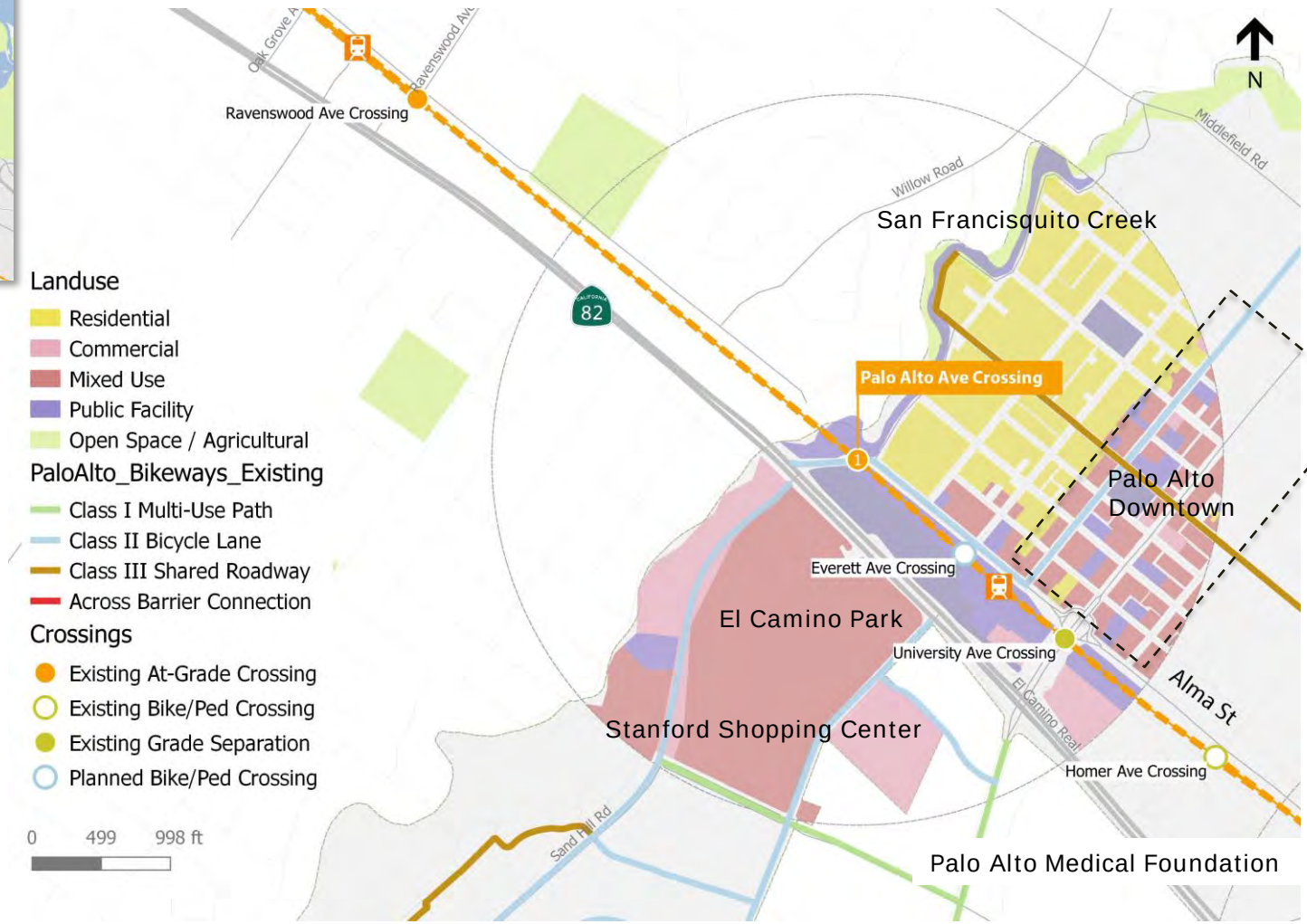
Physical Barrier Effect & Visual Impacts

- East-west accessibility is restricted by Caltrain right of way
- All 4 at-grade crossings have vehicle gates & pedestrian guardrails

CITY OF PALO ALTO

1. Palo Alto Ave (Alma St) Crossing





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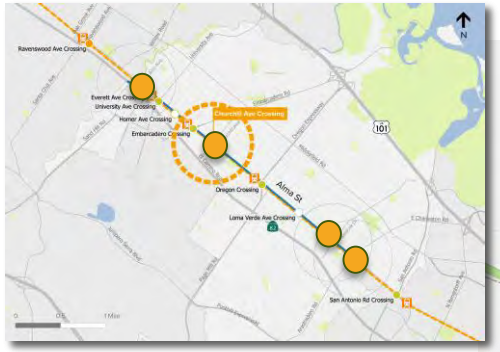
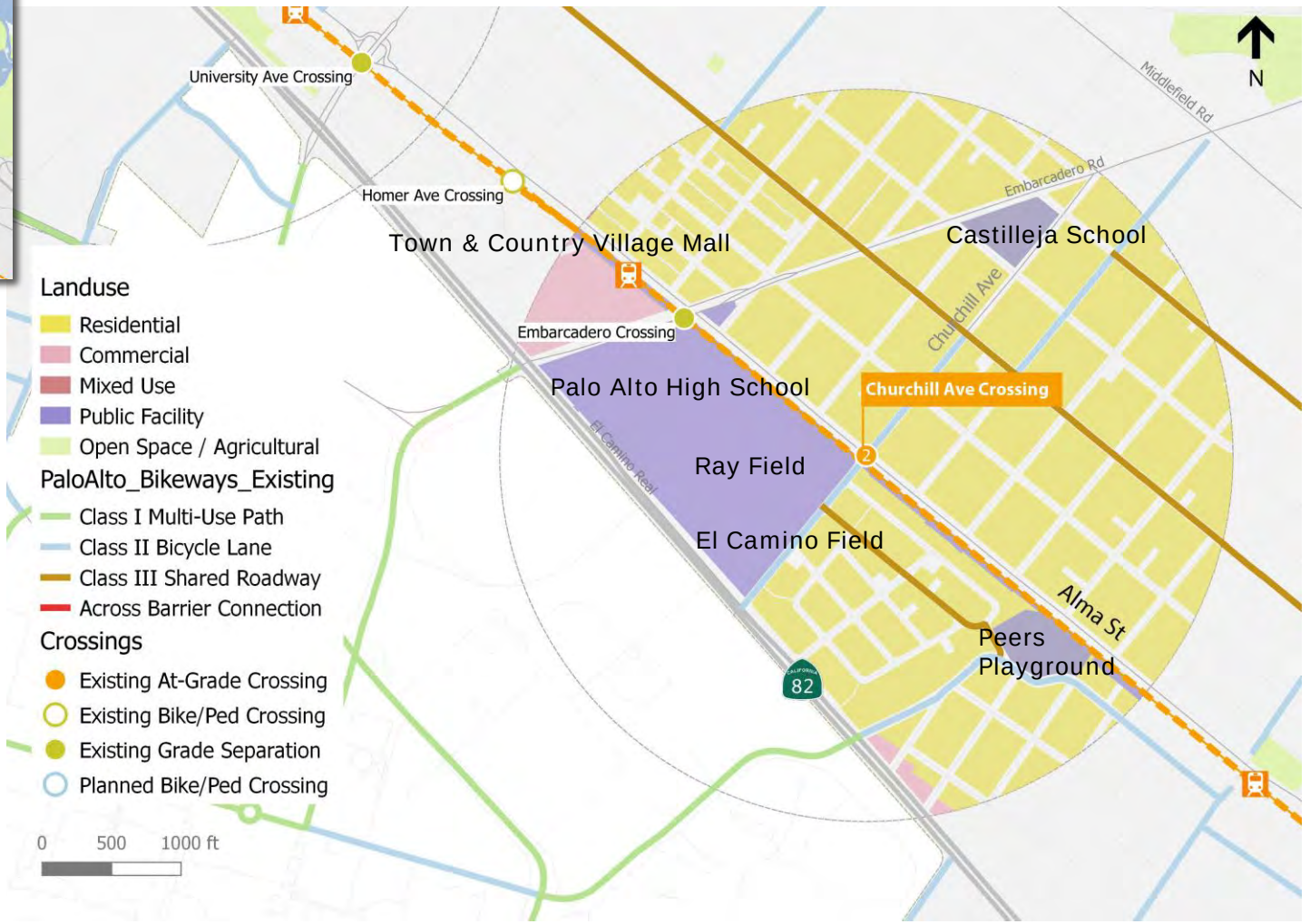
2. Churchill Ave & Alma St Crossing





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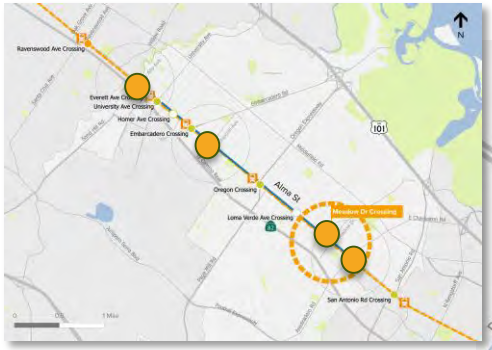
3. Meadow Dr & Alma St Crossing



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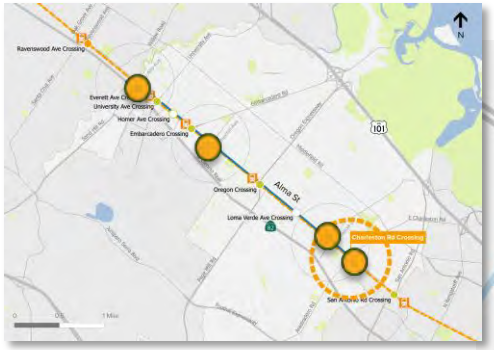
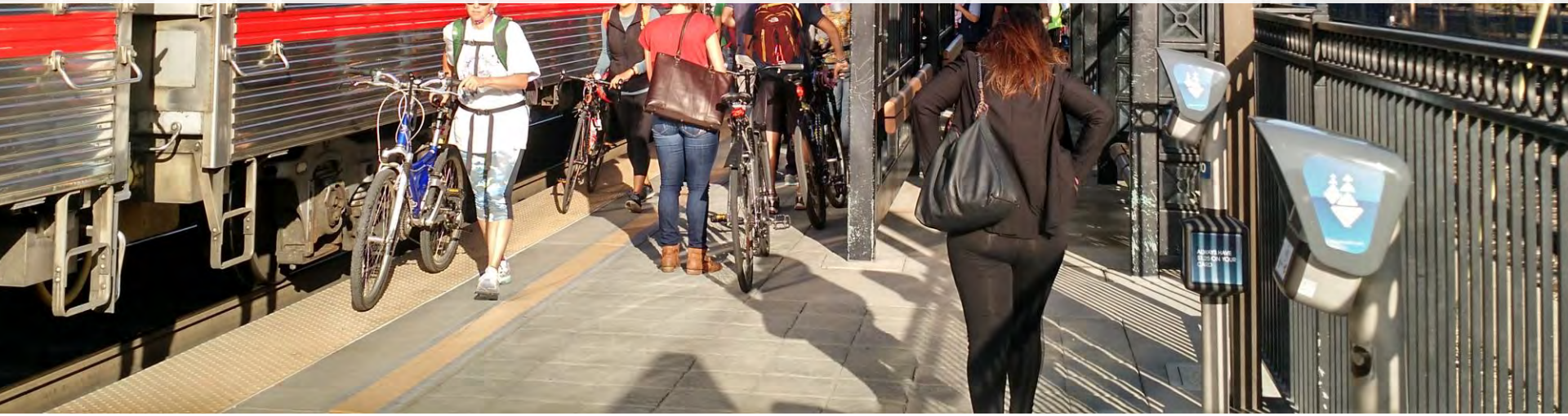
4. Charleston St & Alma St Crossing



CITY OF PALO ALTO

Rail Corridor Circulation Challenges

May 20, 2017



CITY OF PALO ALTO

Attachment S

Technical Memorandum

Date: November 13, 2017

To: Stephanie Strelow, Dudek

From: Gary Black, President, and Jane Clayton, Associate

Subject: Review of Stanford 2018 General Use Permit Draft Environmental Impact Report on Behalf of the City of Palo Alto

---

Hexagon Transportation Consultants, Inc. has reviewed the Draft Environmental Impact Report (DEIR) and the supporting Transportation Impact Analysis prepared for the 2018 General Use Permit (GUP) application filed by Stanford University with the Santa Clara County Planning Office. In order to prepare this letter, we have also reviewed the Project Description and Background Conditions Report included in the 2018 GUP application, the 2015 and 2016 *Stanford University Traffic Monitoring Reports*, and comments made at meetings of the Planning and Transportation Commission (8/30/17 and 11/8/2017) and the City Council (10/16/17). We have conducted this review at the request of the City of Palo Alto and have paid particular attention to the areas included in the City's comment letter for the Notice of Preparation (NOP) related to transportation and circulation. We have also reviewed all of the transportation-related impact findings and the proposed mitigation measures for their adequacy.

The development proposed in Stanford's 2018 GUP application includes 2.275 million square feet of academic and academic support space, 3,150 dwelling units or beds (of which 550 units may be used by faculty, staff, post-doctoral fellows, or medical residents), 40,000 square feet of space for child care centers and facilities for the university's commute alternatives program, and a parking supply reserve of 2,000 spaces. Stanford proposes continuation of the "no net new commute trips" goal included in the 2000 GUP, which is defined as no additional trips above a measured base level during the peak commute time in the campus commute direction (inbound towards campus in the AM peak hour and outbound from campus in the PM peak hour).

Key Areas of Concern

The "No Net New Trips" Goal: Methodology and Feasibility

The 2000 GUP Condition G.4 defines the "no net new trips" goal as "no increase in automobile trips during peak commute times in the peak direction, as counted at a defined cordon location around the campus." That condition also states:

DRAFT

> "Stanford shall mitigate the transportation impacts of its additional development and population growth either through a program of 'no net new commute trips' or through proportional funding of mitigation measures for specified impacted intersections."

Hexagon has concerns about the "no net new trips" policy as it is currently defined. The three key areas of concern are the definitions of the peak periods to be monitored, the direction of travel to be monitored, and the unlimited use of trip credits to meet the goal. The DEIR invokes the "no net new trips" policy as mitigation for potential impacts. However, Hexagon is concerned that the policy overlooks the following traffic issues.

Lengthening of Peak Period and Definition of Peak Hours: Although AECOM gathers 24-hour cordon count data for 8 weeks every year, the analysis of data to determine whether Stanford has met the "no net new trips" standard is currently limited to the hours of 7:00 – 9:00 AM and 4:00 – 6:00 PM. There is abundant evidence throughout the Bay Area that these traditional peak periods have lengthened, and, in fact, the traffic counts conducted at study intersections for this DEIR were conducted during the hours of 7:00 – 10:00 AM and 4:00 – 7:00 PM. In its NOP letter, the City specifically requested that the EIR identify the peak travel periods for the campus using these 24-hour cordon counts, but this was not done. At a minimum, the peak periods used for monitoring cordon counts should be consistent with the peak periods used for the intersection counts conducted for the DEIR (7:00 – 10:00 AM and 4:00 -7:00 PM).

Hexagon's spot review of the raw cordon count data in the 2015 and 2016 *Stanford University Traffic Monitoring Reports* indicates that the AM peak hour frequently occurs after the 7:00 – 9:00 AM period. Similarly, the PM peak hour frequently occurs after the 4:00 – 6:00 PM period. However, for the purposes of determining whether Stanford has met the goal, any peak hour volume that does not occur during those defined two-hour periods is ignored. The interpretation of "peak commute time" in the goal should be modified for the 2018 GUP so that if, for example, the greatest volume of vehicle trips in the evening occurs between 5:30 - 6:30 PM, then that is the volume that should be used as the basis for monitoring whether or not Stanford has met the standard.

One of the likely reasons why there appears to be a disconnect between Stanford's achievement of the "no net new trips" standard and the community's experience of increasing levels of congestion may be that there are higher levels of Stanford-related trips throughout the day or during much longer periods during the morning and evening than was true in 2001. Therefore, it is critical that a fresh analysis of the peak periods of travel to and from the campus be conducted and that recommendations for future cordon counts be based on that analysis.

Direction of Travel: The "no net new trips" standard currently applies only to the peak direction of travel: inbound towards campus in the AM peak hour and outbound from campus in the PM peak hour. As the university constructs more on-campus housing for students, faculty, and staff, the volume of traffic in the "counter-commute" direction will also increase. Figure 4 of Part 1 of the TIA

DRAFT

shows the change in proportion of resident and non-resident peak hour trips between 2015 and 2035, indicating that resident trips are projected to be a larger percentage of total trips in the future.

Under the 2018 GUP proposal, the volume of "counter-commute" travel could increase substantially, but Stanford would still be deemed to meet its goal as long as the "commute" direction did not increase (or was offset by trip credits). In its NOP letter, Palo Alto requested that the DEIR include an analysis of direction of travel, but this was not done.

Even if Stanford meets the "no net new trips" standard as it is currently written, it would be possible for the development proposed in the 2018 GUP to have intersection impacts that should be mitigated. The DEIR overlooks the possibility that intersection impacts may result from vehicle trips in the other direction (outbound from campus in the morning and inbound in the evening). The EIR should address this issue and propose a means of mitigating any impacts that may be caused by increases in traffic leaving campus in the morning and entering campus in the evening.

Trip Credits: The 2000 GUP specifies that the County will recognize participation by Stanford in off-campus trip reduction efforts and credit reduced trips toward attainment of the goal. Stanford has not met the PM peak hour 2001 cordon count threshold (3,591 trips) in certain years, but has been able to meet the "no net new trips" standard by taking credit for its off-campus trip reduction efforts within a defined geographic boundary (the cordon credit area).

Stanford could continue to increase the number of trip credits it claims in the future as a way of dealing with rising cordon counts through the life of the 2018 GUP. The fact that in 2015 Stanford claimed 844 trip credits, equal to 23.5% of the 2001 "trigger" value for the PM peak hour, raises a question as to whether there should be a limit or cap placed on the percentage of trip credits that may be taken during the life of the 2018 GUP in order to meet the standard. For example, Stanford proposes to take trip credits every year after providing funding for bicycle facility improvements in Palo Alto and neighboring jurisdictions (in Chapter 8 of the DEIR).

This concern is heightened by the large number of potential problems concerning the trip credit methodology that were raised in the *2016 Stanford University Traffic Monitoring Report.* No fewer than nine issues have been raised by the consultant preparing the report for the County. Hexagon believes these issues should be addressed and resolved as part of the EIR process since they are central to the "no net new trips" methodology. Hexagon also believes that trip credits should only be granted for actual trip reductions, not predicted reductions.

Hexagon notes that the monitoring reports do not provide any information on the various measures for which credits have been claimed each year, only the total number of credits claimed. In its NOP letter, Palo Alto requested greater transparency in the cordon count and trip credit reporting.

Feasibility of Mode Split Required to Meet Standard: On page 5.15-156 of the DEIR, the drive-alone mode share is given as 43.2% in 2015, which would need to be reduced to 36.5% to meet the "no net

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new trips" standard for the 2018 GUP development (assuming no trip credits are taken).[1] The University has been successful in reducing single-occupant trips to levels much lower than the County average. However, the TIA (Figure 2 of Part 1) indicates that SOV mode share is approximately 50% and has been flattening out in recent years, indicating that additional reductions may be difficult to achieve. Given the environmental characteristics of the commute shed of Stanford affiliates, such as land use density, transit availability, and other factors, it is likely to be challenging to reduce that mode share by an additional 6.7%.

The TIA (Part 1, pp. 10-11) includes the following strategies expanding Stanford's TDM programs in order to meet the "no net new trips" standard under the 2018 GUP:

- Commuter buses
- Expand local bus service and first/last mile connections (Marguerite shuttle)
- Improve key bike facilities to reduce road stress for cyclists on access routes to campus
- Parking fees and policies
- Student vehicle prohibitions

However, it is an exceedingly ambitious goal to construct 2.275 million square feet of academic and academic support space and 3,150 new beds/units and to not increase peak hour vehicle volumes at all. After many years of a highly successful TDM program, all of the "low-hanging fruit" is gone, and it may prove difficult to persuade many of the remaining SOV drivers to change modes. Stanford should explore what it will take to achieve a 36.5% SOV mode share (no net new trips) with real-world examples.

If the "no net new trips" standard is not met under the 2018 GUP, then Stanford has proposed that it be "given the option of achieving No Net New Commute Trips by funding other entities' trip reduction programs before applying such funds to its proportionate share of intersection improvements." Ways in which the funding provided could be programmed as consistently over multi-year periods as possible should be explored, rather than on an annual basis with large dollar amounts in some years and no funding at all in other years, depending on the preceding year's monitoring report. Successful trip reduction programs require consistent funding to be most effective.

2015 Cordon Counts and the 2018 GUP Trip Generation Rate

The trip generation rates for the new development proposed in the 2018 GUP are based entirely on the 2015 cordon counts conducted as part of the County's annual monitoring process regarding the "no net new trips" standard. To the extent that the 2015 cordon counts do not accurately capture the number of vehicle trips generated by the campus during the AM and PM commute times, the trip generation estimates for the proposed growth will be correspondingly underestimated, which should be corrected in the Final EIR.

[1] The TIA indicates that the drive-alone mode share was approximately 50% in 2015. The Background Conditions Report also states that the drive-alone rate is 50% (page 4.47) The difference between the two percentages given for the 2015 drive-alone mode share (43.2% and 50%) should be explained.

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Identification of "AM peak hour" and "PM peak hour": As discussed above, the number of peak hour trips presented in the 2015 *Stanford University Traffic Monitoring Reports* is the peak hour volume during the periods of 7:00 – 9:00 AM and 4:00 – 6:00 PM. However, due to the lengthening of peak commute periods throughout the region and the widespread use of flextime schedules, the peak traffic volume within that window of time may not actually be the peak traffic volume if a longer or different peak period were considered. The DEIR did not address the issue of changes in the peak commute times, even though the City requested such an analysis and it is key to the trip generation estimates used in the DEIR; this should be considered in the Final EIR.

"Hidden" vehicle trips: The 2015 cordon counts may also underestimate Stanford's existing trip generation if there are vehicle trips that are not counted. The City's NOP letter asked the DEIR to study the extent to which Stanford commuters are avoiding cordon counts by parking on local streets in adjacent city neighborhoods. The DEIR addresses this concern on page 5.15-176, and Figure 5.15-21 shows that there are Residential Parking Permit programs in place in all the Palo Alto residential neighborhoods adjacent to campus. However, two of these programs did not exist when the 2015 cordon counts were conducted (Evergreen Park – Mayfield and Southgate). The DEIR should have included some estimate of off-campus parking.

The DEIR also notes that there is very little on-street parking that is not time-restricted adjacent to campus, with the exception of approximately 150 parking spaces on the Stanford side of El Camino Real. The DEIR states that:

> "These on-street spaces are essentially filled before the traditional peak hour of 8:00 – 9:00 AM. Thus, drivers using these spaces are not traveling during the peak hour, and therefore are not parking in this location to avoid cordon counts."

Since the cordon counts begin at 7:00 AM, the fact that these spaces are filled by 8:00 does not mean these drivers aren't avoiding cordon counts. As noted above, Hexagon suggests that the cordon counts be re-evaluated to determine the actual peak hour, and these spaces should be included.

Another potential issue with the 2015 cordon counts is related to the exclusion of vehicles that enter campus and then leave it within 15 minutes, because they are considered cut-through traffic that is not generated by Stanford. Because of this, if a Stanford affiliate is dropped off or picked up on campus, the vehicle that enters campus to drop them off in the morning or leaves campus after picking them up in the evening is excluded from the cordon count, even though that trip is clearly a Stanford-generated trip. An evaluation of the cordon locations where a vehicle entered and where it exited campus would help identify some of these trips and distinguish them from actual cut-through trips. The Final EIR should account for this issue.

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Analysis of Transit Capacity and Performance

The City's NOP letter requested that the DEIR evaluate transit performance and efficiency as it relates to site design, mobility, and access. A map showing transit priority areas for nearby transit agencies (Figure 5.15-10) and a map showing areas within a 5-minute walkshed of Marguerite stops with headways of 15 minutes or less (Figure 5.15-22) were included, but they do not show the location within the 2018 GUP area of key points of development proposed in the 2018 GUP. The EIR should include further discussion about optimal land use and site design to support an effective and efficient transit system on campus.

The City's NOP letter also requested that the demand, capacity, and utilization of Caltrain, connecting transit services at the Palo Alto Intermodal Transit Center (PAITC), and the PAITC itself be studied. The DEIR does not include a capacity assessment of the PAITC at all, including its bus bays, layover facilities, and the operational impacts of an expanded Marguerite service on other transit providers, which should be addressed in the Final EIR.

The capacity analysis of Caltrain includes a key assumption that the trains will include eight cars by 2035, rather than the current five cars. The Caltrain electrification/modernization project now underway does not include funding for extending platforms so that 8-car trains could be utilized. To make the capacity analysis consistent with the electrification project, it should not be assumed that the infrastructure improvements necessary to run 8-car trains will be operational by 2035. If train capacity were constrained by the existing 5-car maximum, then there would be a significant impact to this transit service. Hexagon suggests that an appropriate mitigation measure would be to make a fair share contribution to the platform retrofit needed at the PAITC to permit lower level boarding, which would speed up dwell time.

The DEIR asserts that transit capacity is not a potential impact under CEQA, but we disagree. Since a project can be found to cause a significant impact to transit if an element of it would conflict with an adopted policy regarding public transit or decrease the performance or safety of transit facilities, then operating extremely crowded trains would qualify as conflicting with an adopted policy and as reducing the performance of the service from the rider's point of view. Transit services generally have adopted policies or standards regarding load factor (how many riders they can accommodate per bus or per car). If a load factor is exceeded by a large amount, then the service is no longer comfortable or convenient. Such a load factor would clearly also have secondary impacts on mode choice.

Aside from how the issue is treated under CEQA, there is also a basic operational issue that relates to Stanford's ability to achieve the "no net new trips" standard. If achieving the standard would require an increase in the transit mode share, as conservatively assumed by the DEIR analysis, but the capacity is simply not available on the trains to handle the increased ridership, then the standard would probably not be achieved. This could be the case if the assumption regarding 8-car trains is changed to 5-car trains. The analysis should be re-assessed in light of these considerations in the Final EIR.

Requested Parking Reserve of 2,000 Spaces

Stanford has requested approval of a 2,000 space parking supply reserve, for which it does not seek initial authorization because it seeks to discourage automobile ownership and use. However, Stanford

proposes that it be able to seek Planning Commission approval to construct parking spaces from that reserve under any of three defined circumstances.

One of the proposed circumstances for increasing the parking supply is meeting the "no net new trips" standard. There is an obvious contradiction here: if Stanford is meeting the standard, why would it need up to 2,000 additional parking spaces? Clearly, additional parking supply would make it increasingly difficult to meet the standard in the future.

There are two obvious ways in which Stanford could meet the "no net new trips" standard and yet still need 2,000 more parking spaces by 2035. One is that the standard can now be met through an unlimited use of trip credits. Stanford could meet the standard through services and facilities that reduce SOV trips off-campus, but still need additional parking for new trips to campus generated by the development proposed in the 2018 GUP. The second relates to the lengthening of the peak period. If an increasing number of trips are made outside the peak periods as they are defined (7:00 – 9:00 AM and 4:00 – 6:00 PM) under the 2000 GUP or if the trips made in a single peak hour no longer represent as large a percentage of daily traffic as has been true historically (because traffic is more evenly spread over a much longer period of time), then Stanford would need additional parking to accommodate those trips – even though the standard, as currently monitored, has been met. The EIR should address this issue directly and define a more stringent qualifying circumstance for purposes of allowing construction of 2,000 more parking spaces or eliminate this circumstance from the request.

Review of Impacts and Mitigation Measures

Hexagon evaluated all transportation-related impact findings in the DEIR to determine their adequacy. The DEIR's analysis of every study intersection was reviewed carefully, to ensure that all potential mitigation measures at impacted intersections were included. The following sections address each impact evaluation about which Hexagon has comments or questions. Impact discussions – and specific intersection impacts – about which Hexagon has no comments or questions are not included.

Level of Service Threshold for Unsignalized Intersections

***DEIR*:** The DEIR states on page 5.15-57 that "None of the applicable jurisdictions have an officially adopted significance criterion for unsignalized intersections. For purposes of this analysis, significant impacts are defined to occur when the addition of project traffic causes:

- The average intersection delay for all-way stop-controlled intersections or the worst movement for side-street stop-controlled intersections to degrade to LOS F, and
- The peak hour traffic signal warrant from the California Manual of Uniform Traffic Control Devices (CA MUTCD) to be satisfied at an unsignalized intersection already operating at LOS F."

Hexagon Comments: The City's threshold for non-CMP signalized intersections is LOS D, and the City's practice has been to apply that threshold to unsignalized intersections as well. The significance criteria

for impacts at unsignalized intersections have been cited in several TIAs in recent years as when the project causes a movement to degrade to LOS E or F and the peak hour signal warrant is met. This Issue concerning Palo Alto's impact criteria is relevant to the unsignalized study intersection of Bowdoin Street / Stanford Avenue in the DEIR, which is discussed further below.

The following section addresses all of the study intersections within Palo Alto where a significant impact was found and where Hexagon had comments, plus the intersections of I-280 Southbound Off-Ramp/Page Mill Road, I-280 Northbound Off-Ramp/Page Mill Road, and Bowdoin Street/Stanford Avenue.

Intersection Impacts (2018 and 2035 Conditions)

I-280 Southbound Off-Ramp and Page Mill Road (#13)

***DEIR*:** Proposed mitigation measure for 2018 impact is "Contribute fair share funding toward the installation of a traffic signal." However, on page 5.15-92, the DEIR references the *Page Mill Expressway Corridor Study Report* and notes that the improvement concept is for this intersection is "a roundabout, with traffic signal at the I-280 NB Ramps intersection, and a third eastbound and westbound through lane on Page Mill Road to the east of the I-280 Northbound Ramps intersection." The DEIR says the Project's fair-share funding towards a traffic signal at this intersection "may be applied toward a roundabout."

Hexagon Comments: Stanford should contribute its fair share of the roundabout and other improvements that have been agreed upon by the three agencies (Santa Clara County, City of Palo Alto, and Town of Los Altos Hills) for this intersection. Providing fair share funding towards a traffic signal is insufficient, since that is not the intersection modification that has been agreed upon.

The DEIR does not find an impact at this intersection under 2035 conditions. The LOS calculation sheets in Appendix F of the TIA indicate that a traffic signal is assumed at this intersection under 2035 conditions, even though Appendix E of the TIA indicates that the lane configuration and traffic control (all-way stop control) are the same as under 2018 conditions. All changes in roadway network assumptions should be stated clearly in the text of the report, and all tables and figures should be consistent with any noted changes.

The intersection should be evaluated under 2035 conditions with all-way stop control and with a roundabout, not with a traffic signal, since the timing of the roundabout construction is uncertain.

I-280 Northbound Off-Ramp and Page Mill Road (#14)

***DEIR*:** No impact is found at this unsignalized intersection under 2018 or 2035 conditions. Under 2018 conditions, the intersection operates at LOS E both with and without the project, and the increased delay is one second. Because signal warrant analyses were only conducted for unsignalized intersections operating at LOS F, no signal warrant analysis is included in Appendix G of the TIA.

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For the 2035 evaluation, Appendix E of the TIA shows no change to the lane configuration or traffic control at this intersection, although the LOS calculation worksheets indicate that a traffic signal is assumed under 2035 conditions.

Hexagon Comments: In general, any changes in the roadway network (lane configurations, traffic controls, signal phasing, etc.) between 2015 and 2018 or between 2018 and 2035 should be clearly stated in the TIA and the DEIR and all appendices should be consistent.

Because the intersection is already operating at LOS E during the AM peak hour and the increase in delay on the stop-controlled approach is only one second, there would not be a significant impact even if the more stringent LOS D standard were used for unsignalized intersections.

Junipero Serra Blvd – Foothill Expressway and Page Mill Road (#17)

***DEIR*:** The proposed mitigation measure at this intersection for both the 2018 and 2035 impacts is "Contribute fair share funding toward installation of an overlap signal phase for northbound and southbound right-turning vehicles and widening of southbound Junipero Serra to two lanes between Stanford Avenue and Page Mill Road to align with the existing designated right-turn lane." The text on page 5.15-92 notes that this would allow southbound right-turning vehicles additional queuing space so southbound through vehicles do not block the right-turn lane. Under 2018 conditions, there would still be a significant and unavoidable impact even with this mitigation measure, although under 2035 conditions, this measure was found to reduce the impact to a less-than-significant level.

Hexagon Comments: The mitigation measure proposed is reasonable, but ignores the other changes that have been proposed for this intersection. The *Page Mill Expressway Corridor Study Report* recommends the addition of a third eastbound and westbound through lane on Page Mill Road between the I-280 interchange and Porter Drive (just east of Page Mill Road), as noted on Page 5.15-124 of the DEIR. Measure B does not provide sufficient funding for the entire Page Mill corridor project, including modifications to this intersection, so it would be reasonable for Stanford to make a fair share contribution to it. Because the DEIR's proposed mitigation does not fully mitigate the Project's impact at this intersection, a fair-share contribution to the Page Mill widening (possibly HOV lanes) at this intersection should also be included in the mitigation measure, in addition to the proposed changes to the Junipero Serra approach.

Bowdoin Street and Stanford Avenue (#34)

***DEIR*:** No impact is found at this unsignalized intersection under 2018 or 2035 conditions. Under 2035 conditions, the intersection operates at LOS D without the project and at LOS E with the project during the PM peak hour. Because signal warrant analyses were only conducted for unsignalized intersections operating at LOS F, no signal warrant analysis is included in Appendix G of the TIA.

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Hexagon Comments: As noted previously, the City's practice has been to use LOS D as the impact threshold for unsignalized intersections, even though there is no formal policy statement regarding unsignalized intersection impact criteria. If a more stringent LOS D threshold were to be used and if the peak hour signal warrant were met, then the project would result in a significant impact at this intersection. The Final EIR should include signal warrant analyses on Palo Alto unsignalized study intersections operating at LOS E.

If the finding of no significant impact were to be changed to a finding of significant impact (based on LOS E in the PM peak hour and a signal warrant analysis), installing a traffic signal at this location would not be recommended as a mitigation measure, due to its fairly close spacing with other signalized intersections on Stanford Avenue, at Peter Coutts Road and at Hanover Street. The City's preferred approach to this intersection would be a roundabout or a treatment other than a signal at this location.

El Camino Real and Embarcadero Road (#48)

***DEIR*:** Significant impact found in 2035, but not 2018. Proposed mitigation measure is "Contribute fair-share funding toward the addition of a second northbound left-turn lane." Page 5.15-131 of the DEIR notes that VTA's Bus Rapid Transit (BRT) project has proposed a separate bus lane on El Camino Real, but not through this intersection. The DEIR concludes that it is not possible to determine what, if any, effect this mitigation measure would have on the BRT since there is no final design available.

Hexagon Comments: As part of the Preferred Scenario selected for Palo Alto's Comprehensive Plan Update, queue jump lanes (not exclusive bus lanes) in the curbside lane have been proposed for transit on El Camino Real. Is there be adequate right-of-way for both an additional northbound left-turn lane and queue jump lanes? Would it be possible to implement both? The DEIR notes that the City is "currently designing bicycle improvements at this intersection."

Alma Street and Charleston Road (#58)

***DEIR*:** Significant impact found under both 2018 and 2035 conditions. Proposed mitigation is "Contribute fair-share funding toward the addition of a designated northbound right-turn lane and installation of an overlap phase for the northbound and southbound right-turn movements." The impact would remain significant and unavoidable after implementation of this mitigation.

Hexagon Comments: As part of the Preferred Scenario selected for Palo Alto's Comprehensive Plan Update, grade separation between Charleston Road and the Caltrain tracks has been proposed. Because the DEIR's proposed mitigation does not fully mitigate the Project's impact at this intersection, a fair-share contribution to the grade separation project should also be included in the mitigation measure.

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Freeway Impacts (2018 and 2035 Conditions)

***DEIR*:** The DEIR states that the project would result in significant and unavoidable impacts on four freeway segments under 2018 conditions and on 11 freeway segments under 2035 conditions. The impacted segments are on SR 85 and I-280. No specific mitigation measure is proposed, although it is noted that to the extent that vehicle trips are reduced to achieve the "no net new trips" standard and through applying any fees from exceeding the standard to alternative programs that reduce vehicle trips, the project's contribution to freeway congestion would also be reduced.

Hexagon Comments: The freeway segment analysis does not follow the methodology set forth in VTA's *TIA Guidelines* or in C/CAG's guidelines. According to VTA's *TIA Guidelines* (page 44), a freeway segment is said to have an impact if the level of service falls from LOS E or better to LOS F. If the segment is already operating at LOS F, then a project has an impact if the number of new trips added by the project is more than 1% of the freeway capacity.

Instead of referring to the level of service on the study freeway segments, the DEIR uses volume-to-capacity ratios (v/c) for both the 2018 and 2035 conditions. The TIA states there would be an impact if a project causes a freeway's v/c ratio to increase from less than or equal to 1.0 to greater than 1.0. If the segment is already operating at a v/c ratio greater than 1.0, then there would be an impact if the number of new trips added by the project is more than 1% of the freeway capacity. If the freeway evaluation used level of service instead of v/c ratio, there may be more freeway impacts than have been identified in the DEIR.

A few cities in Santa Clara County have identified contributions to regional freeway and transit facilities as mitigation measures for significant freeway impacts. VTA has developed a structure for a program of Voluntary Contributions to Transportation Improvements, which can be used by local agencies when preparing development agreements. The County has the opportunity to require such a contribution to regional facilities in its development agreement as an additional condition if the "no net new trips" goal is not achieved.

VTP 2040 includes four highway projects that are relevant to the impacted freeway segments on SR 85 and I-280 and could be considered as candidates for a fair-share funding contribution for the freeway impacts identified in the DEIR. A contribution to improvements at the Palo Alto Intermodal Transit Station would also be appropriate to consider.

Freeway Ramp Operations

***DEIR*:** The DEIR notes that ramp queuing is not considered an environmental impact, but rather an operational consideration that is managed over time by Caltrans and local jurisdictions. The ramp analysis is presented for information purposes only.

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In the text following the Existing, 2018, and 2035 off-ramp queuing evaluations, it is noted that the left-turn queue at the I-280/Page Mill Road southbound off-ramp would exceed the pocket storage length, but that the queue would be served within the total ramp storage and would not spillback into the freeway mainline.

Hexagon Comments: Regarding the I-280/Page Mill Road southbound off-ramp, the text is somewhat misleading. An extremely long exit lane is provided on I-280 for this off-ramp, and the queue extends a long way into that lane during the AM peak hour. Due to the length of that exit lane, it is true that through traffic is not blocked on the freeway, but the DEIR implies that there are no problems at this location since the "queue would be served within the total ramp storage." A more detailed description of existing and future conditions at this off-ramp is warranted. This off-ramp is analyzed as an all-way stop controlled intersection under 2035 conditions, even though the intersection analysis assumed the intersection would be signalized by 2035. As discussed above, the proposed improvement at this location is a roundabout.

Construction Impacts

***DEIR*:** The DEIR finds that construction traffic would cause a significant impact and that it would be reduced to a less-than-significant level with the proposed mitigation measure.

Hexagon Comments: The City has expressed concern about the difficulty that its emergency responders have in meeting their response time targets when there are frequent lane closures or roadway detours due to construction. A new system for emergency responders is being implemented that will identify the best route for responders to take, based on current information about the roadway network. The mitigation measure should be revised to require the University to inform the City of all roadway changes immediately, so that the system is kept current at all times.

Transit Impacts

***DEIR*:** The DEIR finds that the project would result in a less-than-significant impact on public transit based on (a) an analysis of transit delay and (b) the fact that "The proposed 2018 General Use Permit does not propose infrastructure changes outside the Project site and, thus, would not interfere with the ability of transit agencies to modify or expand service."

Hexagon Comments: The DEIR takes a very narrow view of whether the project would conflict with an adopted policy, plan, or program regarding public transit, or would otherwise decrease the performance or safety of such facilities. The DEIR does not present the analysis of transit capacity as part of the impact analysis, but addresses that topic separately. See comments regarding the transit capacity analysis of Caltrain under "Key Concerns" above.

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The City requested additional transit-related data and analysis in its NOP letter. Although some of the requested additional information regarding transit has been provided, the following requested items are not covered in the DEIR:

- Boardings, speed, and frequency of individual Marguerite lines;
- An evaluation of transit performance and efficiency as it relates to site design, mobility, and access;
- An assessment of the capacity, access, and operations of the Palo Alto Intermodal Transit Center (PAITC), including a capacity assessment of bus bays, layover facilities, and potential operating impacts to other transit providers using the PAITC, especially if Marguerite service is expanded.

The Final EIR should provide this requested additional data and analysis regarding services and facilities that serve Stanford-affiliated transit patrons.

Residential Streets

***DEIR*:** The DEIR finds that the project would not substantially increase intrusion by traffic in nearby neighborhoods and that there would be a less-than-significant impact. Traffic impacts on residential streets were estimated using the Traffic Infusion on Residential Environment (TIRE) methodology. The threshold for an increase in traffic that would be noticeable to residents is a 0.1 increase in the index. The analysis was conducted for the College Terrace and Crescent Park neighborhoods, and the minimum daily volume increase required to increase the Index by 0.1 was calculated for a few roadway segments.

Hexagon Comments: In general, the TIRE methodology is somewhat problematic in evaluating traffic diversion impacts for a number of reasons. One reason is that it is based on average daily traffic (ADT), not peak periods of traffic, and sometimes residents are most sensitive to increases in traffic during commute hours when diversions are most likely to occur. Hexagon acknowledges, however, that no other tools have been developed that are widely considered superior to the TIRE index. The TIRE index uses a logarithmic scale, such that as ADT increases, larger proportional increases in additional project-related traffic are required in order to result in an increase to the index.

The DEIR notes that "on a daily basis Hamilton Avenue (just west of Lincoln Avenue) carries about 16% of the combined volume (University Avenue plus Hamilton Avenue); however, between 4:00 – 7:00 PM, it carries about 67%." This clearly indicates that a large amount of traffic is already being diverted to Hamilton during the PM peak period. Because of that diversion, ADT is already higher than it otherwise would be on Hamilton. And, because of that higher ADT, the number of additional vehicle trips needed to trigger a 0.1 increase in the TIRE index is also much higher than the amount required to trigger a change on the streets evaluated in the College Terrace neighborhood. For example, Table 5.15-28, "Crescent Park Neighborhood TIRE Index Results," shows that 1,025 additional vehicles per

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day would be needed on Hamilton Avenue (between Hamilton Court and Lincoln Avenue) to increase the index by 0.1, given that the daily traffic volume is 3,700. In other words, ADT would have to increase by 28% to trigger a 0.1 increase in the TIRE index.

What this boils down to is that because Hamilton Avenue already experiences a large amount of diverted traffic, the additional diverted traffic resulting from the 2018 GUP development is insufficient to cause a significant impact under the TIRE methodology. In fact, even if the estimate of 121 project-generated trips on the above-referenced segment of Hamilton Avenue were doubled or tripled, it would be considered a less-than-significant impact, since it would still be well below the threshold of 1,025 trips. Although some residents may take issue with this finding, the DEIR applies the TIRE methodology correctly.

Emergency Access

***DEIR*:** The DEIR finds that the project would not result in inadequate emergency access. This finding is based on the fact that the proposed 2018 GUP "would not result in any infrastructure changes outside the project site, and thus would not create fixed physical barriers to, or impede, emergency access."

Hexagon Comments: The rationale for this finding refers only to infrastructure changes outside the project site, but the DEIR should also consider any changes on campus due to the 2018 GUP development that would impede emergency access. In its NOP letter, the City asked that the DEIR evaluate impacts to response times for fire, rescue, and emergency medical services. This is not provided in the transportation (or public service) sections of the DEIR, and should be addressed in the Final EIR.

Bicycle and Pedestrian Facilities

***DEIR*:** The DEIR states that the 2018 GUP would not result in a significant impact to bicycle and pedestrian facilities because it "would not result in any infrastructure changes outside the Project site and would [not] preclude implementation of planned bicycle or pedestrian facilities and, thus, would not create hazardous conditions where none exist today."

The DEIR used StreetScore, a proprietary methodology of Fehr & Peers, to evaluate Quality of Service (QOS) of bicycle and pedestrian facilities. The proposed intersection mitigation measures are evaluated for secondary impacts to bikes and pedestrians using StreetScore, and none were found to have a significant secondary impact.

Hexagon Comments: The StreetScore methodology used by Fehr & Peers is a newly developed tool and is not widely accepted as a standard evaluation tool in the traffic engineering community. Hexagon notes that the ratings do not seem to be that sensitive to lane geometry changes. In some cases, the rating given to bicycle or pedestrian facilities does not change at all as a result of the proposed mitigation measure. In other cases, adding a lane does not affect the Quality of Service because the intersection is already at the worst rating (4) and the mitigation measure is deemed to

"maintain but not exacerbate current uncomfortable conditions." This is the equivalent of saying that if an intersection is already at LOS F that additional trips can't make it worse – which is clearly not permitted under the intersection impact criteria. In such cases, the Final EIR should address ways in which the bicycle and/or pedestrian facilities can be modified to improve conditions for cyclists and pedestrians as well as motorists.

***DEIR*:** A bicycle capacity analysis of campus gateways was conducted (pp. 5.15-167 – 169), but not as part of the impact discussion. Peak hour bicycle volumes were converted into cyclists per minute to provide an indication of how intensely the campus gateways are being utilized. The analysis concluded that the anticipated growth in bicycle commuters under the 2018 GUP would not exceed capacity at these gateways.

Hexagon Comments: The City's NOP letter states that "the DEIR should identify critical intersections on bicycle routes that currently have inadequate integration of bicycle facilities and determine needed improvements." However, the DEIR does not address this. In addition to the gateway capacity analysis, the design of bicycle facilities and their integration with routes used by Stanford commuters should be addressed. For example, Embarcadero Road is a daunting corridor for cyclists, but the analysis just says there's adequate capacity at the gateway on Galvez Street south of Arboretum Road, which is on the campus. Other corridors may also have issues.

The Final EIR should address the access routes used by bicyclists, not just the campus gateways, and should expand the analysis to include safety, comfort and connectivity, as well as capacity. In order to meet the "no net new trips" goal, Stanford will need to further increase the bicycle mode share. One of the strategies put forth in the TIA for expanding the TDM program is to identify key improvements that would directly reduce the road stress for cyclists on access routes to campus, which should be included as part of the EIR.

***DEIR*:** Separate from the impact discussion (i.e., not offered as a mitigation measure), The DEIR notes that Stanford will provide improvements to bike and pedestrian facilities on unincorporated land near Escondido and Nixon schools.

Hexagon Comments: The list of potential improvements suggested on page 5.15-112 of the DEIR should be reviewed to confirm that they reflect the most recent ideas regarding needed improvements for Safe Routes to School for these schools. The University should continue to coordinate with the City and the Palo Alto Unified School District to define and implement improvements that reflect the most recent Safe Routes to School recommendations. In addition, because development on campus can result in large bursts of new school children as residential projects are completed, it's important that the University remain responsive when new demands for school travel are generated by new development. .

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***DEIR*:** Stanford also proposes in Chapter 8 of the DEIR to fund specified off-site bicycle improvements in Palo Alto, East Palo Alto, Menlo Park, and unincorporated San Mateo County. Stanford would apply for trip credits towards the "no net new trips" goal based on these bicycle facilities in all future years after the facilities are constructed. The proposal for Palo Alto is to connect existing facilities at Bol Park and the Stanford Perimeter Trail. "The improvements would be installed along Hanover Street, which would provide a continuous route through southern Palo Alto neighborhoods and the Stanford Research Park to the Stanford campus. (DEIR, p. 8-4)" Stanford would contribute up to $250,000 in funding towards the design and implementation of bicycle improvements in the Hanover Street corridor, "which is the full estimated cost of these improvements".

Hexagon Comments: The proposal to provide better connectivity between the Stanford Perimeter Trail and the Bol Park Path makes good sense, since the Bol Park Path is a heavily used facility and provides a route from campus to Terman Middle School and Gunn High School. However, the specific details of the improvements proposed in the DEIR have not been accepted by the City as the most critical modifications needed to improve this bike corridor. Further, some of the specific elements of this project, as listed on page 8-4 of DEIR, may already be covered by the recent agreement between the City and the County regarding improvements at the intersection of Hanover Street and Page Mill Road. Stanford representatives should coordinate with Palo Alto staff to better define this project and ensure that it does not include elements that are already covered by the $3.2 million agreement with the County but does include funding for elements that are still critically needed for upgrading this bikeway.

On-Campus Parking Supply and Off-Campus Restrictions

See comment under Key Concerns above.

***DEIR*:** Stanford wants to exclude parking spaces at EV charging stations from the count of parking spaces allowed under the 2018 GUP. The rationale is that these spaces require turnover, such that other spaces are needed for the same cars when they are not charging.

Hexagon Comments: Since the number of EV charging stations is likely to increase substantially by 2035 as EV ownership rates increase, this will not be a trivial number of parking spaces in the future. Signs at charging stations say that "Vehicles Must Be Actively Charging" to park in these spaces, but how is that enforced? If someone parks their car at an EV charging station and plugs it in, do enforcement staff look to see if it is actively charging? How long do people have after their car is charged to move it? In many public garages, it is common for EV drivers to leave their cars parked in the space all day long, even if it does not take all day to charge it.

DRAFT

Additional Comments

This section includes additional issues noticed by Hexagon and not addressed in any of the preceding sections.

2018 GUP, Background Conditions Report, page 4-58: Intersection improvements identified as mitigation measures for the 2000 GUP were divided into two tiers. A condition of the 2000 GUP "required Stanford to construct Tier 1 intersection improvements regardless of whether Stanford achieved the 'no net new trips' goal." A two-tier approach may also make sense for the 2018 GUP, with a condition of approval that requires a fair-share contribution towards improvements at the Palo Alto Intermodal Transit Station in order to accommodate 8-car trains for Caltrain service. The County could require such a contribution regardless of whether Stanford achieves the "no net new trips" goal because increased Caltrain capacity is so critical to further reductions to the SOV mode share and the projected increases in Caltrain ridership.

TIA, Part 1, Figure 5 , "Stanford University Employee Mode Share," provides information about the modes used by commuters coming from different geographic subareas. The information is extremely useful, but also raises questions about survey design and validation. For example, the figure shows a number of people walking from the North Bay (Marin, Napa, and Sonoma Counties). Stanford should continue to refine its survey process. Also, East Palo Alto is not identified in any of the geographic subareas. East Palo Alto should be identified on this figure and in Tables 7 and 8.

TIA, Part 1, Table 7, "Percent of Stanford Affiliates (Driving) by Geographic Area": The table indicates that Sunnyvale and Santa Clara are north of campus and would use Alpine Road and Sand Hill Road to access the campus from I-280. Was this error only made on the table or did the trip distribution and assignment actually incorporate this error?

TIA, Part 2, pages 103-104: The TIA states that "adjustments were made to the survey data to account for a known bias in the surveys. More detail on how these biases were adjusted for can be found in the 2018 GUP TIA Part 1." Part 1 does not include detail on these adjustments. This information should be added to the TIA.

TIA, Part 2, page 134: A reference is made to "C/CAG's bus routes." This should be corrected to read "SamTrans's bus routes."

DRAFT

Attachment T

REDUCING ROAD CONGESTION THROUGH INCENTIVES: A CASE STUDY

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Revised on Nov. 15, 2014

ABSTRACT

Traffic congestion is a burden on modern society: hundreds of billions of dollars are wasted each year due to extra fuel consumed, wasted time of commuters, traffic accidents, etc. Congestion occurs when the demand for transport capacity exceeds supply either in a sustained manner each day or just during peak hours. In the former case it is necessary to add transport capacity, whereas adding capacity to combat peak-hour congestion can be very expensive and create a vicious cycle which attracts "latent demand" to fill in the added capacity. Peak-hour demand must therefore be actively managed. Currently, several cities and agencies employ congestion charging which, while effective, often lacks popular support. In this paper we describe an approach that uses incentives to nudge commuter behavior towards congestion-reducing times and modes of travel. Specifically, we describe an incentive program, CAPRI (Congestion And Parking Relief Incentives), which aims to reduce peak-hour traffic in Stanford University. CAPRI rewards commuters who drive during off-peak hours and those who walk or bike to work. Commuter behavior is monitored using RFID sensors for automobiles and a smartphone app–*My Beats*–for walkers and bikers. A commuter who signs up for CAPRI earns points for the "good trips" she makes, and these points can be redeemed for rewards (both monetary and in-kind) in a fun, online game. CAPRI also nudges commuters through features like personalized offers, social influence and status. The paper describes the program, highlighting the effect of each of these features in nudging commuter behavior.

Keywords: Traffic Congestion, Travel Demand Management, Incentives, Personalization, Social Influence, Behavior Shift

1. INTRODUCTION

Traffic congestion is a serious problem occurring every day in cities around the world. According to a recent study (*1*), congestion-related costs surpassed $121 billion in the US in 2011, and this figure is projected to jump to $199 billion by 2020. The consequences of traffic congestion include increased air pollution, extra fuel consumption, increase in traffic accidents, and the diversion of commuters' time from more desirable pursuits.

Given the severity of the problem, cities and transport agencies are employing various methods of addressing congestion. The methods can be classified into two broad categories: increasing transport capacity and curbing the demand. It is necessary to increase transport capacity when the demand exceeds the supply in a sustained fashion and this is expensive; for example, Illinois has a plan underway (*2*) to widen tollways in the Chicago region at a projected cost of $12 billion. Adding capacity to address just peak-hour congestion can not only be prohibitively expensive, it can create a vicious cycle of attracting additional peak traffic—the so-called "latent or induced demand"—and drive the transport system back to a state of congestion (*3*). Hence, peak demand must be actively managed and reduced. Several demand management schemes have been studied and deployed; notably, (a) congestion charging—levying a charge on peak-hour commuters, (b) road rationing—forbidding road use for vehicles on some days depending on license plate numbers, (c) carpool lanes—restricting highway lanes for single occupancy vehicles, (d) ridesharing and vanpooling—encouraging commuters to share vehicles, and (e) travel mode-shifting programs—encouraging commuters to use public transit or bikes. The effectiveness of these measures ultimately rests on the commuters' willingness to support and adopt them.

This paper studies the use of incentives to increase the willingness of commuters at Stanford University for adopting certain congestion-reducing behaviors. Specifically, we aim to reward commuters who travel during off-peak hours (in the shoulder hours adjacent to the morning and evening peak hours) and those who walk or bike to work. Thus, in terms of reducing peak traffic, our approach can be viewed as the complement of congestion charging schemes. Vickrey (*4*) was an early and remarkably prescient proponent of congestion charging. He pointed out that road congestion is an example of the "tragedy of the commons (*5*)" effect: a free public good (namely, the road) will tend to suffer from overuse. Therefore, he argued, congestion charges need to be levied to operate road networks at loads well below the point at which they are congested. Several cities (*6,7,8*) have implemented "congestion charging" mechanisms; essentially, drivers pay a fee for entering *congestion zones* or using pre-designated roadways during peak hours. However, congestion charging schemes can suffer from a lack of popular support and thereby fail to be implemented in the first place (see (*9*), for example).

By being a "carrot" rather than a "stick", incentive approaches are viewed favorably by commuters and, therefore, enjoy certain advantages over congestion charging schemes. Participation in incentive programs is voluntary and on an opt-in basis. Therefore, incentive programs are incrementally deployable, i.e. it is not necessary to include all commuters at the outset. On the other hand, for reasons of fairness, congestion charging schemes must include all the concerned commuters. Incentive programs invite commuters to reveal their good commuting behavior so they may claim rewards rather than go to great lengths to hide their bad behavior so as to avoid charges and penalties. This can considerably reduce the burden of enforcement.

The major questions for a commuter incentive program are: (i) is it effective in inducing the right behavior, and (ii) if so, at what monetary cost? An experiment conducted at a reasonable scale is necessary to answer these questions. This paper describes such an

experiment, called CAPRI (Congestion And Parking Relief Incentives), which we have designed and implemented at Stanford University (*10*). The aims of CAPRI are to nudge Stanford University drivers away from peak-time travel, to park at underutilized parking lots and to adopt alternate modes such as biking and walking. The nudges are administered through a combination of monetary rewards, social influence and personalized recommendations.

CAPRI was launched in April 2012 and invited the participation of about 10,200 permit-holding car commuters at Stanford; of these, 3,082 registered for the program. An additional 975 registered for the walking and biking incentives using a smartphone app. We describe the main elements of the CAPRI program and the technological platform, which is a combination of RFID and smartphone-based sensing of commuter movements, and a cloud-based incentive or "nudge" engine. CAPRI builds on the INSTANT (*11*), Steptacular (*12*) and Insinc (*13*) programs in terms of the behavioral interventions and technological elements. The rest of the paper analyzes the commuter behavior shift in detail. We summarize the main findings as follows: compared to the general Stanford population, CAPRI participants are 21.2% less likely to commute during the morning peak hours of 8–9AM, and 13.1% less likely to commute during the afternoon peak hour of 5–6PM. CAPRI also successfully converted tens of commuters from driving to walking or biking to the campus. Through a regression analysis, we show that incentives have played an important role in shifting the commuting behavior of CAPRI participants over time.

2. LITERATURE REVIEW

Incentive programs for reducing congestion. Spitsmijden (Dutch for "peak avoidance") is a series of commuter incentive program conducted in the Netherlands to reward drivers for driving during off-peak hours. It was shown that positive incentives were able to reduce the amount of peak traffic by around 60% (*14,15,16*) in the test population of 340 participants. The rewards in the ten-week program were high: from 3 to 7 euros per avoided peak-hour trip. Sensors were deployed on the road system and in the vehicles of the participants for behavior detection. An experiment in Osaka, Japan gave drivers a one-month free bus ticket. It was observed that drivers who were given free bus tickets took buses more frequently than before, but the effect did not persist after the trial (*17*). A similar study in Germany investigated the effect of offering pre-paid bus tickets to college students (*18*). In Melbourne, Australia, an incentive program offered free rail fares to rail travelers who completed their trips before 7AM in order to alleviate the overcrowding issue during morning peak hours (*19*). A similar program is currently underway in Singapore (*20*).

A recent mobile traffic app, Smartrek, was designed to predict the length of commute time with different departure times, and give varying levels of reward credits to users choosing different departure times (*21*). The prediction of future traffic conditions and suggestion of routes used both historical and real-time traffic data. The program ran for 10 weeks and gathered 308 completed observations. It was found that users were willing to change departure times and routes for as many as 35% of their trips.

Incentive programs for influencing driver behavior. There exists research that focuses on using insurance-based incentives to influence the driving behavior of participants. Usage-based insurance (UBI), for example, uses devices plugged into a car's diagnostic port to record and analyze information such as distance driven, the time at which the trip was undertaken, and unsafe driving behaviors (e.g., hard braking). These data are used to improve the risk profile of

the insured and offer potential discounts in insurance premiums. One experiment showed that drivers who were offered mileage-based insurance premium on average drove 5%, or 560 miles, less per year (*22*).

Since the advent of smartphones, there are an increasing number of applications of smartphone apps to monitor commutes and encourage environmentally friendly traffic modes. UBIGreen is a smartphone app that senses users' transportation behaviors and gives graphical feedback (*23*).

As compared to these programs, the scale of the CAPRI program is higher in terms of the number of participants (excluding the Melbourne and Singapore public transit early travel incentive programs), the number of trips observed, and the duration of the project. Secondly, and in common with some of the above programs, CAPRI has made extensive use of technology for sensing (a custom-designed RFID system, and mobile app) and for interaction with the participants (an "always on" online portal). Finally, CAPRI gives monetary rewards through a lottery-like random reward mechanism rather than deterministically. This has allowed CAPRI to use a budget of just $1/participant/week (or 10 cents per morning or evening trip) for nudging.

3. DESIGN AND IMPLEMENTATION OF CAPRI

Background and motivation

Stanford University is one of the largest employers in the San Francisco Bay Area (*24*), and its growing population has led to an increase in traffic volume. This has caused congestion on the roads around the campus and strained the parking resources on campus. Stanford University signed a General Use Permit (GUP) with the County of Santa Clara in 2000 (*25*). One of the provisions in GUP states that Stanford is required to manage its transportation impact under a "no net new commute trips" standard: the amount of traffic during peak hours must not increase by more than 1% over 3,319 vehicles in the morning peak hour, and 1% over 3,446 vehicles in the afternoon peak hour (these numbers were measured in 2000). Failure to adhere to this standard has severe consequences for Stanford, including fines and the refusal of building permits for new construction projects.

Existing efforts to mitigate the traffic in Stanford include free campus shuttles from and to nearby transit stations, cash incentives ($300/person/year) to off-campus staff and students who do not buy parking permits on campus, subsidized public transit passes, and discounts on parking permits for carpooling commuters. These measures have been effective in reducing the total number of commuters who drive alone. It does not directly address peak-hour commuters whose number has been increasing over time. The CAPRI program directly addresses peak-hour commuters and aims to reduce their number.

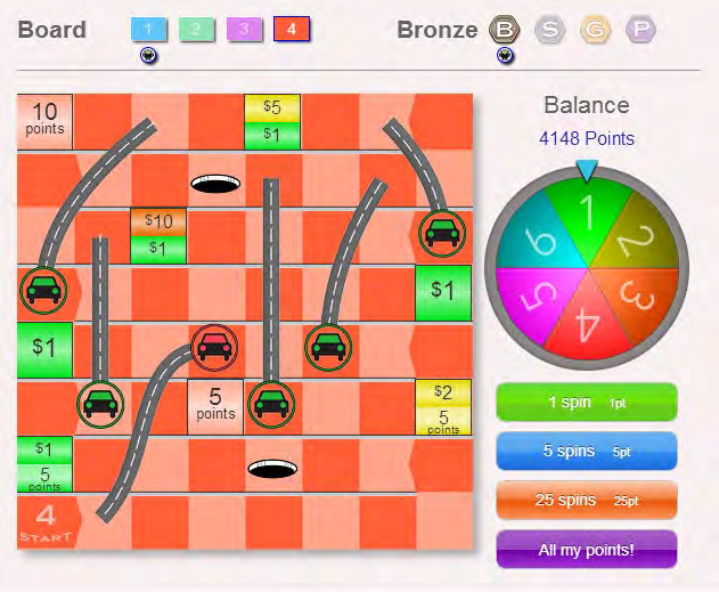

FIGURE 1 Chutes-and-ladders game for redeeming cash reward in CAPRI.

Design

Stanford University parking permit holders who parked inside the "congestion cordon" were invited to participate in the program on Apr 2nd, 2012. Those who enrolled were given passive RFID tags to place on their windshield. The tags were sensed at ten main entrances/exits of the Stanford campus. The sensors detected participants' vehicles for 3 hours in the morning (7–10AM) and in the afternoon (4–7PM) on each weekday. The peak-hours were defined to be 8–9AM and 5–6PM. For each automobile detected by the sensors during the off-peak shoulder hours (7–8AM and 9–10AM, and 4–5PM and 6–7PM), the participant was awarded 10 points. Additionally, CAPRI assigned each participant a *boost day*, a day on which their off-peak trip earned them 30 points. From May 14th, 2013, CAPRI incentivized walkers and bikers by awarding them between 10 and 25 points depending on the length of the commute. Walking and biking activity was monitored using a smart-phone app, called *My Beats*. The CAPRI program concluded on Sept 30th, 2014.

Participants can redeem their points for cash in one of two ways: (i) deterministically, by trading 100 points for $1 (or a full week's worth of off-peak trip points, ignoring boost points), and (ii) randomly, by playing a chutes-and-ladders game using their points on the CAPRI website (FIGURE 1). Playing the game is tantamount to a "self-administered lottery". The game gave cash rewards ranging from $1–$50. 87.3% of the participants used the random rewards option. Since participants were allowed to change the manner of redeeming rewards (deterministic or random), it is interesting to note that 13.2% of the participants chose to switch from the deterministic option to the random option at some point during the program. The rewards were paid out as paycheck supplements or through bank deposits.

CAPRI used a number of other interventions to increase the popularity (and hence the enrollment through friend recommendations), engagement and behavior shift among the participants. We review the important ones below.

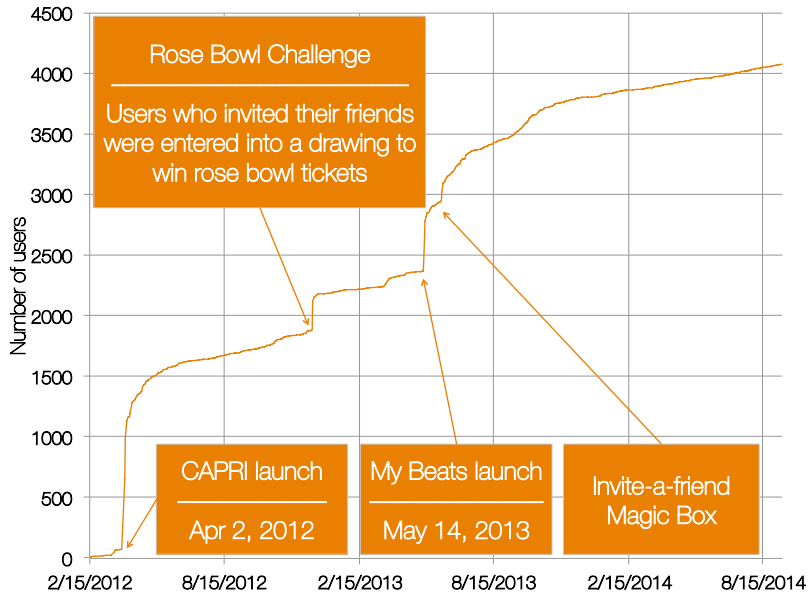

FIGURE 2 Number of CAPRI registrants over time

Status system. Participants were placed in one of four status levels: Bronze, Silver, Gold, and Platinum. Participants started at the Bronze level. Depending on the number of off-peak shoulder hour trips they made on a weekly basis, they could upgrade their status from their current level to the next. At the Silver, Gold and Platinum levels, failure to make the number of off-peak shoulder hour trips required for that status level results in a degrading of the status by one level.

Status is only worth something if it affords a privilege; CAPRI used status as follows. Participants with higher status had higher odds of winning rewards in the game. Further, higher-valued rewards were only available at the higher status levels. For example, the $50 reward was only available at the Platinum level. These two features—higher status means higher odds of winning and higher-valued rewards—have been also been used in the INSTANT (*11*), Steptacular (*12*) and Insinc (*13*) projects.

Friends. Participants were allowed to invite their friends (such as those who were eligible to participate in CAPRI) to join the program as well as to connect with their friends on the CAPRI portal. A participant could see their friends' recent updates; e.g., a status upgrade, a cash award won, etc. This feature provided a basis for social influence to spread.

"Magic Box". From the data it gathered, CAPRI learned a participant's preference for commuting off-peak (e.g., only twice a week, only on Monday and Tuesday mornings and Wednesday evenings). It also learned a participant's propensity for shifting to off-peak based on their response to past offers. Based on these learnings, CAPRI offered personalized incentives through a tab in a commuter's portal called *"Magic Box"*. Each week some of the participants received such offers. Magic Box offers were previously used in Insinc (*13*).

"Trendjacking". Stanford is involved in numerous high profile sporting events like the Rose Bowl, the "Big Game" (the annual football match between the Stanford Cardinals and the

Berkeley Golden Bears), etc. CAPRI offered tickets to some of these events and used them to incentivize behavior shift or increase enrollment.

The My Beats smartphone app and parking incentives. CAPRI detected walking and biking activity using the My Beats app (for both Android and iOS). The app was also developed so as to detect where a person parks so that we could reward those parked in designated and underutilized parking lots. However, due to poor cellular signals at some of the parking structures, My Beats could not accurately and reliably detect parking behaviors. Therefore, we could not implement the parking incentives portion of CAPRI.

4. ANALYSIS OF CAPRI

The CAPRI program started on April 2, 2012 and ended on September 30, 2014. Over the two and a half years, 4,057 Stanford affiliates completed the registration process; this includes 3,082 car commuters and 975 biking/walking commuters. These car commuters cover about 30.0% of the 10,290 car commuters in Stanford who were ever eligible to participate during this period. A graph of the number of registrations over time is shown in FIGURE 2. The figure indicates that there were significant increases in the number of registrations during promotional programs like the Rose Bowl Challenge and from personalized offers like the invite-a-friend magic box. These users conducted a total of 734,562 RFID scans and 98,751 My Beats trips. CAPRI has given out a total of $211,989 in incentives.

Demographics

A closer look at the demographics of CAPRI participants reveals that 63% are female; 72% are staff members, 14% are students and the rest are faculty; and 68% are younger than 45 years of age. On an average day, 795 unique participants make 1,196 automobile trips. Note that a unique participant can contribute both a morning and an evening trip. Moreover, the scanners do not operate other than during the 6 hours specified; thus, a participant's morning trip may not be detected even though their evening trip is detected. The My Beats app records 158 unique participants making a total of 225 walking or biking trips on an average weekday. 1,095 participants have at least one CAPRI friend and 46 users have six or more friends. The top friend-maker in CAPRI has 31 friends.

Automobile Commutes

In this section we investigate the behavior of automobile commuters in CAPRI. Stanford University employs an independent consultant company to count the number of vehicles entering and exiting campus each day for six weeks in the spring and two weeks in the fall each year. This generates the "cordon count data" and gives an aggregate profile of all the traffic entering and leaving the campus during the morning and evening peak and shoulder hours.

FIGURE 3 compares the profile of the overall Stanford traffic monitored in 2013 and traffic due to CAPRI users since the start of program. For the three-hour monitoring window of CAPRI in the morning and afternoon, i.e. 7–10AM and 4–7PM, we average over days and normalize the traffic time density so that the area under each curve in FIGURE 3 is exactly one. From the aggregate profile collected by the university, we find that during an average day a total

of 11,620 inbound trips and 13,315 outbound trips occur in the corresponding monitoring windows (this includes pass-through traffic, visitors, construction vehicles, etc.). CAPRI commuters make 619 inbound trips and 577 outbound trips per day during the same hours. The percentage of the number of commutes before, during and after the peak hour is also shown in the figure. The fraction of trips in the gray-shaded area, indicating the peak hour, is the *peak-hour trip ratio*.

From FIGURE 3, we see that:

- **The overall Stanford traffic density is heaviest during the peak-hours**. The morning peak-hour trip ratio is 38.2% and the evening peak-hour trip ratio is 37.3%.
- **CAPRI users avoid peak hours.** For CAPRI participants, the peak-hour trip ratio is only 30.1% in the morning and 32.4% in the evening, which is a 21.2% and a 13.1% reduction from the Stanford-wide traffic.
- **CAPRI users respond to incentives**. The commute density for CAPRI participants peaks adjacent to (but just outside) the peak hours. Furthermore, CAPRI users prefer commuting during the hour before the peak hour as compared to the hour after the peak hour.

As only aggregate statistics about Stanford traffic are available from the cordon count, we cannot unambiguously determine whether there is a significant shift in the commute hours of CAPRI users after they joined program. It is possible that CAPRI users may have been commuting during off-peak hours even before the program. To support the hypothesis of a behavioral shift under incentives, we conducted a survey in May 2013, in which users were asked if they had shifted their commute time after joining CAPRI. In the next section, we compare the performance between self-declared shifters and non-shifters and gain some insight into their behavioral change.

Shift statistics segmented by user-declared behavior change

In May 2013, a survey of CAPRI participants was conducted. The survey aimed to obtain a better understanding of CAPRI participants' behavioral change, especially given the lack of commute data for these users before they joined CAPRI. The responses from the survey are used to determine if there has been a shift in the participant's commute times since joining CAPRI, the amount of shifting, the reason for shifting, etc. In total, exactly 1,000 CAPRI users responded, among which 602 users claimed that they had shifted commute time by some amount since joining CAPRI, while 398 users declared that they did not shift. Based on this information, we split the users into two groups: self-declared shifters and self-declared non-shifters.

As shown in FIGURE 4, self-declared shifters did indeed shift: the peaks of the time density of these commuters occur at 7:58 and 9:02 for morning inbound commutes, and at 16:58 and 18:01 for afternoon outbound commutes. These are times just adjacent to, but outside, the peak hours. The peaks of the commute time density for self-declared non-shifters occur well before peak hours: around 7:30 for morning inbound commutes, and 16:15 and 16:40 for afternoon outbound commutes, which are *drastically* different from the self-declared shifters. From these observations, we infer:

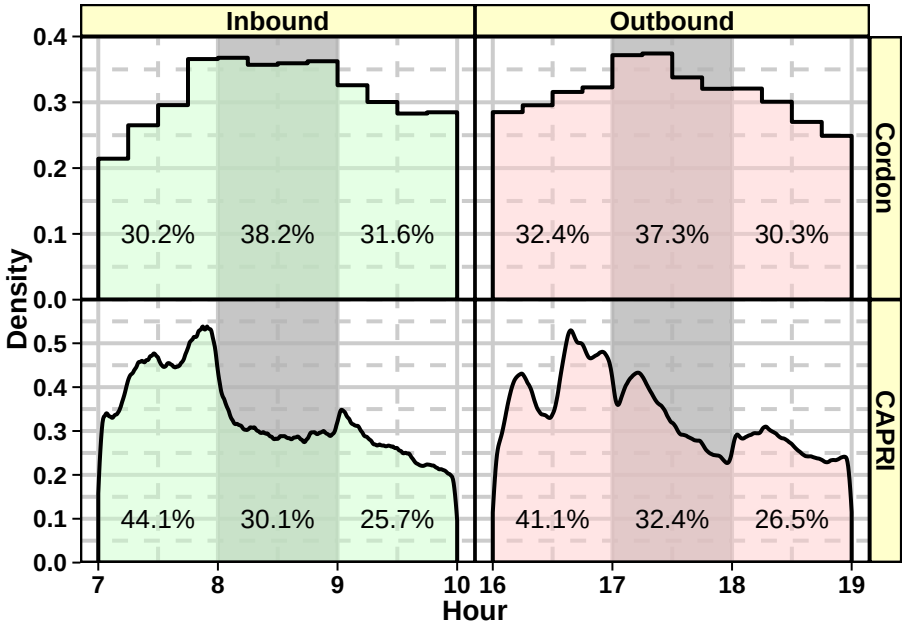

FIGURE 3 Stanford commute time density (cordon counts) vs. CAPRI participants' commute time density on an average day. The time window is 7–10AM and 4–7PM. Areas shaded gray indicate the designated peak hours: 8–9AM and 5–6PM. Each density is normalized: the area under each curve is 1.

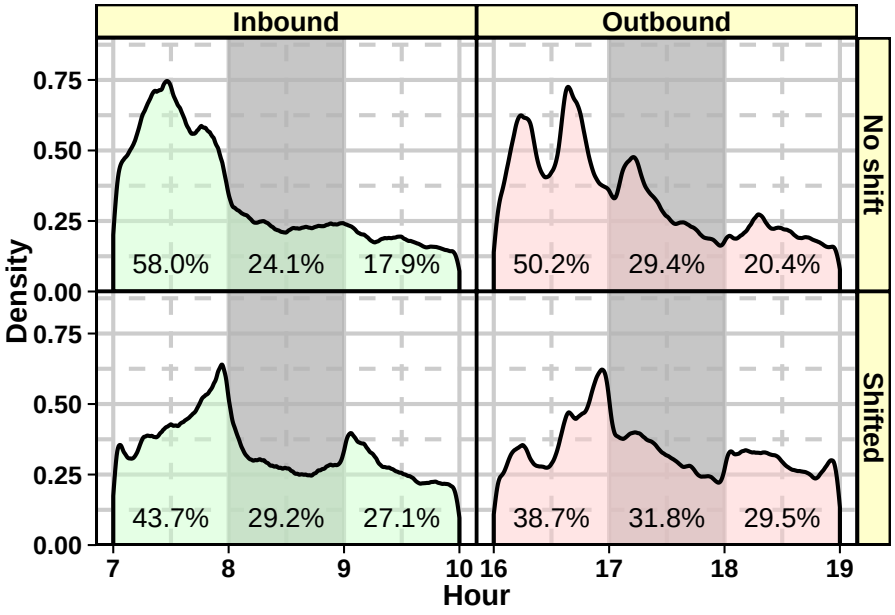

FIGURE 4 Commute time density for self-declared shifters and non-shifters in CAPRI survey. Areas shaded gray indicate the designated peak hours: 8–9AM and 5–6PM.

- The self-declared shifters shifted the *minimum amount necessary* to receive rewards from CAPRI; these shifts can be reasonably attributed to CAPRI.
- The self-declared non-shifters were likely already commuting *far away from peak hours*. Although CAPRI did not cause this commute behavior, it provides incentives for these users to *maintain* their behavior.

Linear regression on features affecting automobile commute time

To further examine the behavioral shift of CAPRI users, we conduct a linear regression analysis to quantify the effects of different factors that affect the commute times of CAPRI participants. The commute time of each participant on every morning/afternoon is regressed on:

- Whether the user has won any rewards from CAPRI in the past week;
- Whether the user has any friends winning rewards from CAPRI in the past week;
- Whether the day of the commute is a boost day for this user;
- The day of the week.

These features capture the impact from incentives, friends' winnings and daily schedules. As the peak hours in CAPRI are in the middle of the 3-hour windows (7AM–10AM and 4PM–7PM), commuters may shift their commute times *earlier* or *later*. To consider shifts in different directions, we categorize users into two groups: those whose median commute time is before the center of the peak hour (early users) and those whose median commute time is after the center of the peak hour (late users). Thus, for morning commutes, early users consist of those whose median commute time is prior to 8:30, while late users consist of those whose median commute time is after 8:30; for afternoon commutes, early users are those whose median commute time is prior to 17:30, and late users are those whose median commute time is after 17:30.

TABLE 1 shows the linear regression coefficients for different features affecting CAPRI participants' commute time. As shown in the table, for early users, winning rewards in the past week can have an immediate impact on their commute time: they shift 4 to 5 minutes earlier in both morning and afternoon commutes (hence away from peak hours). The winning of a participant's friend also has an impact, albeit a smaller one: early commuters who have friends winning rewards in the past week travel around 1.5 minutes earlier. Early commuters also advance their commutes by an additional minute on their boost days to ensure receiving bonus award points.

For late users, those who won rewards in the past week shift about 3 minutes later in morning and afternoon commutes (hence away from peak hours). Rewards won by friends and boost days do not significantly influence the afternoon commutes of late users.

On Fridays, both early and late users tend to leave earlier. In particular, late users leave 10.8 minutes earlier on Fridays.

In summary, the rewards in CAPRI have a direct effect on participants' commute time: they shift their commute time away from peak hours when receiving rewards in the recent past. The influence of friends and the boost day is also observed.

TABLE 1 Linear Regression Coefficients for Different Features on CAPRI Participants' Commute Time. Statistically Significant Coefficients Are Shown (5% Significance Level).

Morning Commutes	**Early Users**		**Late Users**	
	Time	**p-value**	**Time**	**p-value**
Mean commute time	7:50	$< 2\times10^{-16}$	9:01	$< 2\times10^{-16}$
The user won rewards in the past week	-5.3min	$< 2\times10^{-16}$	+3.2min	$< 2\times10^{-16}$
The user has friends who won rewards in the past week	-1.5min	3.51×10^{-10}	-	-
It is the user's boost day	-1.0min	3.41×10^{-7}	+1.6min	1.48×10^{-9}
It is Friday	+0.9min	7.02×10^{-4}	-2.3min	2.05×10^{-11}
Afternoon Commutes	Early Users		Late Users	
	Time	p-value	Time	p-value
Mean commute time	16:58	$< 2\times10^{-16}$	17:57	$< 2\times10^{-16}$
The user won rewards in the past week	-4.0min	$< 2\times10^{-16}$	+2.8min	1.18×10^{-13}
The user has friends who won rewards in the past week	-1.7min	5.00×10^{-9}	-	-
It is the user's boost day	-1.0min	4.10×10^{-5}	-	-
It is Friday	-3.0min	$< 2\times10^{-16}$	-10.8min	$< 2\times10^{-16}$

My Beats App Commutes

In My Beats, variable numbers of points are given for walking and biking commutes based on distance. Most of these trips are between 10 and 30 minutes in duration.

We observe that there are some My Beats app users who also have automobile commutes logged in CAPRI. Indeed, some users almost completely converted to walking and biking commutes after the launch of My Beats. To find these users, we define a *convert* as a participant who had at least 10 automobile commutes logged before the My Beats launch, has since logged more than 10 My Beats trips, and has more My Beats trips than automobile commutes since the launch. In total, there are *28* such converts. For example, there is a participant who made 192 automobile commutes before the launch but made *exclusively* bike commutes after the launch of the app. This shows that CAPRI is effective in persuading some participants to shift modes from driving to walking and biking.

"Magic Box" and Trendjacking

In total, CAPRI deployed more than 10 rounds of magic boxes offers in the fall of 2013. These included instant status upgrades, bonus points for friend invites, bonus points for eligible trips, and points for completing a survey on commute behavior.

Magic boxes are effective in shaping participants' commute behavior. For instance, in August 2013, CAPRI issued a one-week magic box that gives bonus points for eligible My Beats trips. 202 users accepted the offer. FIGURE 5 shows the number of My Beats trips made by CAPRI participants. As shown, those who accepted the offer increased the number of My Beats trips they made by 61% compared to the week before; whereas, other participants had an increase of only 1% in trip count over the previous week. Additionally, a memory-effect can be observed in those who accepted the offer: the two weeks following the end of the magic box saw increases of 36% and 47% in the number of My Beats trips over the week prior to the magic box.

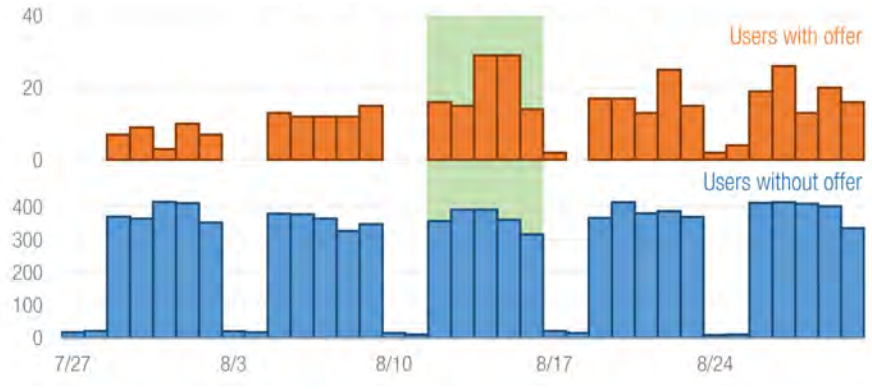

FIGURE 5 The number of My Beats trips made by CAPRI participants, grouped by whether the user received and accepted the magic box offer of bonus points for eligible trips. Shaded week indicates the bonus period.

During the 2013 Rose Bowl Challenge (an annual collegiate football championship for which Stanford qualified), CAPRI offered five pairs of tickets to some lucky participants. In order to qualify for the draw, a participant had to invite their friends to join CAPRI and each accepted invitation earned the participant one entry into the raffle. Over the 2 weeks period of the challenge, over 500 friend invitation emails were sent and 287 invited users successfully completed registration, resulting in an increase of over 13% in CAPRI's total user population.

5. SUMMARY

This paper analyzed CAPRI, an incentive program that aimed to shift drivers out of the peak hours and towards alternate modes such as walking and biking. We conducted an analysis of CAPRI based on 734,562 automobile trips and 98,751 walking and biking trips collected from 4,057 CAPRI participants during two and a half years. We found that the rewards in CAPRI were effective in incentivizing users to drive during off-peak hours, and to walk and bike. In particular, rewards received in the recent past shifted users' commute times away from the peak hours, and there were some users who converted from driving to walking or biking to work. Furthermore, personalized offers—the "magic box"—was useful in shaping users' commute behavior and increasing their participation.

As mentioned in the paper, the My Beats app could not detect parking behaviors accurately and reliably due to poor cellular coverage at some of the designated parking lots. In future, we intend to study parking incentives.

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Attachment V

2017 CMP

2017 CONGESTION MANAGEMENT PROGRAM DOCUMENT

PREPARED BY THE SANTA CLARA VALLEY TRANSPORTATION AUTHORITY
THE CONGESTION MANAGEMENT AGENCY FOR SANTA CLARA COUNTY

Valley Transportation Authority
Solutions that move you

DECEMBER 2017

2017 Congestion Management Program

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EXECUTIVE SUMMARY

In accordance with California Statute, Government code 65088, Santa Clara County has established a Congestion Management Program (CMP). The intent of the CMP legislation is to develop a comprehensive transportation improvement program among local jurisdictions that will improve multimodal transportation system performance, land use decision-making and air quality.

The main requirements of the CMP statutes can be summarized as follows:

- Requires the designation of a Congestion Management Agency (CMA) in each urbanized county, to develop and update the CMP and monitor its progress over time.
- Sets up a performance review process, by mandating the designation of a network of transportation facilities that will be periodically monitored for congestion, and by requiring the designation of a level of service standard for roadways and performance measures for all modes of travel.
- Promotes the use of alternatives to the single-occupant automobile through trip reduction programs, land use / transportation integration strategies, and transportation demand management (TDM) measures.
- Promotes integration of decisions about land development, transportation investment and air quality by requiring a process to determine the impacts of local development decisions on the countywide transportation network.
- Requires a seven-year investment strategy, referred to as a Capital Improvement Program (CIP), to support the CMP goals. The CIP is updated biennially and links project eligibility for regional/state funding to the CMP.
- Requires a computerized travel model and uniform database for estimating future transportation needs and impacts.
- Encourages infill development in core areas and along major transit corridors.

The Santa Clara Valley Transit Authority (VTA), as the designated Congestion Management Agency, has prepared this 2017 Congestion Management Program in accordance with the requirements of the CMP legislation. The purpose of this document is to summarize the elements, policies and procedures of the VTA CMP.

WHAT'S NEW IN THE 2017 CMP

The 2017 update signifies an evolving role for the CMP in our region's future. It summarizes the current VTA CMP, changes to the CMP over the past two years, as well as key areas that are likely to be addressed in the coming two years. The 2019 update is expected to have more significant changes due to the items noted below. The 2017 update is minor in comparison. The following is a summary of key changes and additions in the CMP 2015:

- **Added VTA's Mission, Vision, and Core Values** – A new chapter was added to the CMP Document that describes VTA as an agency. The CMP Document was developed based on the mission, vision and core values identified in the Strategic Plan.

- **Additional discussion of Senate Bill (SB) 743 implementation and relationship to the CMP auto LOS standard** – In keeping with the original intent of documenting SB 743 in the previous CMP Document, there are updates regarding the Office of Planning and Research (OPR) development of new criteria to evaluate transportation impacts under CEQA. While OPR has not yet submitted final draft guidance to the Secretory of Natural Resources for rule-making as of September 2017, some cities (such as San Francisco, Oakland and Pasadena) have already changed their CEQA metrics and practices, and other cities (such as City of San Jose) are in the process. Based on indications from OPR, VTA expects that mandatory statewide implementation of VMT analysis to replace LOS analysis in CEQA will be phased in over the next few years. VTA will continue to monitor the SB 743 implementation process and provide assistance to Member Agencies in updating local CEQA standards, and consider potential changes to the CMP and Technical Guidelines as appropriate.

- **Updates to the status of key VTA transportation projects** – The CMP System Definition chapter (Chapter 2) includes updated descriptions of transportation projects VTA is leading or participating in, including the BART Silicon Valley extension, VTA Bus Rapid Transit (BRT) projects, the Light Rail Enhancement Project, the Caltrain Modernization Program, and the Silicon Valley Express Lanes Program. It also includes information related to two new efforts that began in late 2015, the Transit Network Redesign and as part of that effort, the implementation of a new frequent transit network.
- **Updated information about regional programs** – Chapter 7 contains updated discussions of regional planning efforts led by the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC), such as Plan Bay Area and the PDA Investment & Growth Strategy.

- **Updated Capital Improvement Program (CIP) project listing and funding information** – The list of capital projects in the CMP Capital Improvement Program in Chapter 8 has been updated to reflect completed projects, revised cost estimates, and other changes to maintain consistency with the Transportation Improvement Program (TIP). Updated information has been added about various funding sources related to capital projects in Santa Clara County.

Key areas that the CMP will address with Member Agency input over the next two years include:

- **Implementation of SB 743 Legislation** – As noted above, the Governor's Office of Planning and Research (OPR) is currently updating the CEQA Guidelines to remove auto LOS analysis and require vehicle miles traveled (VMT) analysis in the CEQA analysis of transportation impacts and mitigation measures. SB 743 did not directly call for changes to the Transportation Analysis Standards Element and Multimodal Performance Measures Element of the CMP, however it is expected that these elements will be updated for compatibility with the new CEQA Guidelines. VTA will continue to monitor potential legislation affecting CMPs and intends to update the CMP, with input from the VTA Board, Committees, and Working Groups, over the coming years. VTA will also continue to provide information and assistance to Member Agencies in updating local CEQA standards as appropriate.
- **CMP Monitoring and Conformance Program transition to utilize Big Data** - Since 1997, VTA has used aerial photography to collect data on freeway congestion. Beginning with the 2017 Monitoring & Conformance Report, VTA is studying innovative approaches to data collection such as Big Data[1] (see Chapter 8 for more information). VTA envisions that a transition to Big Data could potentially provide more reliable data for a lower cost. In addition, Big Data may open up new avenues for congestion analysis in areas such as duration of congestion, automobile travel times and reliability, congestion spillover to alternate routes, causes of congestion, transit travel times and reliability, modal split, automobile trip generation, and vehicle miles traveled.

[1] Big Data is a phenomenon currently impacting a wide range of industries, defined as "a new generation of technologies and architectures designed to economically extract value from very large volumes of a wide variety of data, by enabling high-velocity capture, discovery, and/or analysis" (Big Data: Beyond the Hype, White Paper by Datastax Corporation, March 2012). In the field of transportation monitoring and analysis, Big Data methods involve aggregating traffic-related information from GPS-enabled vehicles and mobile devices, traditional road sensors and hundreds of other sources (INRIX website, accessed 9/11/2013).

ELEMENTS OF THE VTA CMP

CMPs must contain five elements: a system definition and traffic Level of Service (LOS) standard element, a multimodal performance measures element, a transportation demand management and trip reduction element, a land use impact analysis element, and a CIP. In addition to these five elements, other actions, such as the development of a countywide transportation model and Multimodal Improvement Plans, are necessary to meet the requirements of the Statute.

In response to the statutory requirements and the Strategic Plan's vision, VTA has chosen to define its CMP in terms of nine elements that logically structure the program. Each of the nine elements corresponds to a chapter of the CMP and is briefly summarized below:

1. System Definition Element — The CMP Transportation System consists of a roadway network, a transit network, and a bicycle network.

The System Definition Element is linked to other elements in the CMP because all projects proposed for the CIP must be on or benefit the CMP Transportation System. Additionally, roadways included in the CMP Roadway Network will be monitored for conformance with the CMP level of service standard.

The designated CMP Roadway Network includes state highways, county expressways and principal arterials. The adopted definition for principal arterials is: roadways that connect with the freeway and/or county expressway system and meet one of the following criteria: (1) state highway; (2) six-lane facility; or (3) non-residential arterial with average daily traffic of 30,000 vehicles per day.

While the CMP Statutes do not expressly require adoption of a transit network, it does require the inclusion of specified transit system performance measures. Therefore, the CMP includes a Transit Network consisting of rail service and selected bus service. Performance measurements have been established for VTA Transit Service and are identified in the Transit Sustainability Policy and its complementary document, the Service Design Guidelines. The guidelines establish ridership thresholds and ensure that transit service operates as efficiently as possible.

One of the goals of VTA's CMP is to provide for safe and convenient bicycling throughout the county for various types of trips, such as work, school, errands, and recreation by focusing improvements on the Cross County Bicycle Corridors (CCBC). The CCBC is a network of 24 routes for bike travel through the county that are identified in the Santa Clara Countywide Bicycle Plan, adopted by the VTA Board of Directors in 2008.

2. Transportation Analysis Standards Element — For the purpose of congestion monitoring and management, the CMP statute requires that CMAs develop a minimum automobile level of service (auto LOS) standard for CMP Network roadways. Auto LOS describes the operations of roadway segments or intersections in terms of vehicle speed, volume and capacity, and traffic delay. Auto LOS evaluates operations for all common motor vehicle types, including automobiles, light and heavy trucks, and motorcycles. In addition, although congestion affects transit vehicles operating in general purpose lanes, transit operations are affected by additional factors and are typically evaluated separately from auto LOS.

The Transportation Analysis Standards Element contains the adopted auto LOS standard for the CMP Roadway Network and describes the methodologies for evaluating auto LOS. The auto LOS standard is important because CMP Roadway Network facilities must operate within the adopted standard or the Member Agency responsible for the facility must prepare a Multimodal Improvement Plan for that facility.

In addition, Member Agencies must monitor auto LOS using adopted methodologies. A comprehensive description of the auto LOS standard is presented in the CMP Technical Standards and Procedures: Traffic Level of Service Analysis Guidelines and is available upon request.

3. Multimodal Performance Measures Element — The purpose of the Multimodal Performance Measures Element is to define specific transportation system performance measures that can help evaluate how well Santa Clara County's transportation system serves the traveling public. Twelve measures are described in the Element. These measures can be used in a variety of analyses. Some may be used in the development of the countywide long-range transportation plan, some may be used in the CMP monitoring process, some may be used in analyses of the impacts of specific development projects, and some may be used for more targeted efforts such as corridor studies, transit or roadway capital projects.

4. Trip Reduction and Transportation Demand Management (TDM) Element — This element defines and describes TDM programs and lists funding sources Member Agencies can access to implement these projects. Some programs that would be recommended as part of the TDM element include parking management and pricing, roadway pricing, commute alternatives, and cash subsidies. The current countywide transportation plan, VTP 2040, and the Community Design and Transportation (CDT) Program encourage the development and continuation of successful trip reduction efforts through incentives and partnerships.

5. Countywide Transportation Model and Database Element — This element contains a description of the countywide transportation model required by the CMP Statute. The Statute requires that the countywide transportation model be consistent with the regional

transportation model developed by MTC with data provided by ABAG. The countywide transportation model is used to help evaluate cumulative transportation impacts of local land use decisions on the CMP System. Because of the model's significance in the overall CMP, it is extremely important that the model accurately reflect existing land use and transportation conditions.

The CMP also requires local models to be consistent with the countywide transportation model. A comprehensive description of these consistency requirements is presented in the CMP Technical Standards: Local Transportation Model Consistency Guidelines.

6. Land Use Impact Analysis Element — This element describes the procedures used to analyze the transportation impacts of local land use decisions on the transportation system, and the programs designed to influence policy development to better support a multimodal transportation system. The Land Use Impact Analysis Program links local land use decisions with broader transportation and air quality impact analysis. The VTA CMP includes the Proactive CMP Process[2], adopted by the VTA Board in May 1997, which provides a framework for VTA comment on development projects and plans and for quarterly reporting to the Board on Member Agency development decisions.

VTA has developed and adopted Transportation Impact Analysis (TIA) Guidelines to ensure that all projects are analyzed uniformly and consistently. Comprehensive descriptions of the TIA Guidelines are included in the CMP Technical Standards. Over the 2012-2014 timeframe, VTA engaged in a comprehensive update of the TIA Guidelines document to emphasize the reduction of automobile trips and take a balanced, multimodal approach to addressing transportation impacts and effects. Updating the TIA Guidelines offers VTA the opportunity to encourage the use of multimodal performance measures and make the CMP better reflect the goals of SB 375, the regional and countywide long range transportation plans, and local General Plans and policies.

Through a multi-year process, the CDT program was developed in partnership with VTA Member Agencies and the community. The CDT is primarily an advocacy and resource program, providing tools and resources to Member Agencies intended to influence changes in policy, administration, and urban design that encourage well-designed, high-amenity development in cores areas, around transit station areas, and along major transportation corridors. In addition, the CDT Program has given out planning and capital grants to Member Agencies that are developing plans and projects in accordance with the CDT guidelines and planning initiatives.

[2] Now generally referred to as the "Development Review Program" in Reports to the VTA Board and Committees.

7. Capital Improvement Program Element — The CIP is a list of capital projects designed to improve the transportation system and air quality in Santa Clara County. The CIP consists of a list of transportation facility improvements that is submitted to MTC for inclusion in the Regional Transportation Improvement Program (RTIP), the State Transportation Improvement Program (STIP) and the Federal Transportation Improvement Program (TIP). The CIP includes projects from the following funding categories: Regional Improvement Program (RIP) and Interregional Improvement Program (IIP), Surface Transportation Program (STP) and Congestion Mitigation/Air Quality Program (CMAQ) (federal), Transportation Alternatives funds (federal), and the Traffic Congestion Relief fund (state). In addition, projects funded by the 1996 Measure B sales tax, the 2000 and 2008 Measure A sales taxes, the 2006 Proposition 1B bond fund, the 2008 Proposition 1A (High Speed Rail) bond fund, Express Lanes revenue, the 2010 Measure B Vehicle Registration Fee and the Transportation Fund for Clean Air are included in the CIP since they affect the county's transportation system.

The Capital Improvement Program is developed in accordance with the statewide and regionally adopted multimodal criteria for project selection. The regional criteria emphasize maintaining and sustaining the existing transportation system, improving its efficiency and effectiveness through congestion relief, safety improvements and consideration of freight movement, expanding the system, and accounting for external impacts on land use and air quality. The CMP Statute requires that the CIP maintain or improve the performance of the multimodal system for the movement of people and goods, mitigate the impacts of land use decisions on the regional transportation system, and conform to air quality mitigation measures included in state and federal air quality plans.

8. Monitoring and Conformance Element — The CMP Statute requires biennial monitoring to determine Member Agency conformance with all elements of the CMP. The Monitoring and Conformance Element describes the monitoring process used in Santa Clara County. VTA monitors freeway LOS and land use decisions on an annual basis, and all other elements of the Monitoring Program, including CMP intersection LOS on a biennial basis.

Once Member Agencies have submitted their monitoring data, VTA will evaluate it to determine changes to and impacts on the CMP System and to ensure that each Member Agency is in conformance with the CMP. If Member Agencies fail to meet CMP standards or implement CMP requirements, they could be found in nonconformance with the CMP and risk forfeiting gas tax subventions from the state. A description of the requirements and methodologies used in the Monitoring and Conformance Program is available in the Monitoring and Conformance Requirements.

9. Multimodal Improvement Plan Element – This element summarizes the process for the preparation and approval of Multimodal Improvement Plans. Beginning with the 2013 CMP,

VTA uses the term "Multimodal Improvement Plan" for "Deficiency Plan" as defined by state legislation, to highlight the range of multimodal solutions available to Member Agencies that have a traffic LOS deficiency.

Multimodal Improvement Plans must be developed for facilities that are not operating within the adopted traffic LOS standard. Multimodal Improvement Plans may be developed by VTA Member Agencies and must be approved by VTA Board of Directors. Multimodal Improvement Plans must include a set of improvements, programs, and actions for the CMP facility that measurably improve multimodal performance and contribute to a significant improvement in air quality. CMP system facilities that are covered under an approved Multimodal Improvement Plan, or a previously approved Deficiency Plan, may operate below the traffic LOS standard as long as the plan is being implemented.

REGIONAL CONFORMANCE

To meet the requirements of CMP legislation, VTA's CMP was developed to conform to the Regional Transportation Plan, as well as the MTC's Guidance for 2017 Congestion Management Programs. The CMP also conforms to the transportation-related provisions of the federal and state California Clean Air Acts, and the regional Clean Air Plan.

MEMBER AGENCY RESPONSIBILITIES

The Congestion Management Program is a cooperative effort between VTA and the CMP Member Agencies – the 15 cities in the county, Santa Clara County, and VTA. Table E.1 outlines the element requirements and major responsibilities of VTA and Member Agencies in complying with the CMP.

THE DEVELOPMENT OF THE 2017 CONGESTION MANAGEMENT PROGRAM

As with all previous efforts, this CMP was developed through a collaborative effort among VTA and its Member Agencies, with occasional guidance from state and regional agencies. The policies contained in this document were initially developed by VTA with input from working groups of the Technical Advisory Committee. Since most elements of the CMP are designed to be implemented locally by Member Agencies, local input throughout the policy development process is crucial to the success of the Congestion Management Program.

After receiving Member Agency and public input, the VTA Board of Directors is responsible for making all policy decisions and for approving the final CMP.

DOCUMENT STRUCTURE & ORGANIZATION

The purpose of the document is to give the reader a comprehensive knowledge of the elements and goals of the VTA CMP. The CMP is organized into nine chapters: the CMP system definition and a chapter describing each element of the CMP. Table ES.1 presents a summary of each element. A number of appendices providing additional information are included at the back of this document. Appendix A provides a glossary of key terms, Appendix I includes the full text of the CMP Statute and related Statutes, and the remaining appendices provide additional technical or descriptive information

In addition, VTA has compiled a set of documents entitled CMP Technical Standards and Procedures that contains all the technical requirements and guidelines that Member Agencies must follow to comply with the CMP. The Technical Standards and Procedures contain the following documents: Requirements for Deficiency Plans, Transportation Impact Analysis Guidelines, Local Transportation Model Consistency Guidelines, Traffic Level of Service Analysis Guidelines, and Monitoring and Conformance Requirements.

TABLE ES.1 | CMP ELEMENTS SUMMARY

CMP Element	Requirement	Timing	Responsible Agency
Transportation Analysis Standards Element	1) Monitor and submit report on the level of service on CMP roadway network intersections using CMP software and procedures.	Dec 1	Member Agencies
	2) Monitor performance of CMP rural highways and freeways	Dec 1	VTA
Multimodal Performance Measures Element	Collect available transportation performance measurement data for use in land use analysis, deficiency plans and the CIP.	Ongoing	VTA
Transportation Demand Management and Trip Reduction Element	No current requirements	Member Agencies and VTA	Trip Reduction and Transportation Demand Management Element
Transportation Model and Database Element	1) Certify that the CMP model is consistent with the regional model	Biennially	MTC
	2) Certify that Member Agency models are consistent with the CMP model	As Needed	VTA and Member Agencies
Land Use Impact Analysis Element	1) Prepare a Transportation Impact Analysis (TIA) for projects that generate 100 or more peak hour trips and submit to the CMP according to TIA Guidelines schedule	Ongoing	Member Agencies
	2) Submit relevant conditions of approval to VTA for projects generating TIAs	Ongoing	Member Agencies
	3) Prepare quarterly report on VTA comments and local agency adopted conditions for VTA Board, CMPP and PAC, TAC, CAC, and BAC	Ongoing	VTA
	4) Prepare and submit land use monitoring data to the CMP on all land use projects approved from July 1 to June 30 of the previous year	Oct 1	Member Agencies
Capital Improvement Program Element	Develop a list of projects intended to maintain or improve the level of service on the designated system and to maintain transit performance standards	Biennially	Member Agencies with VTA
Monitoring and Conformance Element	Outline the requirements and procedures established for conducting annual auto LOS and land use monitoring efforts. Support the Transportation Analysis Standards and Land Use Impact Analysis Elements	Dec 1	Member Agencies and VTA
Multimodal Improvement Plan Element	1) Prepare Deficiency Plans for facilities that violate CMP traffic LOS standards or that are project to violate LOS standards using the adopted Deficiency Plan Requirements.	As Needed	All Affected Member Agencies
	2) Submit Deficiency Plan Implementation Status Report as part of annual monitoring.	Dec 1	Member Agencies with Deficiency Plans

CHAPTER 1 | VTA

This chapter, newly added for CMP 2017, describes VTA as an agency as well as its mission, vision, and core values.

BACKGROUND

While operating Santa Clara County's bus and light rail system is an important part of what we do, it's certainly not the only aspect of our work-and that's a good thing. VTA is a unique organization, so our approach to work must be unique as well. We have wide-ranging authority, including transit development and operations, congestion management, funding, highway design and construction, real estate and transit-oriented development, and bicycle and pedestrian planning. We are truly a multimodal transportation solutions agency, which gives us many great opportunities that other agencies don't have. Our structure is unique in that Bay Area, and to better support our local interests and needs, as well as enhance regional partnerships, we will continue to strive for greater regional independence.

VTA is a collection of more than 2,000 dedicated employees working together to provide transportation throughout Silicon Valley. We provide solutions that move people to their jobs, recreational activities, appointments, home, and more, allowing us to meet the varied needs of a diverse population. From highways to bikeways to safer routes to school, the people of VTA work together to make Silicon Valley residents and workers have the ability to get where they need to go.

MISSION

The **Mission** offers the reason for being. It answers the questions: "Why does this organization exist; what do we do?" To offer services that will add value to the community, this question must be answered clearly and memorably.

For VTA, the answer is: to provide "***solutions that move you.***" Our role is to get people moving and keep the moving.

This answer is broad enough to encompass all the work that VTA does—transit service, congestion management, highway construction, and bicycle and pedestrian facilities—but narrow enough to leave no doubt or confusion about who we are.

VISION

The **Vision** is where we see ourselves in the future. This answers the question "What are you aiming to achieve?" To help the community understand what they can expect from the organization, now and down the line, this question also must be answered clearly.

For VTA, the answer is: ***"To innovate the way Silicon Valley moves."*** This means we plan to position ourselves now and in the future as leaders in the effort to help move the residents of Silicon Valley, an area known for innovation where people expect the newest, cutting edge options to be readily available. Rather than wait for others to develop those options, we will do the innovating: we will create, collaborate and lead, offering options that meet the evolving needs of people around the county.

CORE VALUES

Safety — We plan and deliver services in a way that promotes the health and safety of our employees and the public.

Integrity — We conduct our business in an ethical, honest, and transparent manner.

Quality — We ensure that the services we deliver, and projects that we build, are well designed and maintained to preserve the investment that has been made.

Sustainability — We operate our services and design our projects to minimize the negative impacts on our environment, in a way that can be maintained over time. Additionally, we operate as a sustainable organization by reducing our carbon footprint.

Diversity — We value, respect, and serve the unique needs of our community.

Accountability — We are stewards of the natural resources and transportation tax revenues of the County, take responsibility for our actions, and honestly report our successes and challenges to stakeholders and the public.

PARTNERS

Local jurisdictions hold land use authority, our transportation partner agencies help us make the connections between diverse transit systems, and state and federal agencies set regulations and standards that we must meet, while also provide funding.

We also need to work with community stakeholders and customers to understand the best solutions for a given community. And we need to work with our employees to understand and implement the exciting new ideas that will help further establish VTA as an authority in the transportation industry.

CONGESTION MANAGEMENT PROGRAM

Within this document VTA outlines its responsibility as a Congestion Management Agency (CMA) and how it fulfills those responsibilities. Furthermore, the sections above illustrate VTA's vision in a broader context as a mobility solutions provider. As VTA seeks to reduce congestion at a regional scale through a multimodal approach within a Congestion Management Program (CMP) the ideals outlined above and VTA's duty as a CMA coalesce.

The chapters and information that follows focuses on the CMP statute requirements and how VTA is meeting those requirements. However, this is always to be viewed within the context of VTA as a multimodal transportation solutions provider delivering solutions that keep Silicon Valley moving.

CONGESTION MANAGEMENT PROGRAM AND OTHER VTA DOCUMENTS

This document is complimentary to the other documents that VTA produces - including the Annual Monitoring and Conformance Report, the Valley Transportation Plan, and the Countywide Bicycle Plan. Each of the documents aims to showcase the delivery of projects and programs that will benefit our Member Agencies. Together these interconnected planning efforts position VTA and Member Agencies to fulfill the mission and vision and provide more solutions and choices to meet the transportation needs of the residents and businesses of Santa Clara County.

CHAPTER 2 | CMP TRANSPORTATION SYSTEM DEFINITION

This chapter describes the Congestion Management Program (CMP) Transportation System. The CMP System consists of a roadway network, a transit network, and a bicycle network.

BACKGROUND

In 1990, the State of California enacted legislation to create Congestion Management Agencies (CMAs) in urbanized counties, following voter approval of Proposition 111. Each CMA is responsible for establishing a Congestion Management Program (CMP), envisioned as a comprehensive multimodal approach to solve transportation problems and reduce congestion at the regional scale. In contrast to the previous strategy of continually expanding roadway capacity, the CMP was designed to provide increased and more efficient transit services, increased efficiency of the existing roadway system, reduced traffic demand, and an improved land-use decision making process.

Beginning in 1991, with the enactment of the landmark Intermodal Surface Transportation Efficiency Act (ISTEA), federal transportation funding programs have also encouraged a more coordinated, regional, multimodal approach to transportation planning. ISTEA provisions allowed state and metropolitan planning organizations to take a broader view of the transportation system and its performance. Like Proposition 111, ISTEA shifted a major portion of transportation planning and priority setting from the state to regional agencies, CMAs, and local governments. This overarching philosophy has carried forward to subsequent federal transportation funding bills, including the most recent bill, FAST Act (Fixing America's Surface Transportation Act).

With the adoption of Plan Bay Area 2040 in July 2017, thirteen performance targets guide transportation planning in the Bay Area. These include required targets related to climate protection and adequate housing and voluntary targets related to healthy and safe communities, open space and agricultural preservation, equitable access, economic vitality, and transportation system effectiveness.

The state of California also has adopted three legislative mandates to guide the development of transportation analyses, plans and strategies. These bills are summarized below:

- **AB 32 (Nunez) California Global Warming Solutions Act of 2006.** This bill requires the California Air Resources Board to adopt regulations to require the reporting and verification of Statewide greenhouse gas emissions and to monitor and enforce compliance with this program.

- **SB 375 (Steinberg) Transportation Planning: Travel Demand Models; Sustainable Communities Strategy; Environmental Review, 2008.** SB 375 instructs the California Air Resources Board to set regional greenhouse gas emissions reduction targets from passenger vehicles. The Metropolitan Planning Organization for each region must then develop a "Sustainable Communities Strategy" (SCS), as part of its regional transportation plan, integrating transportation, land use and housing policies to plan for achievement of the emissions target for their region. The second such regional housing and transportation plan adopted by MTC and ABAG, Plan Bay Area 2040 includes the Sustainable Communities Strategy for the Bay Area, as well as the 2040 Regional Transportation Plan.

- **SB 743 (Steinberg) Environmental quality: transit oriented infill projects, judicial review streamlining for environmental leadership development projects, and entertainment and sports center in the City of Sacramento, 2013.** Senate Bill (SB) 743, approved by the California legislature in September 2013, includes changes to the California Environmental Quality Act (CEQA) and CMP law related to the analysis of transportation impacts. Most significantly, the bill directs the Governor's Office of Planning and Research (OPR) to develop alternative metrics to the use of vehicular "level of service" (LOS) for evaluating transportation impacts for purposes of CEQA. The timing of implementing these changes is uncertain; while OPR has not yet submitted final draft guidance to the Secretory of Natural Resources for rule-making as of September 2017, some cities (such as San Francisco, Oakland and Pasadena) have already changed their CEQA metrics and practices, and other cities (such as City of San Jose) are in the process. While the change in CEQA practice does not necessarily affect CMP analysis which is based on separate state legislation, the changes resulting from SB 743 may also encourage VTA to update the CMP and related Technical Guidelines for consistency.

CONGESTION MANAGEMENT PROGRAMS

Propositions 111 and 108 together increased funding for California's transportation system by billions of dollars. With this new funding came the requirement that urbanized counties create or designate a CMA that is responsible for preparing and implementing a Congestion Management Program (CMP) every two years. An additional gas tax was created to fund transportation improvements and CMA activities. The majority of the funds are transferred from the CMA to Cities and the County through gas tax subventions, however Member Agencies must be found in conformance with the CMP to receive these subventions.

Although the primary focus of the congestion management program was originally envisioned as reducing congestion and thus improving mobility for persons and freight, the requirements of the CMP recognize the inextricable links between transportation, land use, and air quality. Over time, CMPs in the Bay Area have evolved to emphasize an overall reduction in single-

occupant vehicle trips and increase in pedestrian, bicycle and transit mode share in addition to managing congestion. Moreover, the statute acknowledges that these policy issues are not only functionally interrelated, but jurisdictionally interrelated as well. Accordingly, the statute requires cities and counties to work together to find cooperative solutions to these multi-jurisdictional problems. By operating as a "bridge" between local agencies and the regional and state levels of government, CMAs play a key role in overcoming fragmented planning and effectively integrating transportation and land use planning at the county level.

The CMP pursues the interrelated goals of managing congestion, reducing single-occupant vehicle trips and improving alternative modes through a combination of capital roadway, transit, bicycle and pedestrian improvements, which are designed to maintain the existing transportation system where possible, and only add new travel lanes where road-widening is the only solution available to improve the transportation network. In addition, the CMP is intended to improve land use planning, develop strategies to reduce traffic demand, and when necessary, establish Multimodal Improvement Plans[1] to address deficiencies according to CMP standards. By addressing these congestion, transportation demand, land use and transportation decision-making issues early on, larger problems that could result in more expensive and less effective solutions may be avoided.

The CMP benefits the local governments, employers, businesses, developers, environmentalists and labor unions in the region. The CMP gives local governments the ability to establish a rational transportation funding process with clear priorities that makes transportation funding more reliable and brings it one step closer to home. A seven-year Capital Improvement Program (CIP) was established to give employers the confidence that local transportation facilities will be maintained and improved as needed. Businesses are assured that transportation investments will contribute to the efficient movement of freight throughout the region, which will improve the economic climate of the county. The CMP creates a "level playing field" that ensures all new development projects in the county are evaluated equally and equitably. On the environmental side, the CMP evaluates individual and cumulative transportation, land use, and air quality impacts due to new development projects. And lastly, the CMP maximizes local, state, and federal transportation dollars to create new construction jobs that will ultimately improve mobility.

The establishment of CMAs, in conjunction with changes in State and Federal transportation funding procedures, shifted decision-making from the State to the regional and local levels. Not only does this mean more money is available for local planning projects, but it also means that

[1] VTA uses the term "Multimodal Improvement Plan" for "Deficiency Plan" as defined by state legislation, to highlight the range of multimodal solutions available to Member Agencies that have a traffic LOS deficiency. See Chapter 10 for more details.

local governments have more flexibility and autonomy to spend this money on projects that benefit their local communities. It also gives citizens an opportunity to provide meaningful input in the decision-making process.

VTA CONGESTION MANAGEMENT PROGRAM

The CMA Statute states that all urbanized counties may create or designate a CMA by resolution of the County Board of Supervisors and a majority of City Councils representing a majority of the population in the incorporated county. Santa Clara County was the first county in the state to form a CMA, and the only county in the state to form a CMA prior to the passage of Proposition 111 in 1990. This accomplishment was possible only after months of collaborative effort by a joint committee of elected officials who were members of the County Transportation Commission and the Golden Triangle Task Force.

The committee met weekly from December 1989 to May 1990 to develop a consensus on the purpose, structure, and goals of the new agency. Their vision for the CMA - "A United Proposal for a Congestion Management Agency for Santa Clara County" - was submitted to all city councils and the Board of Supervisors for ratification. By July 1990, the proposal had been ratified by all 15 cities and a majority of the population in Santa Clara County. As a result, the Santa Clara County CMA was formed. In August 1991 the CMA Board subsequently drafted and adopted a joint powers agreement, which was ratified by the 15 cities/towns and the County Board of Supervisors.

In December 1994, the fifteen cities/towns and the County of Santa Clara passed resolutions designating the Santa Clara County Transit District as the CMA for Santa Clara County. On January 1, 1995 the two agencies formed what was to become the Valley Transportation Authority (VTA). Staff within VTA's Planning & Program Division now performs the functions previously performed by the CMA staff.

The VTA Board of Directors consists of elected governing board officials from VTA's Member Agencies, which are the 15 cities and towns within Santa Clara County and the County of Santa Clara. Membership attempts to balance regional representation and population, and all jurisdictions within the county have representation on the Board. The Board consists of 12 voting members with alternates, with 10 positions representing the 15 cities/towns within the county and the remaining two positions representing the County of Santa Clara. Board members are appointed by the jurisdictions they represent. In addition, the Board includes three ex-officio, non-voting positions representing the Metropolitan Transportation Commission (MTC).

Given the range and complexity of the policy issues they deal with, the VTA Board of Directors has established a set of committees to advise it on policy matters and to provide for in-depth review of individual issues before the Board of Directors takes final action.

Advisory Committees

The Board has established five advisory committees to provide it advice and perspective: Bicycle and Pedestrian Advisory Committee (BPAC); Citizens Advisory Committee (CAC); Committee for Transportation Mobility and Accessibility (CTMA); Policy Advisory Committee (PAC); and Technical Advisory Committee (TAC).

- BPAC consists of sixteen members, one individual representing each Member Agency local bicycle and pedestrian advisory committee. The BPAC advises the VTA Board on planning and funding issues related to bicycle and pedestrian mobility and access. The BPAC also serves as the bicycle and pedestrian advisory committee for the County of Santa Clara.

- CAC is a 17 voting member committee representing the residents of Santa Clara County, as well as specified community stakeholder groups with an interest in transportation including business, labor, environmental, and community interests. The CAC advises the VTA Board on issues impacting the communities and organizations they represent. It also serves as the independent Citizens Watchdog Committee for the 2000 Measure A Transit Improvement Program, and as the 2008 Measure D ballot-specified advisory body that reviews and comments on VTA's comprehensive transit program as part of the countrywide transportation plan.

- CTMA consists of seven representatives of human services organizations, seven representatives that are either senior citizens or individuals with disabilities, and three representatives from either category. It advises the Board on transportation mobility and accessibility issues for senior citizens and persons with disabilities, paratransit services, accessibility to VTA transit services, and VTA’s efforts to comply with the federal Americans with Disabilities Act (ADA).

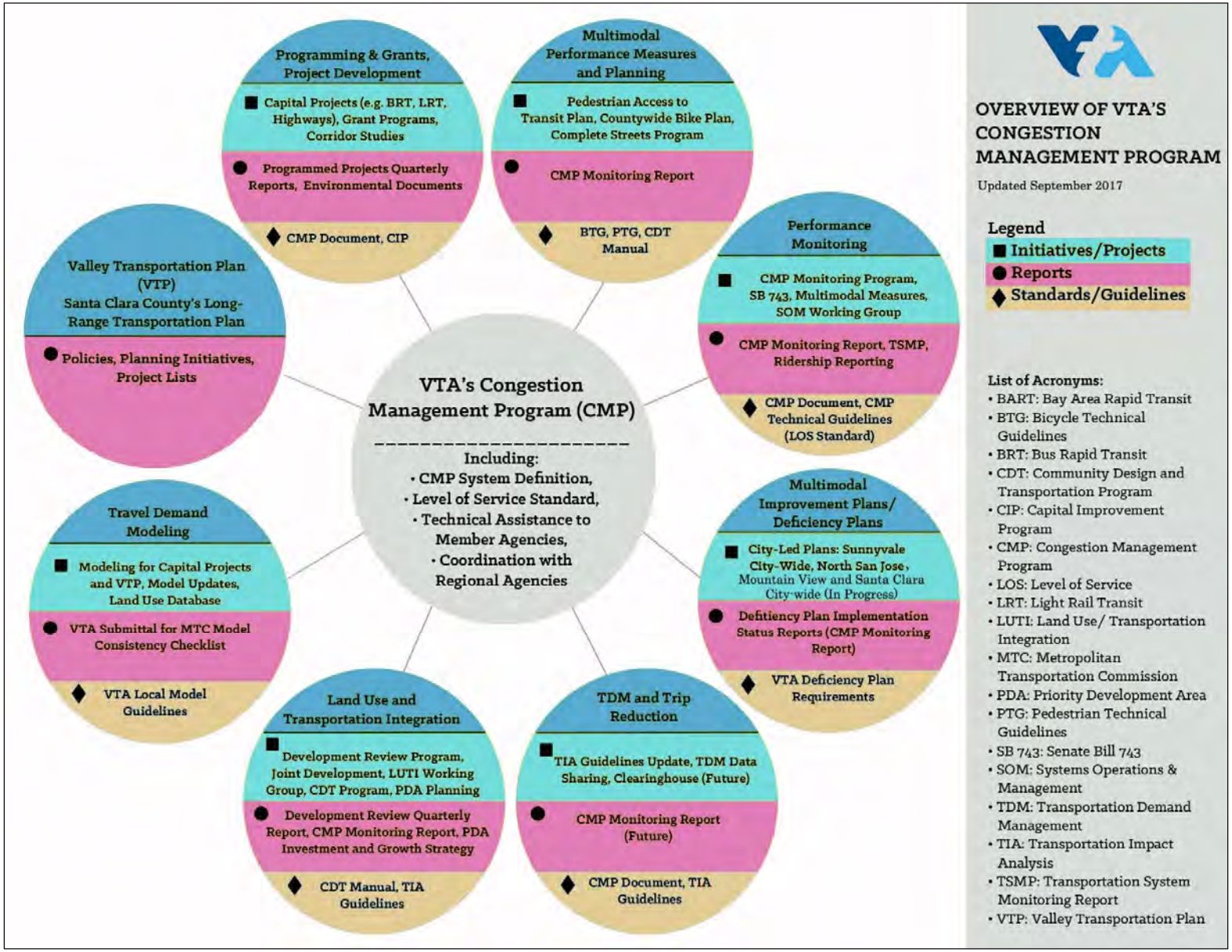
- PAC consists of one elected governing board member from each of VTA’s Member Agencies. It ensures that all local jurisdictions have the opportunity to participate in the development of VTA's policies.

- TAC consists of one senior management level staff member (generally the public works, planning or transportation director) from each Member Agency. The TAC provides technical expertise on transportation projects, programs, funding, and other policy matters.

Over the past several years, VTA has worked with Member Agencies to develop policies, programs, and methodologies to promote multimodal transportation planning and land use/transportation integration. A representation of these efforts and how they relate to the CMP is provided in Figure 2.1, below. Some of the initiatives have included:

- Developing a Transit Sustainability Policy (TSP) that sets the policy framework for monitoring existing transit service and implementing new transit service in Santa Clara County;
- Working with local agencies to plan for infill development around existing transit stations through the Joint Development Program;
- Working with local agencies to update the CMP Deficiency Plan Requirements and Transportation Impact Analysis (TIA) Guidelines;
- Promoting the principles and design criteria included in the Community Design and Transportation (CDT) Manual of Best Practices for Integrating Transportation and Land Use;
- Working with ABAG and MTC to encourage infill development around the core transit network through the Priority Development Area (PDA) Investment & Growth Strategy.

FIGURE 2.1 | OVERVIEW OF VTA'S CONGESTION MANAGEMENT PROGRAM



CMP ROADWAY NETWORK

The CMP Statutes require that all state highways and principal arterials be part of the CMP roadway network. The statute also specifies that roadways can be added to the CMP roadway network in the future. However, once a roadway is added to the network it may not be removed.

Figure 2.2 and Figure 2.3 show the CMP roadway network and intersections, respectively. The network consists of four types of facilities: freeways, county expressways, urban arterials, and rural highways. The roadway network was adopted as part of the 1991 CMP. Since 1991 improvements have been made to the network, including:

- In 1995, SR 85 was completed, Highway 87 was extended from Almaden Expressway to SR 85, and Highway 237 was upgraded to full freeway status from Highway 101 in Mountain View to Highway 880.
- In 1998, Wolfe Road between Stevens Creek Boulevard and I-280 in Cupertino was added to the network.
- Between 2005 and 2007 carpool lanes were added on Highway 87.
- In 2012 the SR 237/I-880 connector express lane opened.
- In 2013 carpool lanes were added to I-880 between SR 237 and US 101.

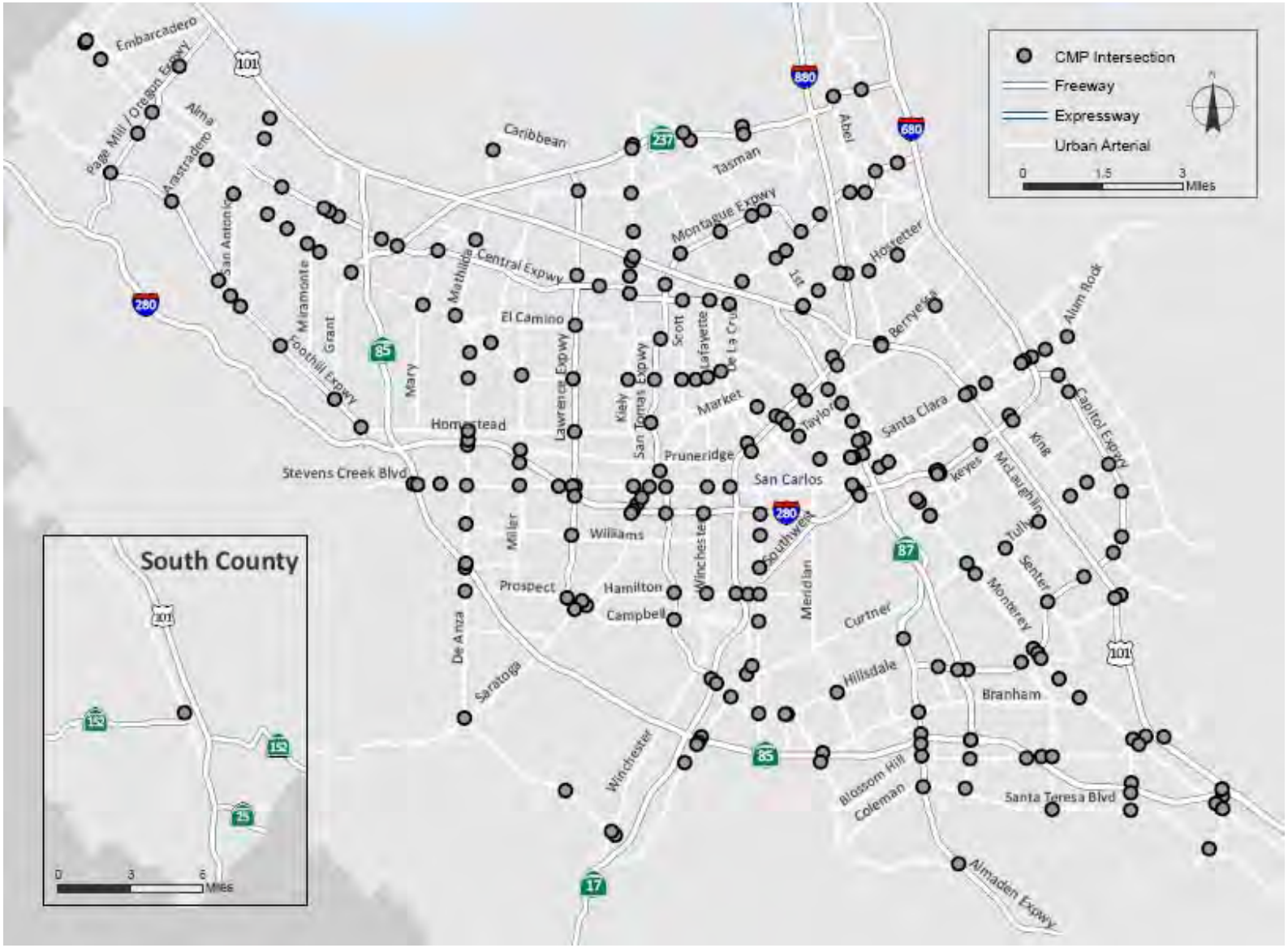
Appendix B lists the roadway segments that are part of the roadway network. The CMP roadway network is monitored regularly to ensure that the roadway network conforms to the CMP auto level of service standard.

The definition of principal arterial is left to individual CMAs. VTA defines urban arterials as roadways that connect with the freeway and/or county expressway system and principal arterials. To be classified as a principal arterial the road must meet one of the following criteria:

- State highway;
- Six-lane facility; or
- Non-residential arterial with average daily traffic (ADT) of 30,000 vehicles per day or greater.

FIGURE 2.2 | CMP ROADWAY NETWORK

FIGURE 2.3 CMP INTERSECTIONS



CMP TRANSIT NETWORK

The CMP statute does not require adoption of a transit network, but does emphasize the importance of transit service. Furthermore, legislation enacted in 1994 requires that CMPs include multimodal transportation system performance measures which incorporate "measures established for the frequency and routing of public transit, and for the coordination of transit service provided by separate operators." (Gov. Code 65089 (b) (2)). As a result, the VTA CMP contains a transit network. The CMP transit network consists of rail transit service (Caltrain, Light Rail, and future BART service) and bus service (grid routes and regional routes). The CMP transit network is illustrated in Figure 2.4. Appendix C lists the routes that are part of the transit network.

EXISTING TRANSIT SERVICE

Santa Clara County is currently served by two major transit operators: the Santa Clara Valley Transportation Authority (VTA) and Caltrain. VTA operates public transit buses, light rail, shuttles, and paratransit within Santa Clara County, as well as providing transit service to major regional destinations and transfer centers in adjoining counties. There are a number of other operators that provide some service within Santa Clara County. Brief descriptions of the different existing services and operators are provided below.

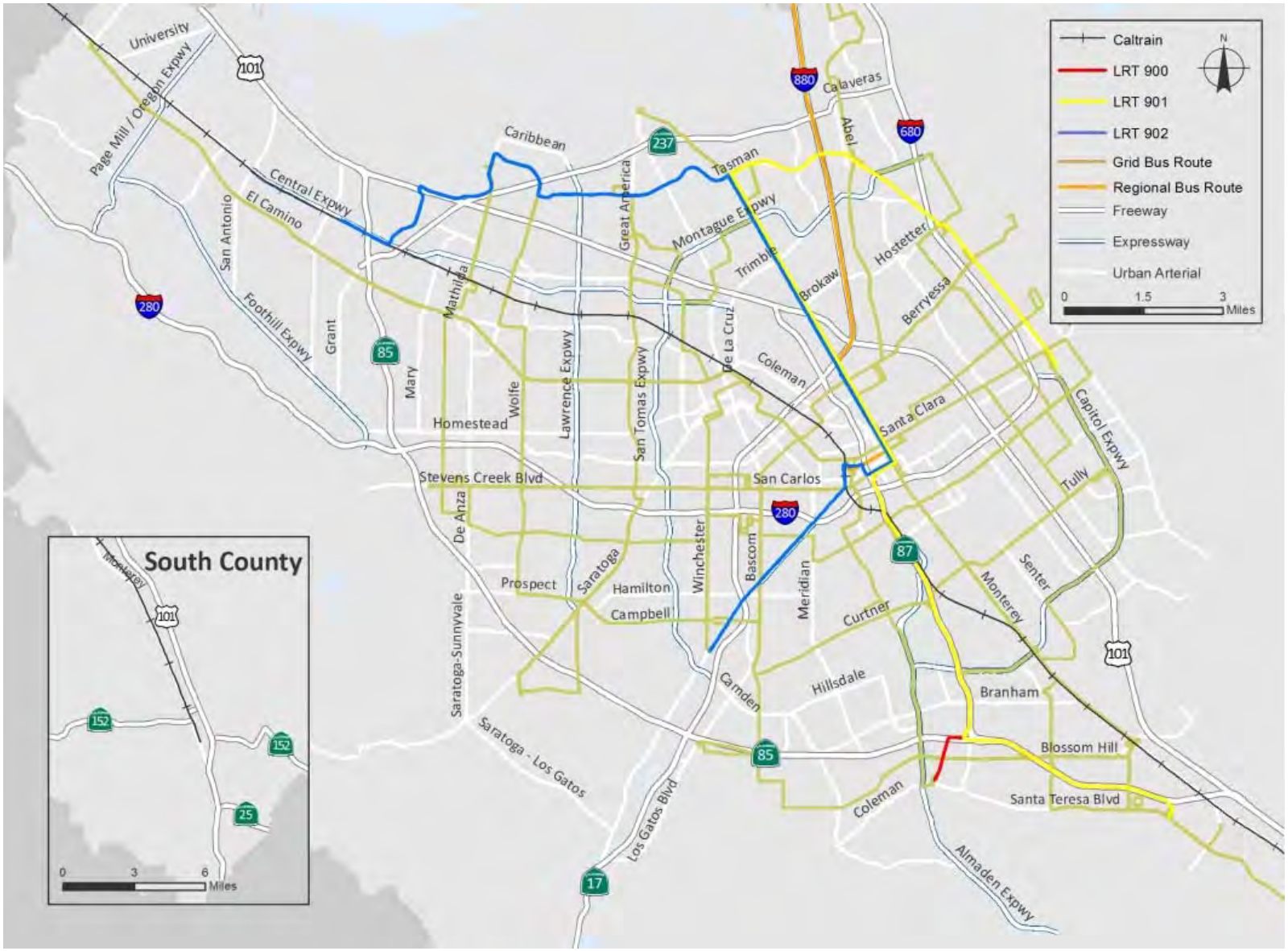
VTA Light Rail — VTA currently operates a 42-mile light rail system linking South San Jose, East San Jose, Downtown San Jose, North San Jose, Campbell, Santa Clara, Milpitas, Sunnyvale, and Mountain View.

VTA Core/Grid Bus Routes — Operated by VTA, core grid routes are the lifeblood of the bus route network. These routes are typically long mainline routes that operate along major corridors and serve the urbanized areas of Santa Clara Valley. They are relatively straight, evenly spaced bus routes operate from early morning into the late evening. Line 22, a grid line, provides the highest ridership line in the bus system. This route provides east-west service along El Camino Real, Santa Clara Street, and Alum Rock Avenue between the Eastridge Shopping Center in San Jose and the Palo Alto Transit Center.

VTA Regional Bus Service — Regional bus routes serve intercity, long distance trips. Two regional bus routes are currently included in the CMP transit network: Highway 17 Express and the Dumbarton Bridge Express (described below) are operated and funded jointly with neighboring counties and transit operators.

Dumbarton Express Bus (DB) — VTA is a member of a consortium including Alameda-Contra Costa Transit District (AC Transit), BART and Union City Transit. This group is responsible for funding and overseeing the operation of the Dumbarton Bridge (DB) weekday express bus services, DB and DB

FIGURE 2.4 | CMP TRANSIT NETWORK



1. These express buses link the Union City BART station in Alameda County to the Palo Alto Transit Center, Stanford University and the Stanford Research Park.

Highway 17 Express Bus Service — VTA and the Santa Cruz Metropolitan Transit District (SCMTD) jointly fund and oversee the operation of the Highway 17 Express bus service between the cities of Santa Cruz, Scotts Valley, and downtown San Jose.

Caltrain — Caltrain operates 77 miles of commuter rail service between San Francisco and San Jose throughout the day and extended rail service from San Francisco to Gilroy during commute periods. The service is operated under the authority of the Peninsula Corridor Joint Powers Board (JPB) consisting of VTA, SamTrans and San Francisco MUNI. SamTrans acts as the operator of the service on behalf of the JPB. On an average weekday, Caltrain operates 92 trains - including 22 Baby Bullet trains, which provide limited stop service along the corridor.

SamTrans — San Mateo County Transit District (SamTrans) provides bus service in San Mateo County, including connections at the Palo Alto Transit Center in Santa Clara County.

AC Transit Service — Alameda-Contra Costa Transit District (AC Transit) provides bus service within Alameda County and provides connections to VTA transit facilities in Milpitas, including VTA's LRT and local buses at the Great Mall Transit Center.

Altamont Corridor Express (ACE) — The Altamont Corridor Express (ACE) rail service is overseen by a Joint Powers Authority created by the Alameda County Congestion Management Agency, VTA, and the San Joaquin Regional Rail Commission. ACE service extends approximately 85 miles from Southern San Joaquin County through the Tri-Valley area and Alameda County to Santa Clara County's Great America, Santa Clara University and San Jose Diridon stations. The service operates four round trips daily during the weekday peak commute periods. The trains operate in the peak direction only, originating in Stockton during the morning peak period and leaving San Jose Diridon Station during the evening peak period. Eight ACE Shuttle routes, operated by VTA, provide "last mile" connections from the Great America station to destinations throughout northern Santa Clara County.

Capitol Corridor Intercity Rail Service — Capitol Corridor is 170 mile commuter rail service that links Sacramento, Oakland and San Jose (Santa Clara/Great America and San Jose Diridon stations). The service is managed by BART and VTA is a member of the Joint Powers Board, which oversees the service. The Capitol Corridor intercity rail service provides seven daily round trips from Sacramento via Oakland to San Jose and additional daily round trips from Sacramento to Oakland with connecting motorcoach bus service to San Jose.

PLANNED TRANSIT IMPROVEMENTS

There are a number of transit improvements and capital projects planned within Santa Clara County in the coming years. The following is a description of several planned improvements. This section is not meant to be an exhaustive list, but rather to highlight key projects in the planning and/or design stages.

BART Silicon Valley – VTA has partnered with BART to develop an extension of the rail system from Fremont to Santa Clara via Milpitas and San Jose. The planned 16.1-mile extension of the BART system will operate along the existing railroad alignment south of the BART Warm Springs Station in Fremont, continue in a tunnel through downtown San Jose, and end near the Santa Clara Caltrain Station. The BART extension from Fremont to Warm Springs is now complete. The extension from Warm Springs to Santa Clara County will be delivered in two phases. The first phase of the extension, from Warm Springs to Berryessa, broke ground in 2012 and is expected to be complete by 2018. VTA is currently conducting the environmental analysis of the second phase in the BART to Silicon Valley project, a 6-mile link from Berryessa to Downtown San Jose, Diridon Station, and the Santa Clara station near the Mineta San Jose International Airport. This section includes 5 miles of tunnel construction.

Light Rail Enhancement Project — VTA's Light Rail Enhancement Project is advancing a series of capital improvements and service changes that were recommended in the 2010 Light Rail Improvement Plan. These changes are necessary to support anticipated growth in the county, including increased density in key areas identified by local governments, as well as the opening of the San Francisco 49ers Levi's Stadium, and the upcoming extension of BART service to Silicon Valley. Investment in these capital improvements and new service will enable VTA to meet increased ridership demand and improve the system for current riders. Current modeling projects that these changes, when fully implemented, will result in travel time savings of as much as 20 - 30% between key origins and destinations.

The Light Rail Enhancement Project will focus on the following key improvements:

- Initiating a new operating plan to serve the anticipated increase in ridership from the BART Silicon Valley Extension. This will include adding a new line to the Light Rail system to provide a direct connection from the future Milpitas BART station to destinations in Santa Clara, Sunnyvale and Mountain View.
- Speed and reliability improvements along North First Street in San Jose.
- Safety and reliability improvements in Downtown San Jose.
- Signal timing and other speed improvements system-wide.

Bus Rapid Transit — Bus Rapid Transit (BRT) refers to a combination of capital and service design improvements, designed to provide faster, more efficient service than standard bus transit. VTA

implements BRT projects in phases, with the first Rapid phase focusing on service design improvements such as simple/direct routing, limited stops, frequent headways, generous hours of operation, and specialized vehicles. These service design improvements are paired with transit signal priority measures, queue-jump lanes, and other small-scale corridor infrastructure improvements to increase the route's speed as a Rapid service. The second BRT phase involves more significant corridor infrastructure improvements, including dedicated transit lanes and upgraded stations, to prioritize transit in the corridor. VTA's Rapid 522 is VTA's first implementation of Rapid service. The line serves El Camino Real, The Alameda, Santa Clara Street and King Road between Palo Alto and the Eastridge Shopping Center in San Jose. The route also features a BRT segment between Downtown San Jose and the Eastridge Transit Center with a dedicated lane segment and upgraded stations.[2]

Building on the success of Rapid 522, VTA will implement two new Rapid services in mid-2018, both connecting to the Berryessa BART station in North San Jose. Rapid 523 will provide a fast and frequent connection between Berryessa BART and downtown San Jose, Stevens Creek Boulevard, De Anza College, downtown Sunnyvale, and Lockheed Martin Transit Center. Rapid 500 will provide fast and frequent service between Berryessa BART, downtown San Jose, and San Jose Diridon Station.

Transit Network Redesign – In mid-2018, concurrent with the opening of the Silicon Valley Berryessa BART Extension, VTA will implement a completely redesigned transit network aimed at maximizing ridership by prioritizing frequent service along transit-supportive corridors. Along with the new transit service network, VTA will implement a number of changes designed to make the transit network easier to understand and use, including a redesigned transit map, new bus stop signage, and new transit hand schedules.

Frequent Transit Network – As part of its transit system redesign for implementation in mid-2018, VTA will introduce a new network of frequent routes that will form the backbone of VTA's transit network. These bus and light rail routes will operate along transit-supportive dense urban arterials every 15 minutes or better on weekdays, and will collectively form a grid to maximize the number of trips possible on the transit network.[3]

Caltrain Modernization Program – This project includes the electrification of the existing Caltrain corridor between the 4th and King Station in San Francisco and Tamien Station in San Jose, upgrades to Caltrain's signaling system, construction of overhead catenary, and the replacement of a majority of Caltrain's diesel trains with high-performance electric trains. These improvements will support a blended High Speed Rail/Electrified Caltrain rail system on the existing two track configuration. These

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This service is termed 'BRT 1' in VTA's *Service Design Guidelines.*

This network of frequent routes will be implemented in mid-2018 filling the role of VTA's existing Core Network.

investments will realize early implementation of modernized electrified Caltrain service by 2022, reduce noise and air pollution, minimize impacts on surrounding communities, reduce project costs, and expedite the implementation of High Speed Rail.

High Speed Rail - VTA has also coordinated with the State High Speed Rail Authority (HSRA) on their efforts to develop high-speed rail service from Southern California to San Francisco. VTA's stake in High Speed Rail (HSR) comes in several areas:

- VTA will work with the HSRA, the JPB and local cities on planning and engineering studies defining capital improvements in the alignment and an ultimate corridor "footprint".
- VTA will work with the JPB and local cities on specific HSR projects, such as grade separations, impacting local road systems and the rail alignment.
- VTA will work with cities on station area plans and land use issues.

CMP BICYCLE NETWORK

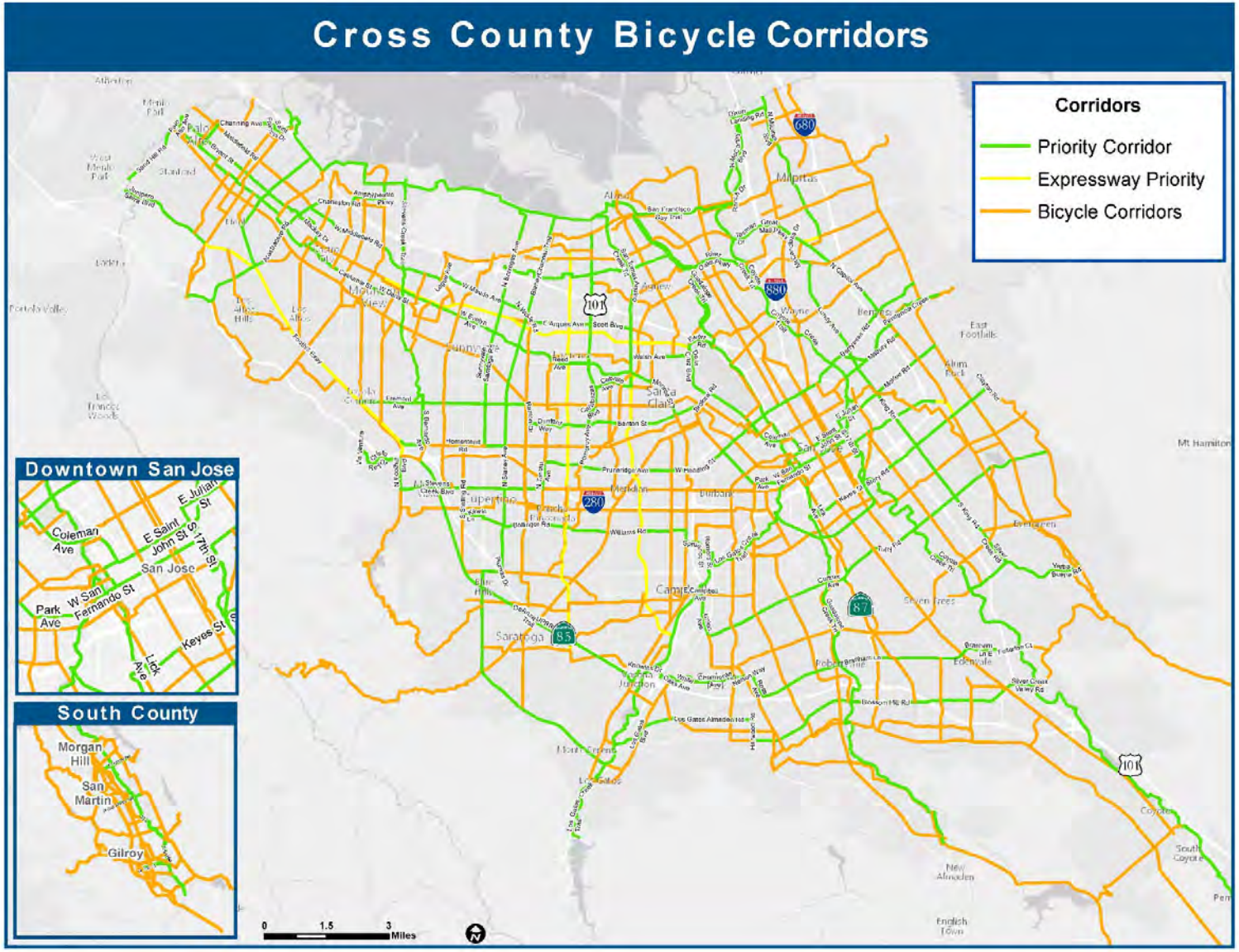
Bicycles play a significant role in the transportation system. They provide direct transportation as well as access to transit services. Therefore, while not a requirement of the CMP Statute, VTA has included a bicycle network as part of its CMP Transportation System.

VTA is currently in the process of updating the Santa Clara Countywide Bicycle Plan (CBP), which was last adopted in 2008. The CBP identifies Cross County Bicycle Corridors (CCBC) and barriers to bicycle route connectivity which require improvements such as freeway interchanges, or bridges without bicycle facilities. The current update expands the plan in several ways, and is a collaborative effort between VTA, Member Agencies, and members of the public. The update focuses on bicycling for all ages, and adds new low-stress corridors to the CCBCs. The update also uses a geographic analysis and public input to prioritize CCBCs, and sets expectations for the quality of bicycle infrastructure on priority CCBCs. The update will also include an implementation plan, and showcase out-of-the-box projects to inspire the community, elected officials, and city staff.

The draft 2017 CCBCs are shown in Figure 2.5. Priority corridors are highlighted.

The Countywide Bicycle Plan forms the basis for the financially constrained list of bicycle projects considered for Valley Transportation Plan 2040 (VTP). This list, the Bicycle Expenditure Program (BEP), will be updated with the next update of the VTP. Additionally, projects within the Countywide Bicycle Plan are eligible to compete for 2016 Measure B Bicycle and Pedestrian funds.

FIGURE 2.5 | CROSS COUNTY BICYCLE CORRIDORS



CHAPTER 3 | TRANSPORTATION ANALYSIS STANDARDS ELEMENT

This chapter describes VTA's Congestion Management Program (CMP) transportation analysis standards. It includes the following five sections:

- CMP Transportation Analysis Standards – Current Practice and Potential Future Updates
- CMP Auto Level of Service Standards
- CMP Auto Level of Service Evaluation Techniques
- CMP Roadway Network Level of Service
- Compliance and Conformance

CMP TRANSPORTATION ANALYSIS STANDARDS – CURRENT PRACTICE AND FUTURE UPDATES

BACKGROUND

For the purpose of congestion monitoring and management, the CMP statute requires that CMAs develop a minimum auto level of service (LOS) standard for CMP Network roadways. Government Code Section 65089 (b) states that the CMP shall contain "Traffic level of service standards established for a system of highways and roadways designated by the agency." In addition, the CMP statute states that "In no case shall the LOS standards established be below the level of service E or the current level, whichever is farthest from level of service A." Thus, the statutes also allow for CMP System facilities that were operating at LOS F during the baseline year to remain at LOS F.

The CMP statute was amended in 1994 (Assembly Bill (AB) 1963, Katz) to require that the CMP include multimodal transportation system performance measures. Although VTA satisfied this requirement by establishing CMP Performance Measures for Santa Clara County (see Chapter 3), these performance measures are informational in nature and are not used to determine Member Agency conformance with the CMP in the Monitoring or Land Use Impact Analysis Programs. The CMP auto LOS standard is the only transportation analysis standard used to determine conformance with the CMP.

The CMP auto LOS standard is used by Member Agencies to analyze transportation impacts and mitigation measures for CMP facilities both when preparing a Transportation Impact Analysis (TIA) report for CMP purposes and when analyzing environmental impacts of a project per the California Environmental Quality Act (CEQA). The CEQA Guidelines establish the link between CEQA and the CMP by including the following question in the Appendix G Checklist:

- "Would the project… b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?"

SENATE BILL (SB) 743 – CHANGES TO TRANSPORTATION ANALYSIS IN CEQA

In September 2013, the California legislature enacted Senate Bill (SB) 743, directing the Governor's Office of Planning and Research (OPR) to develop new significance criteria to evaluate transportation impacts under CEQA. Notably, the bill states that once the new criteria are adopted, "Automobile delay, as described solely by level of service or similar measures of vehicular capacity or traffic congestion, shall not be considered a significant impact on the environment" in the locations where the new criteria will apply (21099 (b) (2)). SB 743 gave OPR discretion to determine the specific metric(s) to replace LOS, based on the criteria that the new metric(s) "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses" (21099 (b) (1)). In addition, the bill required that the new metric(s) apply within Transit Priority Areas[1] but allowed OPR to apply the new metrics in other locations as well. OPR released a *Preliminary Evaluation of Alternative Methods of Transportation Analysis* in December 2013, which included an initial discussion of various alternative metrics such as vehicle miles traveled (VMT), automobile trips generated, multimodal level of service, fuel use, motor vehicle hours traveled, and a presumption of less than significant impacts based on location.

Recognizing the magnitude of this change to transportation analysis on the horizon, VTA brought informational presentations on SB 743 to the Systems Operations & Management (SOM) and Land Use / Transportation Integration (LUTI) Working Groups, VTA Advisory Committees and the Congestion Management Program and Planning Committee (CMPP) in early 2014. VTA staff also participated in Bay Area CMA staff-level working groups on SB 743 and was involved in discussions of SB 743 through the Bay Area CMA Directors and Bay Area CMA Planning Directors meetings. In addition, VTA staff engaged the Governor's Office of Planning and Research (OPR) directly through phone calls and submitted a comment letter in April 2014 addressing potential statewide implementation of new metrics, threshold-setting, and impacts to transit facilities.

In August 2014, OPR released a *Preliminary Discussion Draft of Updates to the CEQA Guidelines Implementing Senate Bill 743*. This document indicated that OPR intended to replace LOS with VMT in the evaluation of transportation impacts, and that the new criteria would apply statewide. Specifically, the document suggested the following transportation impact thresholds:

[1] See Appendix A – Glossary for definition.

- Land use development projects that result in vehicle miles traveled greater than the regional average for that land use type may indicate a significant impact. Projects within ½ mile of frequent transit service, projects that reduce area-wide VMT, and land use plans that are consistent with the applicable Sustainable Communities Strategy may be presumed to have less than significant impacts.

- Transportation projects that include new general purpose highway or arterial lanes, and other projects that induce vehicle travel, may have significant impacts. Projects to primarily improve safety or operations and multimodal (transit, bicycle or pedestrian) improvements may be presumed to have less than significant impacts.

The *Preliminary Discussion Draft* also included guidelines for the analysis of safety impacts, mitigation measures and alternatives.

VTA continued the process of engagement with Member Agencies, other Bay Area CMAs and OPR, and submitted a comment letter on the *Preliminary Discussion Draft* in November 2014. Overall, VTA supported OPR's effort to shift the emphasis of transportation analysis from LOS to VMT and apply the new criteria statewide. VTA also provided detailed comments on the link between CEQA and the CMP, the analysis of VMT impacts of land use and transportation projects, safety impacts, impacts on bicycle, pedestrian and transit facilities, mitigation measures, and the implementation process.

In January 2016, OPR released a *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA.* This document is available on the OPR website at https://www.opr.ca.gov/s_sb743.php. VTA staff brought an update on SB 743 to VTA Advisory Committees and CMPP, and submitted a comment letter to OPR, in February 2016. In the letter, VTA encouraged OPR to move its process forward in a timely manner, offered suggestions regarding transit, bicycle and pedestrian analysis, commented on the role of Congestion Management Programs, and provided other detailed technical comments.

While OPR has not yet submittal final draft guidance to the Secretory of Natural Resources for rule-making as of September 2017, some cities (such as San Francisco, Oakland and Pasadena) have already changed their CEQA metrics and practices, and other cities (such as City of San Jose) are in the process. Based on indications from OPR, VTA expects that mandatory statewide implementation of VMT analysis to replace LOS analysis in CEQA will be phased in over the next few years. VTA will continue to monitor the SB 743 implementation process and provide assistance to Member Agencies in updating local CEQA standards, and considering potential changes to the CMP and Technical Guidelines as appropriate.

POTENTIAL UPDATES TO THE CMP IN RESPONSE TO SB 743

As noted above, the current CEQA Guidelines include an explicit linkage between the CMP and CEQA within the Appendix G Checklist. One question that remains to be resolved as SB 743 implementation moves forward is whether this link will be retained. However, with or without the explicit linkage, it will be desirable for the transportation analysis required by the CMP to be compatible with the transportation analysis required by CEQA.

During discussions with Member Agencies, Bay Area CMAs and OPR, the issue has been raised that a CEQA requirement to analyze and mitigate VMT impacts could be in conflict with the requirement in the CMP to maintain certain transportation facilities at LOS E. For example, a VMT threshold in CEQA leads to the goal to reduce the overall amount of vehicle travel generated by the project, which could incentivize developers to locate projects in infill locations within walking distance of existing jobs, homes, retail, services and transportation facilities. However, this strategy could result in additional traffic on CMP facilities already at LOS E or F, which could result in significant impacts according to CMP criteria. Similarly, to mitigate a facility back to compliance with the CMP LOS standard could require adding auto capacity in the form of additional turn lanes or through lanes, but such mitigation measures could also induce additional vehicle travel and degrade conditions for pedestrian, bicycle and transit modes, potentially increasing VMT.

In February 2015, legislation (AB 1098) was introduced that would amend California Statutes related to the CMP for consistency with the new CEQA metrics under development per SB 743. However, this bill did not advance through the legislative process. VTA will continue to monitor this issue and other legislation affecting the CMP that may be introduced in the future.

Regardless of the timing of amendments to the CMP statutes, VTA intends for the CMP to be compatible with the transportation analysis requirements of CEQA and support the stated goals of SB 743 to “promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses.” The CMP auto LOS standard described in the remainder of this chapter should be considered one piece of the overall CMP toolkit for evaluating land use developments and transportation capital projects along with the Multimodal Performance Measures (Chapter 4), Transportation Demand Management (Chapter 5), Land Use and Transportation Integration efforts (Chapter 5), and Multimodal Improvement Plans (Chapter 10). Altogether, these elements of the CMP are designed to support a sustainable multimodal transportation system for Santa Clara County.

CMP AUTO LEVEL OF SERVICE STANDARDS

Auto Level of Service (LOS) describes the operations of roadway segments or intersections in terms of vehicle speed, volume and capacity, freedom of movement, and traffic delay. LOS measurements are given by letter designations, from A (least congested) to F (most congested).

The LOS standards for Santa Clara County were established in October 1991. The minimum level of service is LOS E, except for facilities grandfathered in at LOS F. The performance of the CMP facilities is monitored at a minimum every two years. If the minimum level of service cannot be maintained on a CMP roadway, Member Agencies must develop Multimodal Improvement Plans to remain in conformance with the CMP. For complete descriptions of the LOS grading scales for the CMP Roadway Network refer to Appendix E.

The LOS of each CMP facility was originally evaluated in the base year of 1991. Baseline trips were defined as the total number of vehicles trips for existing year 1991 traffic plus new trips generated from all approved projects. The baseline auto LOS is the point of comparison for determining conformance with the CMP auto LOS standard. Approved project traffic was included in the 1991 baseline to ensure that all traffic which would be added to CMP roadways was included in the analysis and to ensure that development projects that had received final land use approval would not penalized by the CMP. Existing 1991 data and any anticipated project traffic data were provided by Member Agencies.

The VTA CMP auto LOS standards consist of the following:

1. The CMP auto LOS standard is LOS E. This standard applies across the CMP roadway network, including freeways, urban arterials, County Expressways, and rural highways.
2. Facilities that have a baseline (1991) LOS F for the AM or PM peak period are allowed to remain at LOS F. These facilities are listed in Tables 3.1 and 3.2 and shown in Figures 3.1, 3.2, and 3.3 below. It is important to note these facilities are not exempt from California Environmental Quality Act (CEQA) and National Environmental Protection Act (NEPA) review requirements when applicable.
3. If the auto LOS for a CMP facility is currently LOS F and the facility is not included in an approved Multimodal Improvement Plan, then a project is said to impact the facility if it will cause changes to traffic conditions greater than the following thresholds:
    - **Intersections at LOS F:** addition of the project traffic increases the average control delay for critical movements by four (4) seconds or more, and project traffic increases the critical volume-to-capacity ratio (v/c) by 0.01 or more.

- **Freeway Segments at LOS F**: the number of vehicle trips added by the project is more than one percent of the freeway capacity (the calculation shall be for each direction of travel).
- **Rural Highway at LOS F:** the number of vehicle trips added by the project is more than one percent of the rural highway capacity.

It is important to emphasize that local land use and mitigation decisions can be made based on a stricter LOS standard if established by a Member Agency.

FIGURE 3.1 | FREEWAY SEGMENTS OPERATING AT LOS F IN THE 1991 BASELINE AM PEAK PERIOD

FIGURE 3.2 | FREEWAY SEGMENTS OPERATING AT LOS F IN THE 1991 BASELINE PM PEAK PERIOD

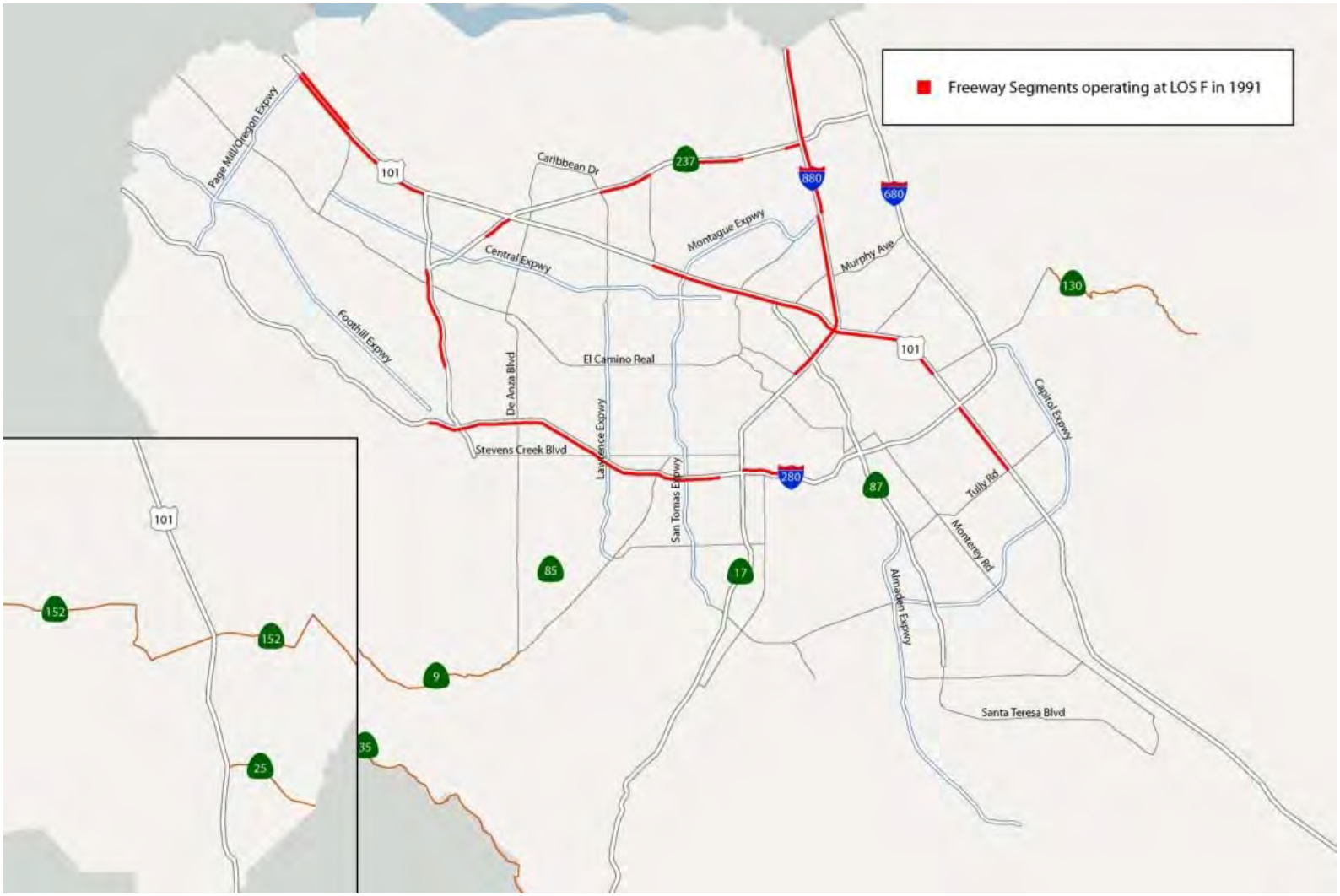


TABLE 3.1 | FREEWAY SEGMENTS AT LOS F IN EITHER 1991 BASELINE PERIOD

CMP ID	Facility	Dir	From/To	From/To	Miles	LOS F	
						AM	PM
1	I-880	NB	SR 237	Dixon Landing	1.99		X
2	I-880	NB	Great Mall Pkwy	SR 237	0.72		X
3	I-880	NB	Montague Expwy	Great Mall Pkwy	0.98		X
5	I-880	NB	US 101	E. Brokaw Rd	1.29	X	
6	I-880	NB	N. 1st ST	US 101	0.49	X	
7	I-880	NB	SR 87	N. 1st ST	0.4	X	
8	I-880	NB	Coleman Ave	SR 87	0.51	X	
9	I-880	NB	The Alameda	Coleman Ave	0.59	X	
10	I-880	NB	N. Bascom Ave	The Alameda	0.82	X	
11	I-880	NB	Stevens Cr	N. Bascom Ave	0.84	X	
12	I-880	NB	I-280	Stevens Cr	0.41	X	
16	I-880	SB	Montague Expwy	E. Brokaw Rd	1.35		X
17	I-880	SB	E. Brokaw Rd	US 101	1.29	X	X
18	I-880	SB	US 101	N. 1st ST	0.49		X
19	I-880	SB	N. 1st ST	SR 87	0.4		X
20	I-880	SB	SR 87	Coleman Ave	0.51		X
29	SR 17	NB	Saratoga	Lark Ave	1.81	X	
30	SR 17	NB	Bear Creek	Saratoga	2.9	X	
39	I-680	SB	King Rd	US 101	0.4	X	
40	I-680	SB	Capitol Expwy	King Rd	1	X	
77	SR 237	EB	McCarthy Blvd	I-880	0.4		X
79	SR 237	EB	N. First St	Zanker Rd	1.61		X
81	SR 237	EB	Lawrence Expwy	Great America Pkwy	1.27		X

FIGURE 3.3 | INTERSECTIONS OPERATING AT LOS F IN THE 1991 BASELINE PM PEAK PERIOD

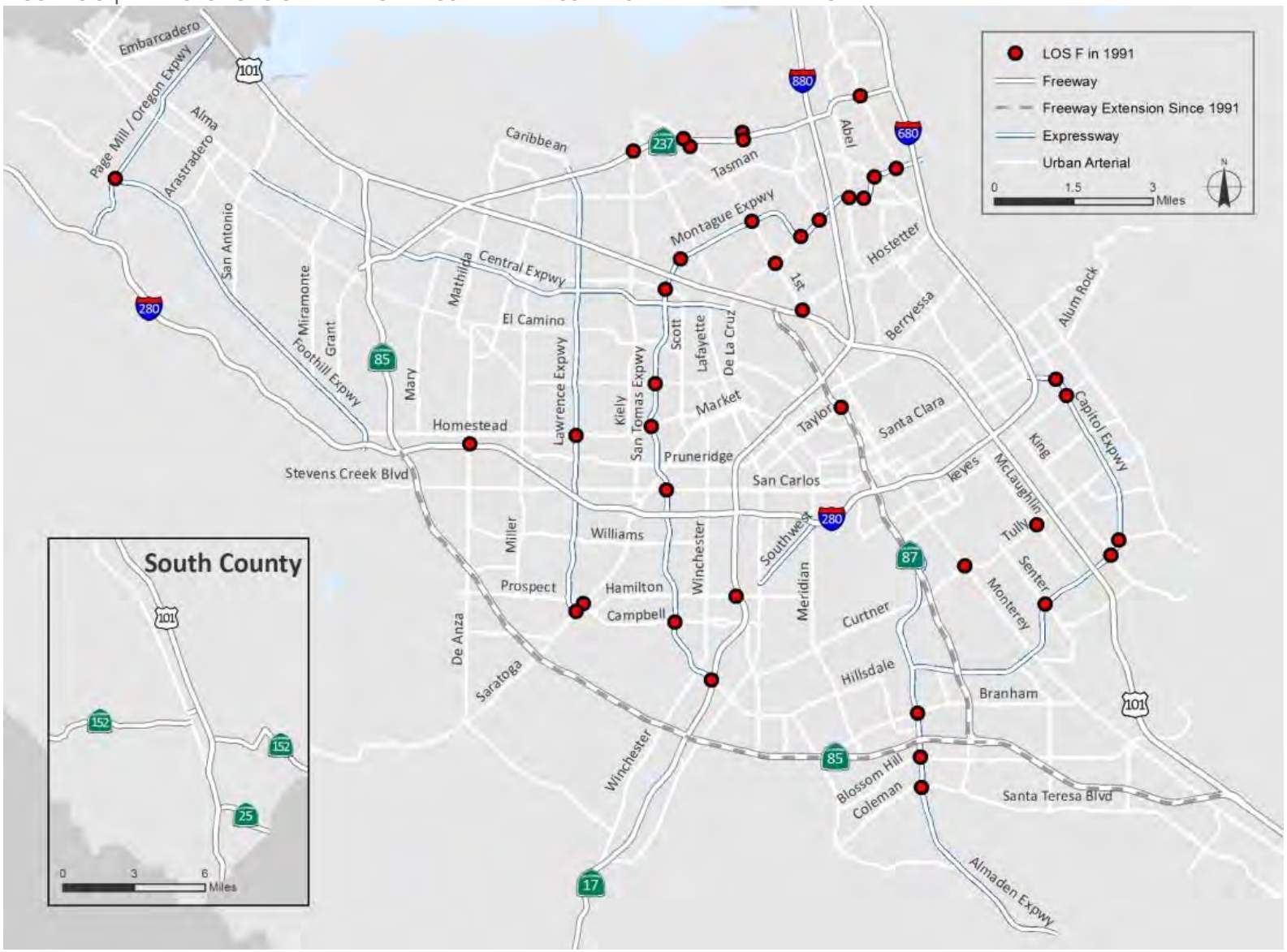


TABLE 3.2 | INTERSECTIONS OPERATING AT LOS F IN THE 1991 BASELINE PM PEAK PERIOD

ID	CMP System Roadway	Cross Street	Location	Jurisdiction
5802	Hwy 17 (SB)	Hamilton Av.	Campbell	State
3108	Hwy 17 (SB)	San Tomas Expwy./Camden Av.	Campbell	SC County
3101	San Tomas Exp.	Campbell Av.	Campbell	SC County
104	Hwy 280 NB Ramps	De Anza Blvd.	Cupertino	Cupertino
213	Calaveras Blvd. (Rte. 237)	Milpitas Blvd.	Milpitas	Milpitas
5720	Montague Exp.	Capitol Av.	Milpitas	SC County
5723	Montague Exp.	Milpitas Blvd.	Milpitas	SC County
5625	Montague Exp.	Main St./Old Oakland Rd.	Milpitas/San Jose	SC County
5801	Montague Exp.	McCarthy Blvd./O'Toole Av.	Milpitas/San Jose	SC County
5640	Montague Exp.	Trade Zone Blvd./McCandless	Milpitas/San Jose	SC County
3031	Page Mill/Oregon Exp.	Foothill Expwy.	Palo Alto	SC County
5405	Almaden Exp.	Blossom Hill Rd.	San Jose	SC County
5205	Almaden Exp.	Branham Ln.	San Jose	SC County
5408	Almaden Exp.	Coleman Rd.	San Jose	SC County
702	Brokaw Rd.	First St.	San Jose	San Jose
3026	Campbell Avenue	Saratoga Av.	San Jose	San Jose
5512	Capitol Exp.	Aborn Rd.	San Jose	SC County
5516	Capitol Exp.	Excalibur Dr. (Capitol Av.)	San Jose	SC County
5430	Capitol Exp.	Senter Rd.	San Jose	SC County
5432	Capitol Exp.	Silver Creek Rd.	San Jose	SC County
5513	Capitol Exp.	Story Rd.	San Jose	SC County
5803	Hwy 237	First St. (North)	San Jose	State
5804	Hwy 237	First St. (South)	San Jose	State
5805	Hwy 237	Great America Pkwy (N.)	San Jose	State
5807	Hwy 237	Great America Pkwy (South)	San Jose	State
5808	Hwy 237	Zanker Rd. (North)	San Jose	State
5809	Hwy 237	Zanker Rd. (South)	San Jose	State
5419	Lawrence Exp.	Saratoga Av.	San Jose	SC County
5732	Montague Exp.	First St.	San Jose	SC County
5734	Montague Exp.	Trimble Rd.	San Jose	SC County
3027	Monterey Hwy. (Rte. 82)	Curtner Av.	San Jose	San Jose

3028	Trimble Rd.	First St.	San Jose	San Jose
3030	Tully Rd.	McLaughlin Av.	San Jose	San Jose
5724	Montague Exp.	Mission College Blvd.	Santa Clara	SC County
3095	San Tomas Exp.	El Camino Real (Rte 82)	Santa Clara	SC County
3098	San Tomas Exp.	Homestead Rd.	Santa Clara	SC County
3090	San Tomas Exp.	Scott Blvd.	Santa Clara	SC County
3083	San Tomas Exp.	Stevens Creek Blvd.	Santa Clara/San Jose	SC County
5416	Lawrence Exp.	Homestead Rd.	Sunnyvale	SC County

CMP AUTO LEVEL OF SERVICE EVALUATION TECHNIQUES

In addition to adopting a Level of Service standard, the CMP statute requires that a uniform methodology be used to evaluate LOS on CMP System roadways. As part of the 1991 CMP development, the Technical Advisory Committee evaluated various LOS techniques and recommended that the Santa Clara County CMA use methodologies described in the 1985 Highway Capacity Manual (HCM) to evaluate LOS. The current VTA Traffic LOS Analysis Guidelines (2003) are based on the 2000 HCM.

The most recent edition of the HCM (2010) contains minor modifications to the methodologies for calculating automobile LOS on roadways, and also introduces new methodologies for evaluating level of service for non-auto modes including pedestrians, bicycles and transit. From 2011 to 2013, VTA staff engaged in an extensive program of testing, education and outreach on the new multimodal performance measures included in HCM 2010. Based on these activities as well as input from Member Agency staff, VTA staff concluded that the measures are not ready to be required for all CMP analysis, but could provide valuable information in certain cases, such as for development projects that propose changes to street geometry. For more information on HCM 2010 Multimodal Level of Service and other multimodal performance measures, see Chapter 4.

The CMP has two methods for monitoring the level of service of the CMP roadway network:

1. The CMP Monitoring and Conformance Report — A periodic study that collects level of service data on CMP roadways as well as land use approval data by Member Agencies.
2. Transportation Impact Analysis Requirement — The CMP requires cities and the County to prepare a Transportation Impact Analysis (TIA) that documents the impacts new developments would have on the CMP roadway network (as well as other parts of the transportation system) and the transportation improvements required to mitigate these impacts.

CMP LEVEL OF SERVICE METHODOLOGIES

The following section outlines specific auto LOS methodologies used in VTA's CMP. The Traffic LOS Analysis Guidelines of the CMP Technical Standards and Procedures include more technical information on auto LOS measurement.

Urban Arterials — The 2000 HCM intersection analysis operations methodology, which is based on Average Control Delay, is used to monitor auto LOS on urban arterials (this includes expressways and principal arterials).

Freeway Segments — Freeway segments are evaluated based on the procedures of the 2000 HCM. Beginning in June 2003, VTA adopted density as the standard for monitoring traffic conditions and traffic impacts due to new developments. Prior to 2003, the CMP used travel speed as the criteria for monitoring traffic conditions.

Rural Highways — Procedures described in Chapter 20 of the 2000 HCM are used to measure the percent time-spent following and average travel speed, with appropriate inputs for peak hour and peak 15 minute traffic volumes, the percentage split between the two directions of traffic, the percentage of trucks in the traffic flow, and the type of terrain.

CMP LOS CONFORMANCE EXCLUSIONS

The CMP legislation excludes certain types of traffic and situations from the determination of conformance with CMP traffic LOS standards (California Government Code Section 65089.4 (f), provided in Appendix J of this document). Exclusions can include traffic caused by interregional travel, construction, ramp metering, traffic signal coordination, and traffic generated by certain types of land use development. The VTA CMP Traffic Level of Service Analysis Guidelines contains complete information on how each of these exclusions is to be addressed in a TIA.

While the traffic problems caused by these situations are technically exempt under statute, local jurisdictions should try to develop solutions for congested roadway facilities to improve traffic conditions on the CMP System. VTA will assist Member Agencies in the effort. In addition, it is important to note that although these projects or situations are exempt from CMP standards, these exemptions do not necessarily apply to the CEQA process.

CMP ROADWAY NETWORK LEVEL OF SERVICE

The CMP Monitoring and Conformance Report summarizes the Level of Service for the CMP Roadway network. The 2016 CMP Monitoring and Conformance Report, the most recent edition released as of fall 2017, includes data from the baseline year (1991) through the year 2016. Auto

Level of Service data is presented for the three types of roadway facilities included in the CMP roadway network: arterial roadways (CMP intersection data), freeways, and rural highways.

A brief summary of the results from the 2016 report is provided below.

ARTERIAL ROADWAYS (CMP INTERSECTIONS)

Auto LOS data was most recently collected and evaluated by VTA and Member Agencies in the fall of 2016.The data collection for 2016 analyzed 242 of the 252 CMP intersections. Ten intersections were not analyzed due to ongoing construction activities during the data collection period. In 2016, there were six CMP intersections that operated below the CMP level of service standard. Five of these intersections, Page Mill Road/Oregon Expressway and Foothill Expressway, San Tomas Expressway and Campbell Avenue, Capitol Expressway and Aborn Avenue, Montague Expressway and Main Street/Old Oakland Road, and Montague Expressway at McCarthy Boulevard/O'Toole Avenue, are exempt from meeting CMP conformance requirements due to operating at LOS F under 1991 baseline conditions. One intersection, Central Expressway & De La Cruz Boulevard, has been operating at LOS F since 1996, prior to which it was operating at LOS E.

The non-exempt intersection of Foothill Expressway and El Monte Avenue was found to operate at LOS F for the first time since 2001 in 2014. However, in 2016 the LOS decreased to LOS E. The change in LOS may be in part due to changes in signal operations at the intersection. The County worked with VTA and the City of Los Altos to improve the LOS to an acceptable level while optimizing Expressway operations, and identify other offsetting measures.

Table 3.3 shows the percentage breakdown by level of service for all CMP intersections since 1991. The detailed listing of LOS levels at each CMP intersection is included in the 2016 Conformance and Monitoring Report.

TABLE 3.3 | CMP INTERSECTION LEVEL OF SERVICE BY PERCENTAGE, 1991 – 2016

LOS	1991	1992	1994	1996	1997	1998	2000	2001	2002	2004	2006	2008	2010	2012	2014	2016
A	4%	5%	4%	3%	1%	1%	1%	2%	0%	4%	3%	4%	4%	4%	4%	4%
B	19%	17%	18%	17%	19%	19%	18%	18%	19%	16%	15%	16%	15%	15%	15%	14%
C	13%	14%	23%	22%	22%	22%	24%	20%	21%	30%	30%	24%	30%	27%	28%	23%
D	27%	36%	37%	36%	31%	34%	34%	37%	40%	41%	41%	40%	38%	45%	38%	39%
E	19%	16%	14%	15%	18%	15%	12%	15%	14%	8%	10%	15%	12%	8%	12%	14%
F	17%	11%	4%	7%	9%	10%	10%	9%	6%	3%	2%	1%	1%	1%	3%	3%

FREEWAYS

Auto LOS data was most recently collected and evaluated in the fall of 2016. In 2016, 93 segments, with a combined length of 95 miles, operated at LOS F in the AM peak hour and 77 segments, with a combined length of 70 miles, operated at LOS F in the PM peak hour. In total, 177 out of 313 directional miles of freeway segments were found to be operating at LOS F in at least one of the peak periods. This is about 6 more lane-miles than the 2015 results.

Of these miles, 24 miles during the AM and 27 miles during the PM were at LOS F in the baseline 1991 year and therefore considered LOS-exempt. The remaining 71 directional miles during the AM and 67 directional miles during the PM are considered deficient.

Figures 3.4 and 3.5 show the auto LOS on the freeway system in 2016 for the AM and PM Peak Periods, respectively. The detailed listing of LOS levels for each freeway segment is included in the 2016 Conformance and Monitoring Report.

RURAL HIGHWAYS

Traffic counts were conducted at the 12 rural highway locations during the fall of 2016. All 12 rural highways operated at LOS E or better in 2016. Three locations recorded minor changes in LOS in 2016 compared to 2014: SR 35 north of SR 9 degraded from LOS B operations in 2014 to LOS C operations in 2016; SR 35 south of SR 9 degraded from LOS A operations in 2014 to LOS B operations in 2016; and Saratoga-Sunnyvale Road north of Big Basin degraded from LOS A operations in 2014 to LOS B operations in 2016. One rural highway, SR 152 west of Holsclaw, saw an improvement from LOS B in 2014 to LOS A in 2016. LOS conditions for all other segments remained the same. For further details on rural highway LOS, refer to the 2016 CMP Monitoring and Conformance Report.

COMPLIANCE AND CONFORMANCE

To be in conformance with the VTA Congestion Management Program, Member Agencies are required to monitor and submit a report on the level of service on CMP intersections within their jurisdiction biennially. Intersections LOS must be calculated using software and procedures that are compliant with CMP adopted standards. Beginning with the 2012 Monitoring cycle, VTA conducts the monitoring and LOS analysis for CMP intersections on behalf of the Member Agencies.

VTA is responsible for monitoring the performance of CMP intersections, freeways and rural highways. VTA must also determine consistency with the LOS standards for the entire CMP roadway network. If a roadway segment is not conforming to the LOS standards based on the monitoring process, the affected local jurisdiction will be notified, and may elect to remedy the LOS problem or prepare a Multimodal Improvement Plan.

FIGURE 3.4 | 2016 FREEWAY MIXED FLOW LEVEL OF SERVICE IN THE AM PEAK PERIOD

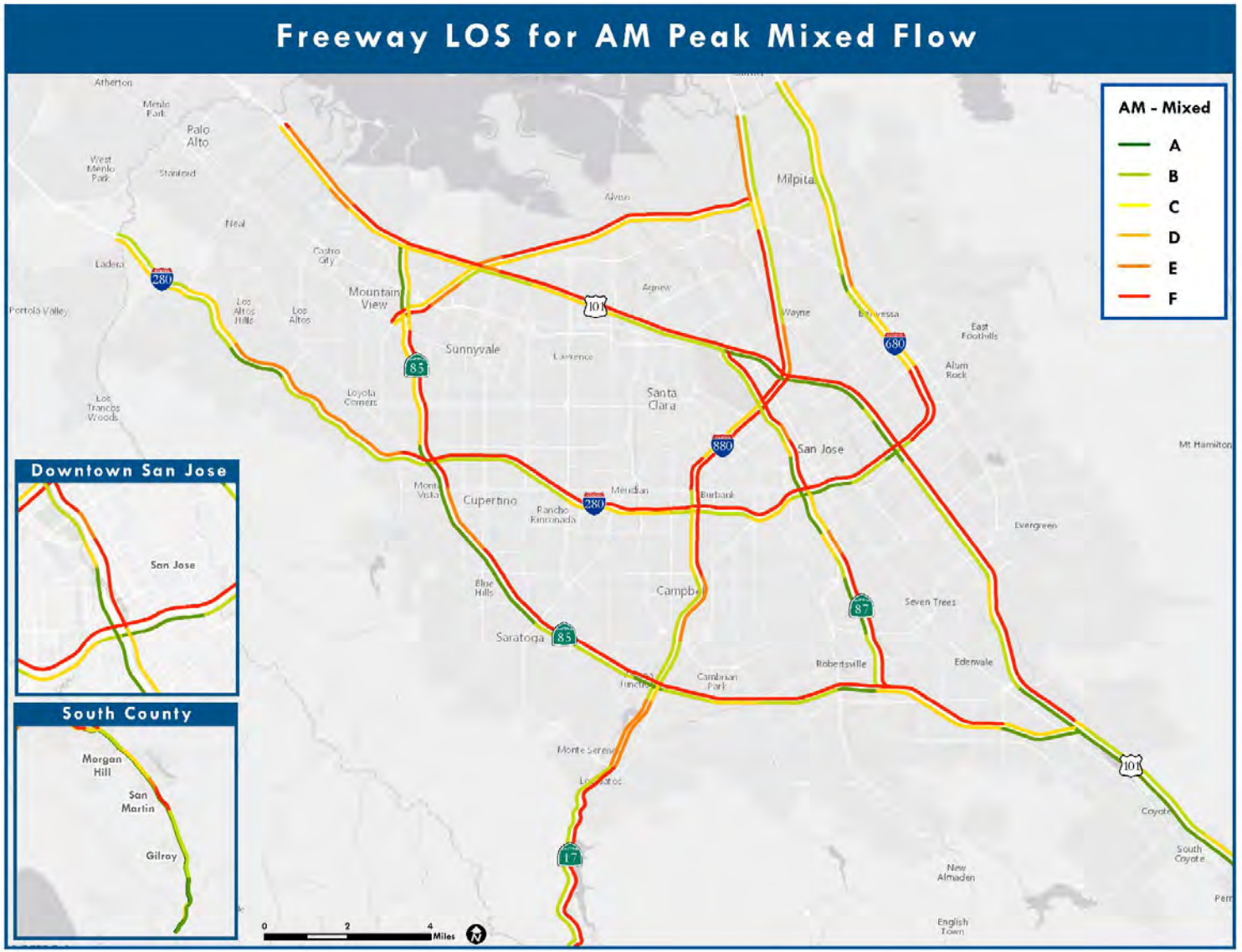
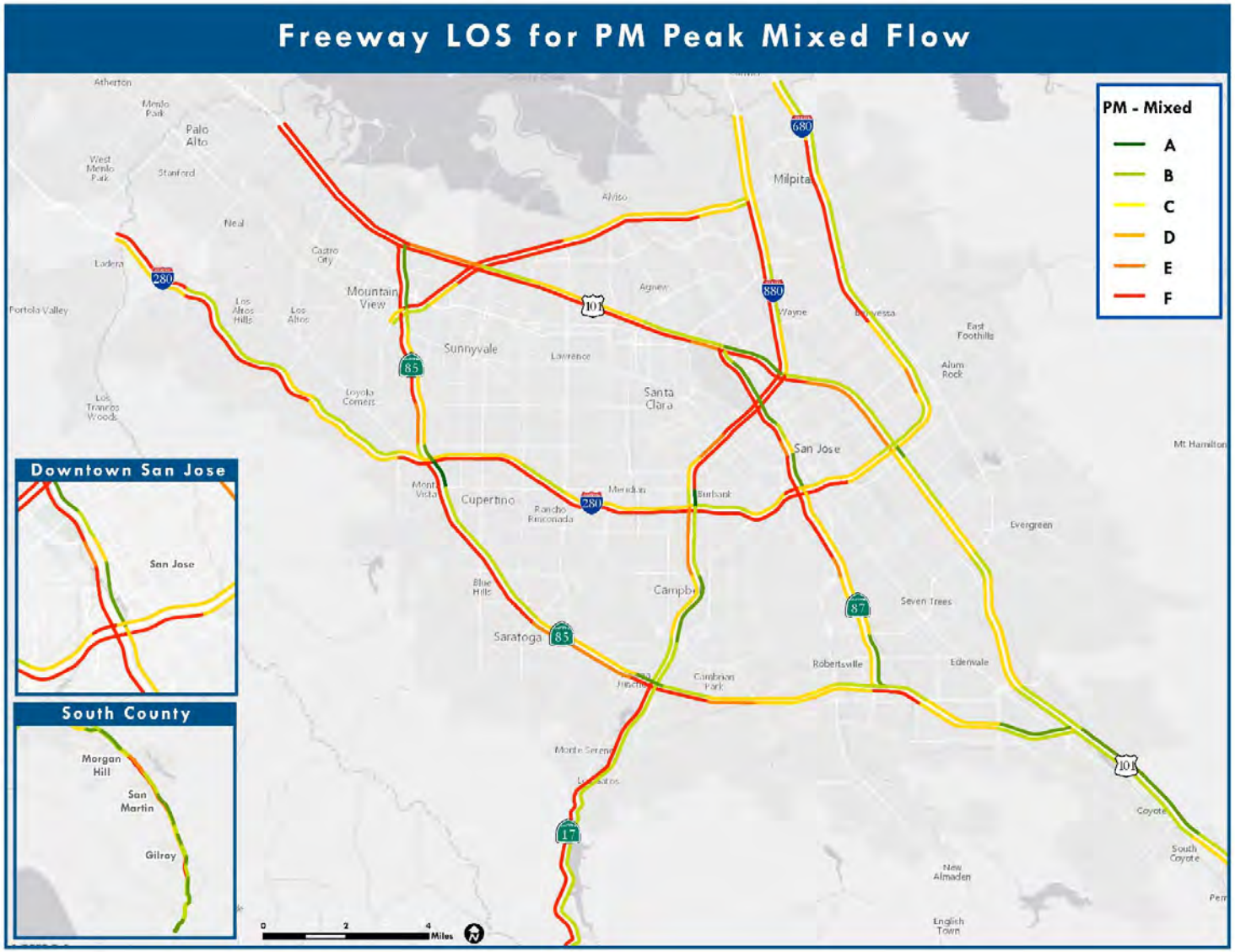


FIGURE 3.5 2016 | 2016 FREEWAY MIXED FLOW LEVEL OF SERVICE IN THE PM PEAK PERIOD



CHAPTER 4 | MULTIMODAL PERFORMANCE MEASURES ELEMENT

This chapter presents the CMP Multimodal Performance Measures Element. The CMP statute was amended in 1994 (Assembly Bill (AB) 1963, Katz: Chapter 1146, Stats 1994) to require that the CMP include multimodal transportation system performance measures.

This chapter is divided into the following sections:

- Background
- Development of Multimodal Performance Measures
- VTA CMP Multimodal Performance Measures
- Use of Multimodal Measures in CMP Elements
- Compliance and Conformance

BACKGROUND

How a problem is defined often leads to how it is solved; and how a problem is defined is frequently a function of its measurement. Transportation problems are traditionally defined in terms of congestion at specific locations (measured in terms of auto level of service—or LOS), and traffic solutions are typically developed to reduce congestion at these specific locations to improve auto LOS.

However, solutions that improve auto LOS may simply shift congestion to another location, not necessarily improving the operation of the overall transportation system. Therefore, while traffic delay on a single roadway may be reduced, overall travel times may not be significantly affected. Over-reliance on auto LOS as a measure of congestion can lead to ineffective choices in capital improvement programs or land use decisions, and can contribute to sprawl or have other unintended consequences. Similarly, solutions designed to improve auto LOS may adversely impact pedestrian and bicycle travel, for example by widening streets and crossing distances or by eliminating bike lanes at the intersection approach to provide a right-turn only lane. Focusing exclusively on auto LOS may also negatively impact transit, for instance by leading to intersection signal timing that heavily prioritizes automobile throughput at the expense of transit vehicle movement. These problems illustrate that Santa Clara County cannot build its way out of congested conditions. Instead, a balanced program of improvements beyond typical physical infrastructure – such as changes to land use development policies and pricing policies that discourage reliance on single-occupant vehicles – is needed to address transportation issues in the coming years.

The Multimodal Improvement Plan process (see Chapter 10) recognizes the inability of facility-based LOS evaluation to measure the performance of the overall transportation system and recognizes the need for implementing alternative actions in solving transportation problems. Performance measures are important tools in addressing transportation problems and developing alternative transportation solutions because they provide an indication of how well the transportation system serves the traveling public and contributes to economic development, environmental sustainability and quality of life. If multimodal transportation solutions are envisioned, then multimodal performance measures are essential analytic tools.

The 1994 amendment to the CMP statute (AB 1963) requires that the CMP include multimodal transportation system performance measures, and that these be used to develop the performance element described in Section 65089 of the statute, which was amended to include a multimodal performance measure. The Government Code Section 65089 (b) states:

> "The program shall contain the following elements:
>
> (2) A performance element that includes performance measures to evaluate current and future multimodal system performance for the movement of people and goods. At a minimum, these performance measures shall incorporate highway and roadway system performance, and measures established for the frequency and routing of public transit, and for the coordination of transit service provided by separate operators. These performance measures shall support mobility, air quality, land use, and economic objectives, and shall be used in the development of the capital improvement program required pursuant to paragraph (5), deficiency plans required pursuant to section 65089.4, and the land use analysis program required pursuant to paragraph (4). "

The VTA Board adopted the ten CMP Performance Measures as part of the 1995 CMP in compliance with AB 1963. The current CMP Performance Measures are summarized below, and technical documentation is provided in Appendix I.

In September 2013, the California legislature enacted Senate Bill (SB) 743, directing the Governor's Office of Planning and Research (OPR) to develop new significance criteria to replace level of service (LOS) in the evaluation of transportation impacts under CEQA. OPR has indicated that LOS will be replaced by Vehicle Miles Traveled (VMT). Further information about SB 743 and its implementation is provided in Chapter 3.

Although SB 743 did not directly call for changes to the Transportation Analysis Standards Element or Multimodal Performance Measures Element of the CMP, it is expected that these Elements will be updated for compatibility with the new CEQA Guidelines once they are adopted. Specifically, VTA will be revisiting the CMP auto LOS standard (see introduction to Chapter 2) and considering

providing further guidance for applying the performance measures described below, particularly VMT, for the analysis of the transportation impacts of land use and transportation projects. These efforts are expected to take place with the next update of the CMP in 2019.

DEVELOPMENT OF MULTIMODAL PERFORMANCE MEASURES

The development of appropriate performance measures is critical to demonstrate and compare the effects of alternative transportation plans or land use decisions. Performance measures provide a common framework in which to evaluate investments and strategies that might otherwise be difficult to compare. They allow an apples-to-apples comparison, illustrating tradeoffs between the alternatives as well as mitigation measures.

The purpose of multimodal performance measures is to evaluate how well Santa Clara County's transportation system serves the traveling public and contributes to economic development, environmental sustainability and quality of life. Individual performance measures may be applied to a specific geographic area or to a single mode type within the County. The results of these individual measures can be used to compare performance during a specific time period or under alternative investment strategies. However, because some measures will be more sensitive to changes that are specific to a particular type of improvement, mode or time, a comprehensive set of measures must be selected to capture the effects on the entire transportation system.

The key considerations when selecting performance measures are:

Suitability — Does the measure meet the goals and objectives of the plan or project they are evaluating?

After defining the suitability of the performance measure, it is important to determine if the following features are met:

Clarity — Is the measure understood by policy-makers, professionals, and the public?

Measurability — Is it possible to use available tools and resources to measure performance? What is the level of accuracy? Is the data reliable? Is the measure related to performance?

Forecastability — Can the performance measure be used to determine if alternatives are comparable? Can existing forecasting tools be used to measure performance?

Multimodality — Does the measure evaluate the travel modes being considered? Does it indicate meaningful tradeoffs between alternative modal investments?

Temporal Issues — Is the measure comparable over time? Is it capable of measuring the magnitude and location of temporal issues on travel demand? Can the measure differentiate between peak-period, off-peak, and daily travel demand?

Geography — Is the measure applicable to all areas of the County? Can it differentiate facility types? Can it be applied at a regional, subarea, corridor, or location specific level?

The first three criteria above: clarity, measurability, and forecastability are critical concepts that must be addressed across all performance measures. The remaining three criteria: multimodality, temporal issues and geography answer performance measure-specific questions; therefore, the degree these criteria are used will vary for each of the performance measures. As a result, some of the performance measures will be more sensitive to changes that relate to a particular type of improvement, mode choice, time of day, or place. To address each issue that affects the transportation system, a comprehensive set of performance measures must be selected.

VTA EVALUATION OF HCM 2010 MULTIMODAL LEVEL OF SERVICE MEASURES

In December 2010, the Transportation Research Board released the 2010 edition of the Highway Capacity Manual (HCM 2010). The HCM is a nationally-accepted resource that contains concepts, guidelines, and procedures for computing the capacity and quality of service of various roadway facilities, including freeways, arterial roads, signalized and unsignalized intersections, and rural highways. The 2010 edition of the HCM contains extensive new methodologies to evaluate level of service (LOS)/quality of service (QOS) for pedestrian, bicycle and transit modes on urban arterial roadways. One of the most significant elements introduced in HCM 2010 is a quality of service orientation in the methodologies, in which the evaluation is based on the perception of safety and/or comfort on the part of the pedestrian, bicyclist or transit rider, in addition to the capacity-based analysis methods presented in previous versions of the HCM.

VTA and Member Agency staff anticipated that the new multimodal LOS measures in HCM 2010 could be useful in evaluating the benefits and impacts of development proposals and roadway projects on pedestrians, bicyclists, and transit riders, as well as drivers. Therefore, to learn more about the multimodal LOS measures and consider potential applications in Santa Clara County, VTA and its Member Agencies engaged in an extensive program of education and testing from 2011-2013. These activities included pilot analyses of key intersections and corridors in the CMP network as well as studies to measure the magnitude of changes in multimodal LOS associated with hypothetical geometric modifications to roadway facilities. These activities were described in greater detail in the 2013 CMP and a Technical Memo prepared by VTA staff (March 2013). VTA staff continually updated the Systems Operations & Management (SOM) Working Group, the Land Use / Transportation Integration (LUTI) Working Group, and Advisory Committees as appropriate during this process, and organized two hands-on multimodal LOS training sessions for Member Agency staff.

The following is a summary of general observations on the HCM 2010 multimodal LOS measures by VTA and Member Agency staff based on the testing, education and outreach described above:

- Street modifications produce LOS changes in the direction (positive or negative) that generally aligns with the intuitive assumptions of VTA and Member Agency staff, with occasional anomalies.
- The magnitude of MMLOS changes are not as predictable as the direction, and require further evaluation.
- Proper application of HCM 2010 multimodal LOS methodologies may require consistent judgment calls and/or the development of guidelines for interpreting certain variables of street geometry.
- HCM 2010 formulas may need to be customized to adjust or disregard certain variables to bring multimodal LOS evaluations more in line with VTA and Member Agency assumptions (for example, results related to right turn islands and road diets). HCM 2010 explicitly states that formulas can be adjusted to reflect local conditions.

Based on the observations noted above, VTA identified the following next steps:

- The potential establishment of HCM 2010 multimodal LOS thresholds in the VTA CMP is not likely in the near term unless new industry standards for implementation and/or revised multimodal LOS formulas are released.
- The 2014 VTA Transportation Impact Analysis (TIA) Guidelines update included a new requirement for projects that modify roadway or intersection geometry to include an informational quality of service (QOS) evaluation of bicycle and pedestrian modes on the modified facility. The TIA Guidelines allow the Lead Agency latitude in selecting the QOS methodology but include the HCM 2010 Multimodal LOS measures as one option recommended for consideration. See Chapter 6 for more details on the 2014 TIA Guidelines update.
- VTA will continue to test and evaluate multimodal evaluation measures used in the Bay Area and elsewhere.

VTA CMP MULTIMODAL PERFORMANCE MEASURES

The 1995 CMP identified nine performance measures intended to meet specific statutory requirements unique to the CMP legislation. Through subsequent planning efforts, the performance measures have continued to evolve to meet the CMP statutory requirements while taking a more sensitive, effective, and efficient approach to measuring performance. In 2006 and 2007, VTA developed the Transit Sustainability Policy which identifies performance measures and thresholds for transit. The Policy ensures that investments in transit service are used efficiently

and serve the corridors with the greatest transit demand. In 2014, the VTA TIA Guidelines were updated to include Pedestrian/Bicycle Quality of Service analysis for certain projects, and Transit Vehicle Delay analysis (due to automobile congestion) for all projects.

This section describes the twelve CMP multimodal transportation system performance measures currently in use. These measures are summarized in Tables 4.1 and 4.2, and a more detailed discussion of each measure is provided below. A technical discussion of the measures and their application can be found in Appendix I.

AUTO LEVEL OF SERVICE

The Highway Capacity Manual defines Level of Service (LOS) as "…qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers." The terms used in describing auto LOS include speed and travel time, freedom to maneuver, comfort/convenience, and traffic interruptions. Auto LOS is categorized from A through F; with LOS A representing free-flow travel and LOS F representing congested traffic flow at specific intersections or along roadway segments. Chapter 2 of this document summarizes the VTA CMP auto LOS standards and describes which facilities are considered to be deficient according to these standards.

Auto LOS is a vehicle-based performance measure that is used to measure imbalances between traffic volume (demand) and capacity (supply) in specific locations on the roadway system. Adding lanes, modifying intersections, increasing transit infrastructure on parallel routes, and using ITS strategies such as signal synchronization, are some of the strategies to increase capacity and improve operations and through-put of roadway facilities. Changes in volume can be caused by intensification of development, mode shifts, time of day shifts, or changes in travel patterns (i.e. changing origins or destinations).

Auto LOS is a widely accepted measure of roadway and intersection performance. Auto LOS alone is a good indicator of trouble spots in the road network. When used in conjunction with other performance measures such as passenger throughput, auto LOS can be a much more meaningful performance measure. Nevertheless, auto LOS has significant shortcomings. An example of this is that a singular focus on traffic auto LOS may encourage the belief that a significant increase in roadway, intersection or interchange capacity is the most effective mitigation measure for traffic impacts. Using other performance measures in addition to auto LOS can help decision makers see the benefits of a wider range of improvements that encourage multimodal uses.

TABLE 4.1 | SUMMARY OF VTA 2017 CMP MULTIMODAL PERFORMANCE MEASURES

Performance Measure	Mode(s) Analyzed	Brief Definition	Metric Improves If…
Auto Level of Service (LOS)	Auto	A measure of vehicle delay and traffic flow at intersections and along roadway segments	Congestion and delay decrease and traffic flows more smoothly at specific intersections or roadway segments.
Vehicle Miles Traveled (Per Capita, Employee or Person-Trip)	Auto	A measure of the total amount of auto travel (trips multiplied by average trip length), associated with a specific site or within a defined area	The total amount of auto travel to/from a specific site or within a defined area decreases, or grows more slowly than the number of residents or employees or the amount of travel by non-auto modes.
Modal Split	All Modes	The percentage of travelers using the major transportation modes (e.g. drive-alone auto, HOV, transit, pedestrian and bicycle)	The total number of trips by transit, pedestrian, bicycle, and HOV modes increases faster than the total number of auto trips to/from a specific site or within a defined area.
Pedestrian and Bicycle Quality of Service (QOS)	Pedestrian and Bicycle	A measure of features of the environment that affect the comfort and safety of pedestrians and bicyclists from the user's perspective.	Physical modifications to intersections or roadway segments provide a greater level of comfort and safety for pedestrians and bicyclists.
Transit Vehicle Delay	Transit	A measure of delay experienced by transit vehicles, associated with overall automobile congestion at specific intersections or along a transportation corridor	Transit vehicles experience reduced delay at an intersection or along a corridor, either through an overall decrease in congestion or through the implementation of transit priority measures.
Transit Accessibility	Transit	An aggregate index of transit frequency, accessibility and coordination to determine how well transit serves the population of Santa Clara County	Transit frequency, accessibility and/or coordination improve.
Air Quality	N/A	Countywide measures of specific pollutants emitted by mobile sources (e.g. autos, trucks and transit vehicles)	Travel patterns reflect lower overall vehicle miles traveled (see above), and/or changes to travel speeds, frequency of starting/stopping, or other factors reduce air pollutants.
Duration of Congestion	Auto	The length of time that a transportation facility is congested	The duration of congestion on a transportation facility decreases.
Hours of Delay/Person-Trip	Auto or Transit	The total amount of delay experienced by users of a transportation facility, divided by the total number of person-trips on the facility.	Transportation facility improvements result in reduced delay or the use of more efficient travel modes increases while delay stays the same.
Travel Time Index	Any mode, most often Auto or Transit	The amount of time to travel between two points by a particular mode, or the average across all modes	Travel time between two points by a particular mode or across all modes decreases.
Transit Sustainability Policy (TSP)	Transit	Ridership and revenue targets for VTA transit service	Average Boardings per Revenue Hour and Average Daily Boardings per Station increase to meet/exceed the target ranges identified in the TSP for each type of transit
Travel Pattern (in Person Trips)	All Modes	The total amount of directional travel between given geographic areas, such as Traffic Analysis Zones (TAZs), cities, or counties	N/A

TABLE 4.2 | APPLICABILITY OF VTA 2017 CMP MULTIMODAL PERFORMANCE MEASURES

Performance Measure	Member Agencies		VTA/Member Agencies	VTA		
	Evaluation of Development Projects	**Evaluation of Long-Range Planning Efforts**	**Evaluation of Transportation Capital Projects**	**Countywide Transportation Plan**	**Monitoring & Conformance**	**Transit Service & Operations Planning**
Auto Level of Service (LOS)	*Required* per CMP Transportation Analysis Standards	*Required* per CMP Transportation Analysis Standards	*Required* per CMP Transportation Analysis Standards	*Required* per CMP Transportation Analysis Standards	*Required* per CMP Transportation Analysis Standards	N/A
Vehicle Miles Traveled (Per Capita, Employee or Person-Trip)	*Recommended* for consistency with recent state legislation	*Recommended* for consistency with recent state legislation	*Recommended* for consistency with recent state legislation	*Included;* Anticipated updates in response to state legislation	Under evaluation for future reporting with Big Data (See Ch. 8)	N/A
Modal Split	*Recommended*	*Recommended*	*Recommended*	*Included*	N/A	N/A
Pedestrian and Bicycle Quality of Service (QOS)	*Required* for per CMP TIA Guidelines changes to roadway geometry or signal operations; *Recommended* for other projects	*Recommended*	*Recommended*	N/A	Key CMP facilities evaluated in pilot studies (2011-2013)	N/A
Transit Vehicle Delay	*Required* per the CMP TIA Guidelines	*Recommended*	*Recommended*	N/A	N/A	N/A
Transit Accessibility	N/A	*Recommended*	*Recommended* for projects changing frequency, accessibility or coordination of transit routes/facilities	*Included*	N/A	*Included*
Air Quality	*Recommended;* Often required in CEQA evaluation	*Recommended;* Often required in CEQA evaluation	*Recommended;* Often required in CEQA evaluation	*Included*	N/A	N/A
Duration of Congestion	N/A	*Recommended*	*Recommended*	*Included*	Under evaluation for future reporting with Big Data (See Ch. 8)	N/A
Hours of Delay/Person-Trip	N/A	*Recommended*	*Recommended*	*Included*	N/A	N/A
Travel Time Index	N/A	*Recommended*	*Recommended*	*Included*	Under evaluation for future reporting with Big Data (See Ch. 8)	N/A
Transit Performance Monitoring	N/A	N/A	*Under Development*	N/A	N/A	*Under Development*
Travel Pattern (in Person Trips)	N/A	N/A	N/A	*Included*	N/A	N/A

VEHICLE MILES TRAVELED

Vehicle Miles Traveled (VMT) is a measure of the total amount of vehicle travel on the roadway network. VMT is calculated by multiplying the total number of vehicle trips by the average distance of each trip. VMT can be normalized to reflect travel efficiency, such as measuring VMT per capita, employee or person-trip. Normalization is an important step to understand the meaning of a given change in VMT. For example, an absolute increase in VMT could indicate a greater number of single-occupant vehicle trips, or an increase in trip lengths; however, if the rise in VMT is slower than the rise in population (showing an overall decrease in VMT/capita), it would indicate that the usage of the transportation network is becoming more efficient over time.

VMT (per capita, employee or person-trip) is therefore a compound performance measure encompassing auto trip generation, average auto trip length, and modal split. This makes it a good indication of the overall efficiency of the multimodal transportation network, but not an ideal tool to identify specific problems in specific locations within the network. An improvement (e.g., a decrease) in VMT per capita, employee or person-trip could be an indication of any combination of the following:

- The total number of auto trips decreases;
- The average length of auto trips decreases;
- Usage of non-auto travel modes, such as transit, bicycle, pedestrian and high-occupancy vehicle (HOV) increases while auto usage stays the same or decreases.

The effects described above could be caused by:

- A more efficient land use pattern, bringing residences, work sites and retail/services in closer proximity to each other (improving accessibility), leading to shorter auto trips and/or a greater share of trips by walking, bicycling and transit;
- Improvements to transportation infrastructure to make transit, bicycle and pedestrian travel faster, safer, and more attractive relative to auto travel;
- Transportation Demand Management (TDM) programs to incentivize other travel modes and reduce auto trips (see Chapter 4).

Conversely, an increase in VMT per capita, employee or person trip could be an indication that the total amount of auto travel is increasing and/or travel by transit, bicycle, pedestrian and HOV modes is decreasing, or not increasing as fast as auto travel. These effects could be caused by an inefficient land use pattern, a degradation of non-auto transportation infrastructure or a significant enhancement to auto infrastructure without equivalent investments in non-auto modes, a reduction in TDM incentives to residents or employees in an area, or any combination of these factors.

During the development of the 1995 CMP, the CMA Board selected VMT per Person-Trip (VMT/P-T) as one of the CMP Multimodal Performance Measures. With the passage of SB 743, VMT measures will take on greater prominence in transportation analyses for CEQA as well as CMP purposes (see intro sections to this chapter and Chapter 2). As such, VTA will revisit this performance measure to consider updates for future versions of the CMP.

MODAL SPLIT

Modal Split shows the percentage of travelers using the major transportation modes (e.g., drive-alone auto, HOV, transit, pedestrian and bicycle). Modal Split can be used in making programming decisions such as determining the trade-offs between highway, HOV, and transit improvements or it can be used to answer policy related questions such as measuring the effectiveness of increasing parking costs in a downtown area to encourage transit ridership. Some recent major development projects and long-term land use plans in Santa Clara County have set modal split targets, such as Apple Park in Cupertino, San Jose's Envision 2040, and the North Bayshore Precise Plan in Mountain View.

Modal Split is useful in identifying transportation capital projects, TDM strategies and long-term land use planning alternatives that provide the greatest increases in transit, bicycle and pedestrian activity, relative to automobile usage. It is also useful in measuring long-term trends in the usage of various transportation modes in a specific area, within a city or countywide.

PEDESTRIAN AND BICYCLE QUALITY OF SERVICE

As part of the 2014 update of the VTA TIA Guidelines, VTA established a requirement for projects proposing changes to existing roadway or intersection geometry or changes to signal operations to include a Quality of Service (QOS) analysis for bicyclists and pedestrians. A QOS analysis is also recommended for other projects and for documenting existing conditions. QOS methodologies typically measure features of the environment that affect the comfort and safety of bicyclists and pedestrians from the user's perspective, such as the presence and width of sidewalks and bicycle lanes, intersection crossing distance and delay, lateral separation from auto traffic, auto volumes, and the presence of landscaping or trees. These considerations are in contrast to capacity-based methodologies for evaluating pedestrian and bicycle conditions in the previous TIA Guidelines. The updated TIA Guidelines recommend a capacity-based analysis only for large or unique projects generating large volumes of pedestrian and/or bicycle trips.

The 2014 VTA TIA Guidelines provide informational summaries of six QOS methodologies, including the multimodal LOS approach presented in the Highway Capacity Manual (HCM) 2010 (see "VTA Evaluation of HCM 2010 Multimodal Level of Service," above, for further information). Lead Agencies have discretion to select appropriate methodologies for bicycle and pedestrian QOS analysis.

TRANSIT ACCESSIBILITY

For the purpose of the VTA CMP, one measure of transit service performance is the local Transit Accessibility Index, which disaggregates transit performance by geographic zone. In contrast to the traditional mobility-based approach for the measurement of transit service performance, accessibility provides a place-based approach for understanding how transit service is divided between areas in Santa Clara County.

The Transit Accessibility Index indicates how well transit serves the population of Santa Clara County. This measure shows where changes in transit service parameters (such as headway and frequency) are desirable and highlights areas where the addition or modification of transit routes and stops may be beneficial. The accessibility index is a sophisticated tool for measuring the effects of changing land uses and densities by striking a balance between zonal travel and household and employment figures. Because it is tied to Traffic Analysis Zones (TAZ), the index can be used to quickly analyze and incorporate both travel demand and demographic data into any accessibility analysis.

The index is derived from travel demand model data, so its outputs are fully in line with the travel model estimations and assumptions used in VTA's transportation demand model. Furthermore, this method of evaluating transit accessibility encourages a systems approach to accessibility analysis through the combined estimation of multiple transit operator performance. Transit Accessibility was used as one of the performance measures during VTA's Next Network transit service redesign effort in 2016 and 2017 in preparation for the opening of the BART Phase 1 extension to the Milpitas and Berryessa Stations.

AIR QUALITY

Vehicle emissions of air pollutants are measured in tons of pollutants and are related to several factors. These factors include vehicle miles traveled, cold and hot starts and stops, speed changes, and idling time. The air quality performance measure is necessary for conformance with state CMP guidelines for air quality impacts, and is often required in CEQA evaluation.

Air Quality is measured countywide by pollutant type during the A.M. and P.M. peak hours using the VTA transportation model and Direct Travel Impact Model 3.1 (DTIM 3.1) designed by Caltrans. The pollutants measured include Carbon Monoxide (CO), Hydrocarbons (HC), Oxides of Nitrogen (NOx), and Particulate Matter (PM).

Air Quality is a good measure of the overall external impacts of transportation system operation, but it does not directly correlate to the benefits of an efficient multimodal transportation system. While increased traffic speed and a reduction in the amount of stopping

and starting reduce most emissions, oxides of nitrogen tend to increase as travel speeds increase. In addition, reductions in air pollution have been achieved in recent years by modifying the composition of gasoline, improving the overall fuel economy of the vehicle fleet on the road, and taking measures to reduce pollution of stationary sources (e.g. power plants, factories, etc). Therefore, it is difficult to know whether improvements in Air Quality are due to efficient modal use or other factors.

Other performance measures related to Air Quality can be used to assess related environmental impacts. For example, energy and fuel consumption can measure the amount of energy required to perpetuate or operate an individual project or the transportation system in an area. For automobiles and buses, fuel or diesel fuel consumption can be a measure, and for light and heavy rail transit, electricity consumption can be used. VTA is proactively seeking opportunities to incorporate energy and air quality improvements into all aspects of VTA operations (See "VTA Activities Related to Energy and Air Quality," Chapter 6).

DURATION OF CONGESTION

Duration of Congestion measures the length of time that particular transportation facilities are subject to congested conditions. When travel demand begins to exceed capacity, travelers have four possible ways to avoid the congestion:

1. Shift modes
2. Choose not to travel (e.g. telecommute)
3. Take alternative routes
4. Travel at less congested times

The first three options will not directly affect the Duration of Congestion; however, if travelers choose to shift travel to less congested times, the duration of congestion will increase over a longer period. This is sometimes referred to as "peak spreading."

Duration of Congestion is an auto-oriented performance measure typically used on highway segments and arterial streets. Duration of Congestion can be affected by changes in travel demand (such as congestion pricing, land-use policies that result in shorter trip patterns, and mode shifts) or changes in transportation capacity (adding highway lanes, modifying intersections, increasing transit infrastructure, and using ITS strategies).

HOURS OF DELAY PER PERSON-TRIP

This measure identifies the system-wide hours of delay travelers experience due to congestion on the transportation system. It is generally measured for private vehicle users including SOV and HOV, but can also be used to measure delay experienced by users of transit or other modes. Delay is generally determined by comparing travel time on the transportation facilities

during peak/congested conditions with off-peak/uncongested conditions. Dividing delay by person-trips accounts for the changes associated with population and job growth.

Delay tends to be more sensitive to mitigation efforts than auto LOS. For example, consider an intersection that is currently operating at LOS F with an average control delay of 100 seconds. An action (or group of actions) could improve the delay to 85 seconds, but LOS would remain LOS F.

Hours of Delay/Person Trip is a good supporting performance measure for freeway/expressway ramp and intersection improvements since most of the delays occur in queuing and stop-and-go situations. Hours of delay can be a good indicator of the effectiveness of adding roadway and transit capacity to a travel market or system-wide. It is also a good indicator for system management projects such as ramp metering and signal timing.

TRAVEL TIME AND TRAVEL TIME INDEX

Travel Time is measured for the selected travel markets for a base year and some future year. For autos, the difference in Travel Time indicates the change in congestion over time. For Transit, the different in Travel Time may reflect differences in congestion or changes to the amount of priority received by transit vehicles. Travel Time can be a more intuitive measure of mobility than delay because the traveling public thinks more about how long a trip takes than how long they have to wait in traffic at specific locations.

The Travel Time Index reports the travel time by a particular mode or the average travel time across modes. The index compares Travel Time over different years, between different alternatives, and between different modes. The strength of this measure is its ability to show the differences in point to point travel time by mode. Therefore, it is an effective measure to use for transit projects as well as roadway improvements.

TRANSIT PERFORMANCE MONITORING

VTA Staff is developing a new framework for evaluating bus route performance that accounts for the ridership and coverage goals of public transit. Under this framework, ridership-purposed routes would be judged by productivity and cost metrics and would not be subject to goals based on service class averages. Coverage-purposed routes would not be evaluated strictly on productivity but rather whether the ridership recorded and social good achieved by these routes justifies the opportunity cost of the service. Since there are more needs for transit than VTA can afford to operate, staff will work to ensure that each route represents the best use of public funds, given Board direction on the ridership/coverage balance.

The forthcoming performance evaluation framework will be enforced by a new Transit Performance Monitoring Program that will function like an ongoing comprehensive operations analysis. Every quarter, VTA staff will present system-wide and route-specific performance data to the Board of Directors. A handful of routes will be selected for a thorough analysis and development of service changes designed to improve performance. These proposals may include routing adjustments, changing the frequency of service, changing the span of service or discontinuance. These service changes, along with community input and other Board direction, will inform the development of VTA's annual transit service plans.

The future performance monitoring policy and monitoring program will be brought to VTA's Board of Directors in early 2018.

TRAVEL PATTERN (IN PERSON TRIPS)

Travel Pattern measures the balance between people and activities such as employment, recreation, and shopping. It is evaluated in terms of person trips, which provides a measure of mobility; increasing person trips indicates increased mobility. The Bay Area and Santa Clara County are divided into several subareas; travel patterns are used to capture the travel demand and growth projection, in terms of person movements, among these subareas.

USE OF MULTIMODAL MEASURES IN CMP ELEMENTS

The CMP statute requires that the multimodal transportation system performance measures be used to prepare the CMP Capital Improvement Program (CIP), the Land Use Impact Analysis Program, and Multimodal Improvement Plans. At this point, the multimodal transportation performance measures are not used to determine Member Agency conformance with the CMP, except for auto LOS (see Chapter 2). Additionally, Member Agencies are not currently required to use most of the performance measures in their evaluation of land-use development proposals, general plans/general plan amendments, or specific plans. The 2014 VTA TIA Guidelines Update included a requirement for Pedestrian/Bicycle Quality of Service analysis for certain projects and Transit Vehicle Delay analysis for all projects. However, other multimodal performance measures may be useful in implementing alternative mitigation measures associated with creating pedestrian and transit-friendly development patterns as promoted in VTA's Community Design and Transportation (CDT) Program, and as pursued by Member Agencies in meeting their own development goals.

VTA plans to use the multimodal performance measures described in this chapter in the identification of the capital projects for the Countywide Transportation Plan and Capital Improvement Program, and in the Land Use Analysis Program and Multimodal Improvement Planning. In addition, VTA uses the measures and approach in the TSP to evaluate existing and proposed transit service and improve transit service productivity. In cases where capital investments in transit routes have already been made, it is the policy of VTA to increase

ridership on these lines by working with cities to improve surrounding land uses and develop supporting policies.

The following is a summary of the applicability of these measures to each of these programs:

Countywide Transportation Plan — VTA uses the CMP multimodal performance measures in the development of its long-range countywide transportation plan for Santa Clara County, Valley Transportation Plan. VTP includes an analysis of two scenarios (a) a baseline year, and (b) baseline plus the program of projects outlined in the plan. These performance measures are used to evaluate the systemwide effects of the two alternatives. A similar analysis will be calculated for VTA's future long-range countywide transportation plans.

Land Use Analysis Program — Certain of these multimodal performance measures will serve to evaluate the effects of land use changes on the CMP Transportation System. Each year, land use data is collected and the countywide land use database is updated. The countywide transportation model can be used to calculate the performance measures under current conditions and compare them with previous land use conditions. This comparison will be particularly useful as data is collected over the long term.

Multimodal Improvement Plans — These performance measures may be used to evaluate the alternative packages of improvements and actions considered for Multimodal Improvement Plans. While state law requires the application of performance measures to local Multimodal Improvement Plans, these particular measures may not be meaningful when applied to small geographic areas. Therefore, for deficiencies that occur on principal arterials located on the CMP System, the jurisdiction in which the deficiency occurs will be responsible for preparing a Multimodal Improvement Plan, which includes level of service as a performance measure and may propose other performance measures. The proposed performance measures must be approved by the VTA Board before the Multimodal Improvement Plan can be approved.

COMPLIANCE AND CONFORMANCE

VTA is responsible for collecting transportation performance measurement data for use in the countywide transportation plan, land use analysis, Multimodal Improvement Plans, and the CIP. Member Agencies are responsible for analyzing multimodal performance measures as required per the CMP and associated Technical Guidelines (see Table 4.2).

CHAPTER 5 | TRANSPORTATION DEMAND MANAGEMENT AND TRIP REDUCTION ELEMENT

This chapter describes the Congestion Management Program (CMP) Transportation Demand Management Element. Throughout this chapter, the term Transportation Demand Management (TDM) will be used to refer to the series of programs that are included in the Travel Demand Management Element.

The chapter is divided into the following sections:

- A Definition of Transportation Demand Management
- TDM, Automobile Trip Reduction, and VTA Guidelines
- TDM and Legislation
- Categories of TDM Strategies
- TDM Programs that VTA Implements
- Funding for TDM Programs
- Compliance and Conformance

A DEFINITION OF TRANSPORTATION DEMAND MANAGEMENT

"Transportation Demand Management or TDM refers to various strategies that change travel behavior (how, when and where people travel) in order to increase transport system efficiency and achieve specific planning objectives."[1]

Transportation Demand Management programs range from simple marketing efforts, such as promoting ridesharing, to more complex public policies, such as developing site-design guidelines or parking pricing programs. These programs are designed to improve the overall performance of the CMP System through elimination or shortening of auto trips, mode shifting, time shifting, or trip linking. To be successful, TDM programs must not only encourage ridesharing, transit, cycling, and walking, but also provide attractive alternatives to single-occupant vehicle trips.

TDM, AUTOMOBILE TRIP REDUCTION, AND VTA GUIDELINES

TDM programs play an important role in reducing automobile trips generated by new development. The goals of TDM strategies can vary from eliminating or shortening auto trips

[1] Online TDM Encyclopedia, Victoria Transportation Policy Institute, accessed July, 2013.

(e.g. telecommuting, trip linking, improving accessibility to services), shifting trips from single-occupancy-vehicle to other modes (carpool, transit, walking, bicycling), or shifting trips away from the most congested routes and times of the day. All of these strategies, when successful, reduce the total number of automobile trips on congested facilities during rush hour. This can have important benefits for the transportation system, and can also provide incentives to developments by reducing the extent of transportation impacts found in their environmental review and Transportation Impact Analysis (TIA) processes. Some recent developments in Santa Clara County have applied aggressive trip reduction targets of 30% or more as part of their TDM programs, including annual monitoring and enforcement.

In response to this trend, VTA updated the CMP TIA Guidelines (October 2014) with automobile trip reduction as one of the primary focus areas. A TIA report is required for all development projects in the County that generate 100 or more net new automobile trips during either peak period. As such, the way that transportation impacts and mitigation measures are analyzed and reported in TIAs makes a meaningful difference in how congestion is addressed by major projects. See "Development Review Program," Chapter 7, for further discussion about the TIA Guidelines and relationship to VTA Development Review.

Prior to the 2014 TIA Guidelines Update, the TIA Guidelines listed a table of standard trip reductions for various project features, including a 5% reduction for TDM programs including financial incentives. The TIA Guidelines also noted that some projects could take larger trip reductions, but did not lay out a specific process for this to be achieved. In response to inquiries from Member Agencies and others, VTA retained the Standard Trip Reductions table but included two additional approaches to taking auto trip reductions in a TIA:

- ***Target-Based Reductions*** may be taken when the project applicant has entered into an enforceable agreement with the Lead Agency that limits the number of automobile trips traveling to and from the project site. The trip reduction program must include a commitment to monitor trip generation and determine whether targets are met, an enforcement structure, and a commitment to summary-level data sharing;
- ***Peer/Study-Based Trip Reductions*** may be taken when studies of similar projects, or of other sites occupied by the project applicant, have demonstrated comparable trip reductions through survey results or other data. The trip reduction program must include a commitment to monitor trip generation, and a commitment to summary-level data sharing.

The 2014 TIA Guidelines also include a requirement for projects to complete an Auto Trip Reduction Statement (ATRS) in the Executive Summary of a TIA Report. The ATRS is intended to provide a concise summary of all automobile trip reduction efforts, including any reductions claimed in the Trip Generation section of the TIA and any additional trip reduction efforts undertaken to mitigate or lessen project impacts.

Over the coming years, VTA intends to work with Member Agencies to gather data on TDM and Trip Reduction efforts by major projects utilizing the "Target-Based" and "Peer/Study-Based" approaches to auto trip reductions in TIAs. This data will be used to create a "TDM Clearinghouse" of data for Member Agencies and others to analyze the usage and effectiveness of various TDM strategies in Santa Clara County.

VTA also envisions taking on a more prominent role in coordinating TDM strategies across multiple jurisdictions in high-growth areas of the county, such as taking an active role in the formation of Transportation Management Associations (TMAs). VTA will work proactively with Member Agencies to identify such opportunities to help establish TDM programs or strengthen existing TDM programs.

TDM AND LEGISLATION

California Government Code section 65089(b)(3) requires that the CMP contain a Travel Demand Element that promotes alternative transportation methods and improves the balance between jobs and housing. TDM strategies are a crucial part of meeting the requirements of the California Clean Air Act (CCAA). The TDM Element of the VTA CMP is designed to conform to the requirements of the State CMP statute, and the Federal and California Clean Air Acts.

The CMP statute states in Government code section 65089 (b)(3) that the CMP should contain the following element:

"A travel demand element that promotes alternative transportation methods, including, but not limited to, carpools, vanpools, transit, bicycles, and park-and-ride lots; improvements in the balance between jobs and housing; and other strategies, including, but not limited to, flexible work hours, telecommuting, and parking management programs. The agency shall consider parking cash-out programs and congestion pricing during the development and update of the travel demand element."

The CMP statute also requires that the CMP be responsive to the California Clean Air Act (CCAA) and the requirements of the regional Clean Air Plan. Specifically, the CMP must consider the potential effect of regional air quality measures in the Trip Reduction and Transportation Demand Element, the Capital Improvement Program, and the Multimodal Improvement Plan Element. Appendix F provides a summary of references to air quality included in the CMP statute.

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD) TRIP REDUCTION REQUIREMENTS

The Bay Area Air Quality Management District (BAAQMD), also referred to as the Air District, recommends programs to reduce solo commuting such as guaranteed ride home programs, shuttles to transit, ride-matching for carpools and vanpools, subsidy programs for transit passes, parking charges, and effective advertising and marketing programs.

In Fall 2012, California Senate Bill 1339 was signed into law authorizing the Air District and MTC to jointly adopt a regional commute benefit program. Pursuant to SB 1339, the Air District and MTC developed the Bay Area Commuter Benefits Program (Program) to promote the use of alternative commute modes such as transit, ridesharing, biking and walking. The Program requires employers with 50 or more full-time employees in the Bay Area to offer commute benefits to employees who work 20 hours or more per week. Employers can meet the requirement by offering any of the following benefits:

- Allow employees to pay for transit, vanpool or bicycle expenses with pre-tax dollars
- Directly subsidize transit or vanpool costs up to $75 per month
- Provide employer-operated transit, shuttle or vanpool services
- Provide an alternative benefit that would be equally effective in reducing auto trips

TRANSPORTATION REQUIREMENTS OF THE CALIFORNIA CLEAN AIR ACT (CCAA)

The CCAA of 1988 expanded the scope and accelerated the pace of air pollution control efforts in California. The intent of the Act was to establish a planning process that would result in attainment of the State's health-based ambient air quality standards at the earliest practicable date.

Each Air District is required to adopt a Clean Air Plan (CAP) that contains a strategy for attaining air quality standards. The Bay Area's Air District's first CAP was adopted in October 1991. In April 2017, the Air District Board adopted the Bay Area 2017 CAP. The 2017 CAP serves to update the Bay Area ozone plan in compliance with the requirements of the California Health & Safety Code. In addition, the 2017 CAP provides an integrated, multi-pollutant strategy to improve air quality, protect public health, and protect the climate. The 2017 CAP will reduce ozone pre-cursors, as well as particulate matter (PM), toxic air contaminants, and greenhouse gases, in order to improve public health and protect the environment and climate.

Recognizing the impact of transportation on ozone, the 2017 CAP includes 23 Transportation Control Measures (TCMs) aimed at reducing motor vehicle emissions due to ozone, particulate matter, air toxics, and greenhouse gas emissions. The TCMs most relevant to TDM are TCM TR2, which calls for supporting voluntary employer-based trip reduction programs, and TCM TR13, which pursues parking policies and strategies. Appendix G contains a list of the 23 TCMs in the Bay Area 2017 CAP.

A significant overlap between the California Clean Air Act and Congestion Management Program's statute occurs in the area of TDM ordinances and programs. TDM implementation is a major feature of the region's Clean Air Plan. VTA administers funding for TDM projects that are aimed at improving air quality, and VTA encourages Member Agencies to implement TDM programs and measures as development projects and land use plans are approved, and as Member Agencies develop and implement Multimodal Improvement Plans (refer to Chapter 10).

CATEGORIES OF TDM STRATEGIES

There is a variety of TDM practices that employers, developers, and local agencies can adopt to manage congestion on the transportation network such as providing cash subsidies, commute options and services, flexible work schedules, and other approaches. The following discussion provides examples of these programs.

PRICING

Pricing strategies aim to adjust the cost of various forms of transportation to encourage more efficient use of the transportation system. These strategies can encourage mode shifts away from single occupant automobile use by adjusting the relative costs of driving and alternative modes. Strategies that raise the price of transportation during the peak period can also shift automobile trips to other times of the day, thus redistributing traffic outside the most congested period of the day.

Parking Cash-Out Program — A parking cash-out program is defined as an employer-funded program under which the employer provides a cash allowance to an employee equivalent to the parking subsidy that the employer would otherwise pay to provide the employee with a parking space. Under California state law, "parking subsidy" means the difference between the amount out-of-pocket costs paid by an employer on a regular basis to secure the availability of an employee parking space not owned by the employer, and the price, if any, charged to an employee for use of that space. A 1997 survey of eight Southern California businesses using parking cash-out programs found that they reduced single-occupancy commuting by an average of 17% and reduced carbon dioxide emissions by 807 pounds per employee per year. This study also found that the parking cash-out programs were considered fair and efficient by employers and employees, had a benefit/cost ratio exceeding 4.0, and led to increased income tax revenue[2].

[2] Donald Shoup (1997), "Evaluating the Effects of California's Parking Cash-out Law: Eight Case Studies," Transport Policy, Vol. 4, No. 4, 1997, pp. 201-216, as cited in Victoria Transport Policy Institute (VTPI) TDM Encyclopedia chapter on Commuter Financial Incentives (available at http://www.vtpi.org/tdm/tdm8.htm).

Since 1993, California state law (Section 43845 of the Health and Safety Code) has required businesses with at least 50 employees in air basins designated as non-attainment areas to offer parking cash-out. Amendments to the CMP statute adopted in 1992 also require consideration of parking cash-out programs in CMPs. However, the original California parking cash-out legislation (Section 43845) only authorized the California Air Resources Board to enforce the law, and the Board in the past has not had the resources for enforcement. Senate Bill 728 (Lowenthal), approved in October 2009, amended the law to shift enforcement to the local level, by allowing cities, counties and local air districts to impose penalties for violation of the parking cash-out law. These changes to the legislation can be a powerful tool for local agencies to encourage the use of alternative modes, reduce Vehicle Miles Traveled, and reduce GHG emissions due to vehicle use.

The California Air Resources Board (CARB) has developed an informational guide for the implementation of parking cash-out programs. This guide is found in Appendix G.

Unbundled Parking in Residential Developments – While it has historically been commonplace for on-site parking to be provided automatically as part of the rental or purchase price of a residence, some developers are taking up the practice of charging for parking spaces separately. This is known as “unbundling” the price of parking from the price of housing. This practice allows residents who choose to own fewer cars than average for the development to save money by not having to pay for parking spots they are not using, and thus encourages lower rates of car ownership and usage.

Parking Management and Pricing — Charging drivers to pay for parking on city streets or in off-street parking facilities, or increasing the parking costs on city streets and facilities are effective ways to reduce automobile travel. As costs go up, commuters are likely to find alternate ways to reach their destination without paying for parking, such as taking transit to their destination, or carpooling with other commuters. This option is especially useful in dense urban areas where traffic congestion and demand for parking are greatest, and where transit, walking and biking options are typically most available. VTA has recently partnered with the Metropolitan Transportation Commission to provide information and assistance to Member Agencies in Santa Clara County who may wish to pursue parking management and pricing initiatives.

Subsidizing Ridesharing — Employers can encourage carpooling by reimbursing the fuel costs, or by subsidizing, by a pre-determined dollar amount per day, those who choose to carpool. Note, however, that any cash given to carpoolers is taxable income. Employers can encourage vanpooling by subsidizing the cost of the vehicle either directly or indirectly. With vanpools, employers can contribute a certain amount per month tax-free. Employers can also encourage both carpooling and vanpooling by providing preferential parking spaces for these modes close to building entrances.

Employee Pre-Tax Commuter Benefits — Financial incentives for employees through tax credits and other mechanisms are important elements to encourage the use of public transit and other alternatives to driving alone. Promoting such alternatives is critical to reducing traffic congestion and improving air quality. Through changes in federal tax law in the 1990s, employers are free to offer a range of commute fringe benefits without fear of tax consequences. These benefits can either be offered in addition to an employee's base salary, or the employer can offer the benefit "in lieu of compensation." Providing a portion of an employee's income in the form of a transit voucher cuts taxes for both the employer (less FICA tax) and the employee (less income tax).

The Federal TEA-21 legislation clarified that the value of any transportation fringe benefit—including free parking, transit passes or vouchers, and vanpool benefits—is not counted as taxable income if an employee is offered a choice between taxable cash benefits and any combination of transportation fringe benefits. The total amount employers are allowed to offer as a tax free commuter benefit has fluctuated over time; as of 2015, federal legislation allows up to $130.

Transit Subsidies – Some employers and residential developments located near transit are now offering free or discounted transit passes to employees and residents. Programs like VTA's Eco Pass allow employers and residential projects to purchase these passes in bulk to encourage greater usage of the transit system (See the next section, "Programs That VTA Implements" for more details). Caltrain's Go Pass offers a similar program.

Alternative Cash Incentive Programs — These programs allow employees to participate in an incentive program where they are rewarded with gifts and prizes for using alternative commute modes. An example of this program is for companies to hold a monthly raffle for all employees that participate in alternative forms of commuting. In Santa Clara County, many employers offer similar programs to reward employees for not driving alone. For example, Stanford University's Commute Club is a well-established, extensive alternative commuter incentive program. This type of program is a fun and rewarding way to get an entire company or organization involved in promoting alternative commute options.

Road Pricing/Congestion Pricing — Road pricing charges drivers a direct cost for driving on a particular roadway or in a particular area. The related concept of congestion pricing seeks to keep congestion levels on the transportation system below an acceptable threshold by charging users a variable fee. Pricing can encourage some drivers to consider alternative modes of travel, travel times or travel routes, thereby relieving pressure on the most congested facilities at peak hours. This strategy is especially effective in reducing single occupancy commute trips if there are alternative commute options such as transit service and ridesharing to choose from.

Express Lanes — Express Lanes are modified HOV lanes that allow non-carpool drivers to use the lane for a fee that varies depending on traffic conditions. This strategy takes advantage of excess capacity in HOV lanes, making more efficient use of the existing roadway system, and has the added benefit of raising revenue for future corridor improvements, including express bus services operating in those lanes.

ALTERNATIVE MODES

Providing options and services to travelers makes it easy for them to change their travel mode. The following is a list of strategies that can reduce the number of travelers that drive alone to their destination.

Bicycle and Pedestrian Improvements –Perhaps the most basic improvement to encourage a shift away from single occupant automobile travel is an enhanced environment for pedestrians and bicycles. These strategies make the streets safer, more vibrant, and attractive for those who arrive at a destination without a car. Bicycle and pedestrian improvement strategies include traffic calming and complete streets policies; provision of a complete sidewalk and walking path network; bike lanes, racks and other facilities; and publicity campaigns that encourage drivers to share the road safely.

Carpools and Vanpools— An alternative to driving alone is to find other commuters heading to the same or similar destinations and form a carpool or vanpool. This saves commuters money on gas, allows them to partially avoid the stress of driving every day, and reduces congestion and carbon emissions by taking some cars off the road. Employers and other organizations can help employees form carpools by maintaining a central database of potential carpoolers. This database can be web-based to provide easy access to company employees. Additionally, 511.org maintains a free to the public regional ride-matching database for the nine-county Bay Area, and provides employer-exclusive ride-matching. The 511.org web-based matching system allows individuals to instantly access a list of commuters – and a link to their email – with which they could share their commute.

Vanpooling is a convenient and popular way to get to work, especially for people who work far from home. “Official” vanpools have seven to 15 passengers, including the driver (who usually rides for free!), and the vehicle may be owned by one of the vanpoolers or leased from a vanpool rental company. 511.org also helps individuals join an existing vanpool, as well as helps individuals or companies start their own vanpools.

Car Sharing Programs —Car sharing programs make vehicles available to people on a per-use basis. They allow people to use a car when they need it without incurring fixed costs. Fees are

paid based on how much the driver uses the car. Lots are conveniently located throughout the urban area, and reservations are quick and easy, and available on-line.

Car sharing expands mobility options by providing people access to a car when they need one, but frees them from having to select it as the habitual mode of choice. Car-sharing has a multitude of benefits:

- Fewer parking spaces are needed for automobile storage, since multiple people use the same car. This reduces the costs of housing since fewer parking spaces would be required for each dwelling unit.
- Developers are able to build more housing on the same amount of land because fewer parking spaces are required.
- Residents and employees are given access to an entire fleet of cars conveniently located throughout the area.
- Companies have access to fleets of vehicles for meetings outside the office, only incurring charges per hour and/or per mile use.

And as usage grows so does convenience of access to the shared cars, since more people accessing the system means more pick-up and drop off locations.

Bike Sharing Program — Bike sharing programs make bicycles available to people on a per-use basis. Similar to car-sharing programs, in a bike sharing program users generally pay fees based on how long they use the bicycle. Bicycles are conveniently located in “pods” throughout an area, usually near transit stations and major trip generators. Payment is accomplished conveniently with a credit or debit card.

Guaranteed Ride Home — Often employees are not interested in using alternative modes because the modes are perceived as being inflexible. Without a guarantee that they will be able to get around in an emergency, many employees will continue to drive alone to work. Guaranteed Ride Home (GRH) programs are designed to address this issue. Employees who enroll in GRH programs receive access to transportation such as taxi service in the event of a personal emergency, for a limited number of times every year. GRH programs have found that while enrollees rarely use the program they, perhaps more importantly, gain peace of mind from the enrollment and are more willing to commit to alternative forms of transportation.

First and Last Mile Connections — First and last mile services are an integral component of building a viable transit network in a suburban environment. First and last mile conditions can be improved with good park–and–ride facilities and innovative shared-ride and parking strategies, strong bicycle and pedestrian connections with both residential and employment areas, and the application of new technologies or programs such as car and bike sharing.

Park and Ride Lots – These lots provide convenient locations for workers who do not live within easy walking distance of a transit stop to drive to a nearby parking lot and take transit the rest of the way to work. This increases the appeal of the transit system by making it useful even to people who live in outlying, low density areas that are difficult for transit to serve directly.

EMPLOYMENT AMENITIES AND SERVICES

These strategies rely on employers to provide amenities that encourage alternative modes or allow flexibility in where and when work gets done, opening up the possibility of reducing the transportation demand during the most congested periods of the day.

On-Site Amenities and Services — Offering employees the amenities they need at or near their work site can make alternative commute modes more desirable. Popular amenities include bicycle facilities, pedestrian friendly networks, and employee-serving uses (e.g., restaurants, ATMs, postal services) both on-site and off-site. Employers also have the opportunity to provide their employees with transportations services that take their employees offsite such as shuttle services to activity centers during lunch, or the use of company vehicles for personal trips during the day.

Flexible Schedules and Work Arrangements — Simply allowing workers to set their own work hours, or setting staggered working hours, can change the company's peak travel period and reduce peak-period demand on the roadway system.

Telecommuting — Some companies have provided hardware and software so that employees can access the company network from home. Hooked into the network from home, these employees may not need to show up at the office at all. While it may not be reasonable or desirable to send employees home all the time, making telecommuting an option for some employees a few days out of the workweek can significantly reduce a company's overall peak-period trips.

New Working Arrangements — Some companies have begun to question the traditional model of maintaining a central office where workers converge every day. For workers whose primary work is done on a computer rather than at a factory, the traditional office model is not necessarily the only workable one. Evidence suggests that some workers have already discarded the model of going to the office every day.

JOBS/HOUSING BALANCE AND MIXED USES

This category covers a range of strategies that bring the places people go throughout the day – employment sites, shopping, entertainment, etc. – closer to where people live, thus requiring

fewer and/or shorter trips to accomplish daily tasks. This requires a fundamental shift in thinking about the purpose of transportation, which has generally been conceived over the past few decades in the United States to be mobility – or the ability to move unimpeded throughout the region at consistently high speeds. A new paradigm focuses instead on access, the ability to reach destinations. Under this paradigm, some amount of localized congestion in dense, urban activity centers can be a good thing if it results from a mixed use built environment where people are able to get around by walking, biking, transit, and short car trips. In the long run, the region as a whole will experience reduced vehicle travel and improved air quality as a result of such development. See Chapter 7 for more information on VTA's efforts in these areas.

PROMOTIONS AND MARKETING

Public knowledge and attitudes have strong effects on travel behavior, so these strategies are important to TDM implementation. As a general distinction, promotion strategies aim to increase awareness of information people need to participate in TDM programs, while marketing strategies seek to understand, guide and influence travel behavior.

Promotion strategies include: bike, pedestrian, and transit maps that are widely available; education programs for public officials, businesses, and employees about TDM; websites or smartphone applications to provide information about transit and alternative travel options; wayfinding systems that make the transit system easier to understand; signage programs or publicity campaigns that encourage drivers to "share the road" with cyclists and pedestrians; and school programs that educate children about modes of transportation (for example, bicycle education is part of the standard curriculum in elementary schools in the Netherlands).

Marketing campaigns include: events such as a "bike to work week" or "eco-commute challenge"; surveys to determine travel preferences, knowledge and opportunities among the population of an area; campaigns that highlight the benefits of alternative modes and seek to change public attitudes; temporary discounts or free service on public transit to encourage people to try the system; and campaigns that connect transportation mode choice to environmental objectives, such as the Bay Area's "Spare the Air" campaign.

TDM PROGRAMS THAT VTA IMPLEMENTS

VTA's current countywide transportation plan, VTP 2040, and its Community Design & Transportation (CDT) Program encourage the development and continuation of successful trip reduction efforts through partnerships and incentive programs. Over the years, public agencies have taken the role of enforcing performance standards during the development review process. Developers that are not able to conform to these standards are able to implement TDM measures as a way of mitigating or lessening impacts. TDM has been a useful tool in managing the impact of development projects with auto LOS as the primary performance

metric for transportation analysis, and TDM will continue to play an important role as the emphasis shifts to VMT under SB 743.

In addition, even in the absence of a government mandate to enforce TDM practices, some companies are willing to maintain TDM programs as community and employee benefits, and may commit to trip reduction measures when applying to build new or expanded facilities. VTA, through its Development Review Program (described in Chapter 7), works with local agencies to review and comment on transportation and environmental analyses of development proposals, and offers recommendations regarding TDM measures where appropriate. In addition, VTA maintains several successful TDM programs, listed below.

ECO PASS

The Eco Pass program allows employers, developers, educational institutions, management companies or homeowners associations the ability to purchase VTA transit passes at a bulk discount rate to provide to employees or residents to encourage transit usage. Eco Passes are good for unlimited use of VTA Bus and Light Rail services, seven days a week. The program also includes an "Emergency Ride Home" provision that allows Eco Pass holders to take a taxi home if they need to leave work in the middle of the day.

SHUTTLE PROGRAM

VTA operates eight free shuttle lines from Great America Station in Santa Clara as well as a Downtown Area Shuttle (DASH) from Diridon Station in downtown San Jose. In 2018, the DASH will be upgraded to a Rapid service, offering faster and more frequent service with additional connections between Diridon Station, downtown San Jose, and the Berryessa/North San Jose BART station. These shuttles help solve the "first and last mile" dilemma that may prevent some commuters from choosing transit when the station is too far from where they live or work. These shuttles bridge the gap and connect commuters to job sites in Sunnyvale, Santa Clara, Mountain View, Palo Alto, Milpitas, North San Jose, and downtown San Jose.

PARK AND RIDE LOTS

VTA maintains 41 park and ride lots in 12 different cities throughout Santa Clara County. The lots connect commuters with VTA's light rail system, Caltrain, Capitol Corridor, Altamont Commuter Express, and several express bus routes.

BIKE SHARING PROGRAM

The Bay Area Bike Share pilot program was launched with public funding in August 2013 in five cities in the Bay Area along the Caltrain Corridor. VTA provided funding for the pilot program in Santa Clara County. The pilot system included 700 bicycles and 70 stations. The participating

cities in Santa Clara County included San Jose, with 16 stations and 129 bicycles, Mountain View, with seven stations and 59 bicycles, and Palo Alto, with five stations and 37 bicycles.

The pilot program concluded in June 2016. As the pilot program was winding down, the Metropolitan Transportation Commission entered into an agreement with a private bike share vendor to operate Bay Area Bike Share under a corporate sponsorship model, using no public funds. In September 2016, Ford Motor Company announced that it would be the title sponsor for the rebranded and expanded bike share system. Ford GoBike will expand bike share to 7,000 bicycles in San Jose, San Francisco, Oakland, Berkeley, and Emeryville The first set of new bicycles and stations were installed in summer 2017.

Palo Alto and Mountain View are not included in the expansion agreement. As of September 2017, these cities are evaluating options for continuing bike share in their communities.

Bike Share programs are intended to:

- Provide access to the first and last mile from major transit stations
- Supplement VTA and employer shuttles between transit and employer sites
- Relieve overcrowding and the routine “bumping” of passengers with bicycles on Caltrain (and on VTA buses or light rail)

HOV LANES AND EXPRESS LANES

VTA, in cooperation with Caltrans, plans for and maintains HOV lanes throughout Santa Clara County to encourage more efficient use of highways. Santa Clara County has the most extensive HOV network of any county in the Bay Area with 190 miles of HOV lanes.

In 2008 the VTA Board of Directors approved the Silicon Valley Express Lanes Program. As part of the Program, the Express Lanes projects will implement a roadway pricing system to allow solo commuters to use the available capacity in the carpool lanes for a fee. The fee would change dynamically in response to existing congestion levels and available capacity in the carpool lanes.

On March 20, 2012, VTA opened the first express lane in Santa Clara County on the SR 237/I-880 connector ramp. During FY 2017, over 3,030,000 vehicles used the express lane including over 465,000 solo drivers (about 15%). The express lane produced estimated toll revenues of $1,270,000 during FY 2017. Data shows that the express lane has successfully improved travel speeds, reduced congestion, increased traffic throughput and provided overall improved traffic operations in the corridor.

The Silicon Valley Express Lanes program includes additional express lane projects under development in Santa Clara County, including SR 237 Phase II, US 101, and SR 85.

FUNDING FOR TDM PROGRAMS

Transportation Demand Management programs can be funded by a wide variety of public and private sources, some of which require VTA involvement or coordination in Santa Clara County.

VTA administers several funding programs that support TDM and alternative modes of transportation: the BAAQMD's Transportation Fund for Clean Air (TFCA), the Santa Cara County Vehicle Emissions Based at Schools (VERBS) Program, the State's Transportation Development Act (TDA), and the Congestion Mitigation and Air Quality (CMAQ) Program. These funding sources are described below, along with descriptions of the federal funding sources which fund the STIP. See Chapter 8 (Capital Improvement Program Element) for more information on these funding programs.

Transportation Fund for Clean Air — The Transportation Fund for Clean Air (TFCA) grant program is funded by a surcharge on vehicle registrations. Assembly Bill (AB) 434 (Sher, 1991), signed into law by Governor Wilson in 1991 added Section 44241 to the California Health and Safety Code, and gave the BAAQMD the authority to collect a surcharge of up to $4 on motor vehicle registration fees paid within its jurisdiction. These funds are administered by BAAQMD and used for programs that will reduce motor vehicle emissions.

Sixty percent (60 percent) of TFCA monies are retained by BAAQMD and distributed on a regional, competitive basis. The remaining forty percent (40 percent), also known as "Program Manager Funds," are returned to the county of origin for allocation within the county on a discretionary basis. VTA is the designated program manager for Santa Clara County.

By statute, only the following project types are eligible for TFCA funds:

1. Implementation of ridesharing programs.
2. Purchase or lease of clean fuel buses for school districts and transit operators.
3. Provision of local feeder bus or shuttle service to rail stations, ferry stations and airports.
4. Implementation and maintenance of local arterial traffic management, including, but not limited to, signal timing, transit signal preemption, bus stop relocation and "smart streets."
5. Implementation of rail-bus integration and regional transit information systems.
6. Implementation of demonstration projects in congestion pricing of highways, bridges, public transit, and low-emission vehicles.
7. Implementation of a "smoking vehicles" program.
8. Implementation of bicycle facility improvement projects that are included in an adopted countywide bicycle plan or congestion management program.

9. The design and construction by local public agencies of physical improvements that support development projects that achieve motor vehicle emission reductions. The projects and the physical improvements shall be identified in an approved area-specific plan, redevelopment plan, general plan, or other similar plan.

Legislation AB 414 (1995) references the trip reduction requirement in the CMP legislation and states that Congestion Management Agencies in the Bay Area that are designated as AB 434 program managers "shall ensure that those funds are expended as part of an overall program for improving air quality and for the purposes of this chapter (the CMP Statute)."

The Air District has interpreted this language to allow a wide variety of transportation control measures now eligible for funding by program managers, including an expansion of eligible transit, rail and ferry projects.

Applications for the regional TFCA (60 percent) funds are made directly to BAAQMD in May of each year. The maximum project award is $1.0 million. The VTA Congestion Management Program, subject to BAAQMD approval, administers the funds for the remaining 40 percent program.

While there is no maximum award in the 40 percent program, Santa Clara County generally receives about $2.0 million per year for the entire program. Member Agencies apply to VTA in late January.

Santa Cara County Vehicle Emissions Based at Schools (VERBS) Program — VERBS is a competitive grant program that funds infrastructure improvements and education/encouragement programs that encourage K-12 students to safely walk, bike, carpool, and ride transit to school. The program was initiated through the Metropolitan Transportation Commission's (MTC) Climate Initiative Program, with a focus on reducing greenhouse gases by shifting travel behavior. VTA administers the program in Santa Clara County. All Member Agencies within the County are eligible to apply.

The purposes of the program are to: 1) facilitate the planning, development, and implementation of a project and/or activity that will reduce traffic, fuel consumption and air pollution in the vicinity of schools; 2) reduce traffic related injuries and fatalities to school children; 3) enable and encourage children, including those with disabilities, to walk and bicycle to school; and 4) make bicycling and walking to school a safer and more appealing transportation alternative, thereby encouraging a healthy and active lifestyle from an early age. As administrator of the VERBS program, VTA staff has released three calls-for-projects. On December 9, 2010, VTA Board of Directors approved the Cycle 1 program of projects. It included five non-infrastructure and five infrastructure projects, totaling approx. $6.6M. The

Board approved the Cycle 2 program of projects on May 2, 2013, which included four non-infrastructure and three infrastructure projects, totaling approx. $5.4M.

Prior to the Cycle 3 call-for-projects release, on April 6, 2017, the Board revised the VERBS program to direct all available funds only to infrastructure projects. Further, the Board approved the proposal that non-infrastructure projects compete for 2016 Measure B Bicycle and Pedestrian Program Education and Encouragement grant funds. Following that action, the Board approved the Cycle 3 program of projects on August 3, 2017, totaling approx. $6.9M. This cycle included seven fully funded projects and one partial funded.

Non-infrastructure Projects:

- Mountain View—Cycle 1, Cycle 2
- Palo Alto—Cycle 1
- San Jose—Cycle 1, Cycle 2
- Santa Clara—Cycle 1, Cycle 2
- Sunnyvale & County—Cycle 1, Cycle 2

Infrastructure Projects:

- Campbell—Cycle 2, Cycle 3
- Gilroy—Cycle 1
- Los Altos—Cycle 3
- Los Altos Hills—Cycle 1
- Milpitas—Cycle 1
- Mountain View—Cycle 2
- Palo Alto—Cycle 2, Cycle 3
- San Jose—Cycle 1, Cycle 3
- Santa Clara—Cycle 1, Cycle 3
- Sunnyvale—Cycle 3

Transportation Development Act (TDA), Article 3 Projects — The State's Transportation Development Act includes several sections or articles – each with a separate project emphasis. Article 3 funds pedestrian and bicycle facilities. TDA funds are derived from a quarter-cent gas tax, returned to the County of origin.

The application and distribution process varies by County. In Santa Clara County, approximately 70% of the annual TDA Article 3 allocation is distributed to member agencies on a prorated basis according to population. The remaining 30% is distributed as discretionary funding on a countywide competitive basis. All TDA Article 3 applications are subject to MTC approval.

Member Agencies submit applications to MTC and VTA in mid-January. Projects are evaluated and prioritized by VTA and Member Agency staff, the Bicycle & Pedestrian Advisory Committee, the Technical Advisory Committee, the Policy Advisory Committee, and VTA Board of Directors. VTA submits the TDA Article 3 priority list of projects to MTC.

Congestion Mitigation and Air Quality Program (CMAQ) — CMAQ funds are to be used to implement the transportation provisions of the 1990 Federal Clean Air Act. These funds are only available to areas designated as non-attainment areas. The Bay Area was briefly designated as an attainment area in 1995. That status was subsequently lost in late 1998 after a series of ozone exceedances in the summers of 1995, 1996, and 1997. Both of these funds are described in more detail in Chapter 8.

The Metropolitan Transportation Commission (MTC) has final programming authority over CMAQ funds. Programming is coordinated at the County level by the CMAs. TDM projects are fundable as system management projects.

Other Sources of TDM Funding — Appendix H provides information on other sources of TDM funding, such as Benefit Assessment Districts, Developer funding, Transportation Impact Fees, and other programs.

COMPLIANCE AND CONFORMANCE

VTA does not require local jurisdictions to implement TDM programs in order to be in conformance with the Congestion Management Program. However, the VTA Multimodal Improvement Plan process encourages TDM-oriented actions in cases where a CMP facility has fallen or is forecasted to fall below the CMP standard where it is infeasible or undesirable to mitigate the impact by increasing capacity. These actions form the basis of a Multimodal Improvement Plan (see Chapter 10). In addition, as noted elsewhere in this document, two Multimodal Improvement Plans have been adopted in Santa Clara County to date which include TDM measures in their program of offsetting improvements, and two additional MIPs are currently under development. VTA will monitor the status of the implementation of the measures in these Plans through the Implementation Status Reports submitted by local agencies (described further in Chapter 10).

CHAPTER 6 | TRANSPORTATION MODEL AND DATABASE ELEMENT

This chapter describes the VTA CMP Countywide Transportation Model and Database Element. It contains the following sections:

- CMP Transportation Model and Database Requirements
- Overview of the CMP Transportation Models
- Transportation Model and Database Maintenance
- Compliance and Conformance

Transportation models are analytical tools that can be used to assess the impacts of land use and development decisions on the transportation system. Transportation models are based on a complex interaction of relationships between variables: a simple example might be the relationship between changes in the price of gasoline and the number of vehicle-miles traveled or transit ridership. They are tools that can be used to project future transportation conditions to determine the need for and effectiveness of transportation projects and infrastructure improvements. As long as the basic relationships established in a base year model validation remain well behaved over time, a well-designed and validated transportation model should predict transportation conditions with some degree of confidence.

The CMP transportation database consists of data that describes existing and future transportation network conditions and socioeconomic characteristics in a quantitative manner. The databases are a basic input for the VTA Countywide model (CMP model) and are typically updated based on updates to the regional socioeconomic data sets provided by the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG) and through periodic updates of the transportation networks during updates of the regional and countywide long-range transportation plans.
The CMP model serves several purposes:

1. Evaluating the transportation impacts of major capital improvements on the countywide CMP System—including those contained in the CMP Capital Improvement Program (CIP).
2. Establishing transportation system characteristics for use by Member Agencies in performing transportation impact analyses, developing local transportation models, and preparing deficiency plans.
3. Providing roadway volume and transit ridership forecasts to support planning studies, environmental analysis, project engineering and design.
4. Helping summarize the relationship between land use decisions (approved development projects) throughout the County and the CMP transportation system.

As this list indicates, the CMP model serves as a fundamental tool for achieving the goals of the CMP: improving transportation conditions and air quality in Santa Clara County.

CMP TRANSPORTATION MODEL AND DATABASE REQUIREMENTS

The CMP Statute requires VTA to develop a uniform database and model for evaluating transportation impacts.[1] The Statute specifies the following three requirements for the CMP database and model, which are discussed in detail below:

1. VTA must develop a uniform database and model for use throughout the County.
2. VTA must approve computer models used by local jurisdictions to determine the transportation impacts of land use decisions on the CMP System.
3. The CMP database and model must be consistent with the Metropolitan Transportation Commission (MTC) regional transportation databases and model.

UNIFORM DATABASE AND MODEL

The legislative requirement for a uniform countywide model and database is critical to the success of the overall Congestion Management Program. The CMP model is used to assist in the land use impact analysis program, to help evaluate projects for inclusion in the Capital Improvement Program; to evaluate system-level improvements to the CMP System due to deficiency plans; and to assist with VTA service and project planning.

In 2005, VTA completed the latest major CMP model update, which has improved overall effectiveness by adding detail to Traffic Analysis Zones expanding the number of internal zones from 385 to 1490 and adding zones associated with four new external counties (San Joaquin, Santa Cruz, Monterey, and San Benito) and consistency with the MTC regional model, expanded geographical extent that incorporates surrounding counties, and updated travel patterns and socioeconomic data that reflects Census 2010 data. The 2005 model has since been improved and is referred to herein as the current model. These specific improvements will be described in later sections of this chapter.

LOCAL MODEL CONSISTENCY

In addition to the requirement for developing a countywide model, the CMP Statute requires that models developed by Member Agencies to project local transportation conditions be consistent with the CMP model and database. This is a logical requirement that helps assure

[1] California Government Code Section 65089 (c)

that all Member Agencies are using uniform techniques to evaluate the impacts of development projects.

Returning to the concept of transportation models as tools, it is clear that local transportation models will serve a similar purpose. Local models, however, operate on a different scale. While a countywide model may be able to predict future traffic volumes on a roadway, a local model would be capable of predicting the number of vehicles that turn left at a specific intersection. In general, since local transportation models are able to include more background information they provide more detailed "city-specific" information than a countywide model.

The CMP Technical Standards include Local Transportation Model Consistency Guidelines. These guidelines provide guidance to jurisdictions in developing or modifying their transportation models for consistency with the CMP models. They identify characteristics required of local models and the relationship of transportation models to traffic impact analyses. The most recent version of the Local Transportation Model Consistency Guidelines was adopted by the VTA Board in 2009.

REGIONAL TRANSPORTATION MODEL AND DATABASE CONSISTENCY

Consistency with the regional transportation model and database is one of the most important requirements of the CMP Statute. This section describes the regional model and database and consistency requirements.

MTC Regional Transportation Model — The Metropolitan Transportation Commission (MTC) is responsible for developing the Bay Area's regional transportation model. MTC has been developing a series of transportation models since the mid-1960s. MTC has recently converted the regional models from trip-based to tour-based models (MTC Travel Model One) and is expected to refine the activity-based models in the very near future. MTC is currently updating the travel analysis zone structure and transportation networks of the regional models. The CMP models are based on the previous version of the MTC transportation planning models known as BAYCAST-90. The BAYCAST-90 travel model demand system was originally developed using 1990 Census data and data from the 1990 regional household travel survey incorporating travel diary data from more than 10,000 households.

ABAG Database — The MTC models use input socioeconomic data prepared by the Association of Bay Area Governments (ABAG). ABAG projections provide estimates of employment, land use, housing, population, and household income at regional, county and census tract levels. ABAG updates its database forecasts every four years. These updates are based on surveys of local land use and development policies as well as revised national, state, and regional forecasting assumptions. The most recent version of ABAG's officially adopted database for

congestion management application is Projections 2013 (P2013). The P2013 series provide forecasts at five-year intervals from year 2010 to the year 2040. The P2013 regional socioeconomic data represents the Sustainable Communities Strategy scenario as required by California SB 375, and was used in the recently adopted MTC Regional Transportation Plan Bay Area. MTC and ABAG have recently updated the regional growth forecasts in July 2017 (P2017), however, those datasets will not be available until early 2018.

The CMP model currently uses the P2013 data set developed by ABAG. The P2013 ABAG Census Tract level allocations were sub-allocated to the smaller CMP zones based on local development characteristics to reflect the most recently adopted General Plans and specific plans for the cities of San Jose, Santa Clara, Milpitas and Gilroy, and based on the locations of approved development projects, developed in coordination with local jurisdictions. City-level control totals of households, employed residents and jobs were maintained for each jurisdiction in Santa Clara County, however, allocations at the census tract level were different than ABAG, as the growth was reallocated to reflect local approved development plans and projects.

VTA tracks major development project construction activity through an informal data collection process of tracking media reports, visiting sites in the field and communicating with Member Agency staff. During late 2014 and early 2015, VTA utilized this process to develop a "2018 Land Use Scenario" providing a reasonable projection of growth through the year 2018 based on projects under construction or recently completed since early 2014 throughout the county. The year 2018 was selected as the horizon year to coincide with the opening of Phase I of the BART Silicon Valley Extension. VTA intends to continue tracking growth and development in the county to assist in future transportation forecasting efforts and assist in allocating growth from the regional level to the local jurisdiction level.

CMP Model and Database Consistency — The CMP model and database are developed to be consistent with the MTC BAYCAST-90 model equations and the ABAG P2013 databases. MTC prepared updated consistency requirements for the CMP[2] in 2011. These requirements have not been updated as of fall 2017. Summaries of the checklist outputs are provided to MTC in a separate submittal. More details regarding specific consistency issues are described in the following sections.

CONSISTENCY WITH MTC MODEL

As noted previously, the CMP model was designed to be consistent with the previous MTC Travel Demand Model forecasting system BAYCAST-90 model. The next section provides a

[2] Appendix B of MTC Resolution No. 3000, June 2011, *MTC Checklist for Modeling Consistency for CMPs*

general overview of the CMP models and also describes several basic modeling characteristics that are shared between the models.

OVERVIEW OF THE CMP TRANSPORTATION MODELS

The CMP models developed for Santa Clara County and currently in use have undergone a series of revisions and enhancements since the original CMP models developed by the Santa Clara County Center for Urban Analysis (CUA) in 1991. The CUA models were a subarea model with a focus on travel patterns in Santa Clara County for 385 zones with travel into and out of the county treated as volumes to and from approximately 100 external zones. This structure was essentially maintained until early 2001 when the 1099 zone MTC regional model, with an addition of about 100 zones in Santa Clara County, was used to develop forecasts for the BART extension to Santa Clara County feasibility study. Shortly thereafter, a complete restructuring of the CMP models, also referred to as the VTA Countywide model, was developed in 2003 using the 1454 zone MTC BAYCAST-90 regional model as the foundation with significant zone and network detail added within Santa Clara County. That version of the VTA Countywide models also included the addition of transit submodes in the mode choice models, as well as expansion of the model region to include 4 addition counties of Santa Cruz, Monterey, San Benito and San Joaquin. The current VTA Countywide model is quite similar to the models developed in 2003, and has had a variety of improvements to more accurately capture markets not modeled in the MTC BAYCAST-90 models (air-passenger trips, truck vehicle trips and bicycle assignments) and to reflect Federal Transit Administration (FTA) recommendations for purposes of New Starts ridership forecasting. The following sections describe the most important characteristics of the VTA Countywide models (referred to as the CMP model).

Transportation Analysis Zones (TAZ's) — The current CMP model has a more refined zone system in Santa Clara County and San Mateo County than the MTC regional models. Additional zones were added to more accurately reflect and support the added roadway network and to provide more detail in transit rich corridors and dense central business districts. In all, an additional 1,122 zones were added in Santa Clara County, and 156 zones were added in San Mateo County. The new model maintains the use of MTC's zone system in the remaining seven Bay Area counties, but enlarges the full model region and zones to include Santa Cruz, San Benito, Monterey, and San Joaquin Counties.

Highway Network and Transit Network — The roadway network used by the CMP model includes additional detail in both Santa Clara and San Mateo Counties. The current CMP model also includes detailed stop, station and route detail in the transit networks for San Mateo and Santa Clara Counties, yet maintains the MTC roadway and transit networks in the remaining Bay Area counties. The Association of Monterey Bay Area Governments (AMBAG) provided the basis for roadway networks in Monterey, San Benito, and Santa Cruz counties and the San

Joaquin County COG provided roadways for San Joaquin County, however, the detailed networks were simplified to match the coarser zone structure in each of those four added counties. Express lane facilities, representing the MTC 'Backbone' express lanes system for 2040, were coded in the network with a toll facility indicator based on the highway corridor segment and the direction of travel. Differential toll facility codes were required in order to apply specific toll rates to optimize utilization of the express lanes to preserve level-of-service for free carpool users. A recent enhancement added to the CMP model is the explicit assignment of bicycle trips to the bicycle subnetworks. Bicycle travel speeds are a function of observed speeds collected using GPS-enabled devices and the mode choice models were revised to directly consider changes to bicycle travel times based on bicycle infrastructure improvements.

Capacities and Speed — The current CMP model incorporates the area type and assignment group classification system published by MTC in BAYCAST-90. Input free-flow speeds for expressways are slightly lower in the CMP models to more accurately match the travel time for the expressway segments during model validation and improve the assignment match of estimated to observed expressway volumes.

Trip Purposes — The current CMP model uses the same trip purposes used in the BAYCAST-90 model and also uses additional trip purposes not modeled by MTC. CMP model trip purposes include the following:

- Home-based work trips
- Home-based shop and other trips
- Home-based social/recreation trips
- Non-home-based trips
- Air-passenger trips to SFO, San Jose Mineta and Oakland International airports,
- Home-based school: grade school, high school, and college trips
- Light, medium and heavy duty internal to internal zone truck trips

The CMP model uses MTC BAYCAST-90 trip generation equations for trip production and trip attraction functions for all trip purposes listed above. In order to address special markets not included in the MTC trip purposes, the CMP model includes several additional trip purposes beyond those modeled by MTC, including:

- Air-passenger trips to San Francisco International (SFO) Airport and San Jose/Mineta International Airport (SJC) and
- Light, medium and heavy-duty external truck trips

Market Segments — The CMP model adopts the BAYCAST-90 disaggregate travel demand model four income group market segments for the home-based work trip purpose in trip generation, distribution and mode choice. In addition, the CMP model also maintains the three workers per household (0, 1 and 2+ workers) and three auto ownership markets (0, 1 and 2+ autos owned) used in the MTC worker/auto ownership models. Trips by peak and off-peak time period are also stratified in the trip distribution, mode choice and highway and transit assignment models.

External Trips — The CMP model uses a different approach for incorporating inter-regional commuting estimates than MTC. For external zones coincident with the MTC model, MTC interregional vehicle volumes were applied for base year 2000 and adjusted to the future by assuming a 1 percent growth rate per year. For external gateways from San Joaquin County and Santa Cruz, Monterey and San Benito Counties, the incorporation of those counties as internal modeled areas obviated the development of external vehicle volumes for those areas of the CMP models.

Pricing — The CMP model uses MTC pricing assumptions for transit fares, bridge tolls, parking charges, and auto operating costs as assumed in the current 2013 MTC Regional Transportation Plan (RTP) and Sustainable Community Strategies (SCS) update. All prices are expressed in year 1990 dollar values in the models. The CMP model also uses regional express lane toll charges for the AM and PM peak periods that are based on optimizing the level-of-service in the carpool lanes through an iterative process in the highway assignments. Depending on the level of utilization, these toll charges vary by direction, time of day and by specific corridor.

Auto Ownership — The current CMP model applies BAYCAST-90 for auto ownership models to estimate the number of households with 0, 1, and 2+ autos by four income groups in each traffic analysis zone. Walk to transit accessibility measures were incorporated in the auto ownership models consistent with MTC BAYCAST-90 to more logically associate low auto ownership households with transit services. The auto ownership models were last calibrated to match 2010 American Community Survey workers per household and auto ownership by county.

Mode Choice — The mode choice models for BAYCAST-90 include the use of nested structures for most trip purposes, however, explicit estimation of nested structures to consider transit submodes were not included in the model specification[3]. The CMP model adds a nesting

[3] A nested structure partitions the alternatives into groups (nests) of similarity. The groups can be further generalized into subgroups (subnests) and so on, which has the form of an inversed tree.

structure for transit submodes of local bus, express bus, Bus Rapid Transit (BRT), light rail, heavy rail and commuter rail underneath the MTC BAYCAST-90 nested structures. Consistent with the BAYCAST-90, mode choice coefficients are preserved by constraining the model to the BAYCAST-90 parameters, except those in transit submode structure. While the CMP model includes a transit submode nest for Bus Rapid Transit (BRT), which is an emerging transit technology in the region, BRT is treated as a local bus mode primarily due to limitations from the combined frequency process in the transit travel time builder used in the CMP models.

Peak Hour and Peak Periods for Highway Assignments — The CMP model uses a three-hour peak period (6 AM to 9 AM) as the basis for determining drive alone, shared-ride, and transit travel times for input to the trip distribution and mode choice models. This was assumed since peak hour travel volumes tend to produce extremely congested conditions for forecast years producing unrealistic volume to capacity ratios and travel times, thus significantly overestimating forecast transit probabilities. The highway assignments produce AM and PM peak hour volumes, AM and PM peak period volumes (5 AM to 9 AM and 3 PM to 7 PM, respectively – each coincident with the time periods of operation for carpools), midday volumes (9 AM to 3 PM) and evening volumes (7 PM to 5 AM). The four time period volumes are then added together to develop daily vehicle volumes.

Vehicle and Transit Assignments — The current CMP model incorporates a methodology analogous to the MTC "layered," equilibrium assignment process, which distinguishes standard mixed-flow lanes from high-occupancy-vehicle (HOV) lanes. The equilibrium assignment process used in the current CMP model is functionally equivalent to the MTC methodology. The CMP model includes additional vehicle classes in the highway assignments for park-and-ride vehicles and drive-alone and carpool toll vehicles.

Drive-alone and carpool toll vehicles for AM and PM peak periods are estimated using a toll model post-processor that estimates toll volumes based on a comparison of the non-toll and toll travel times and costs. This procedure assumes that toll choice occurs after the decision to choose auto versus transit has already been considered, and therefore does not influence transit mode choice. A toll choice constant for drive-alone and carpool modes was developed based on a calibration of toll volumes estimated by application of the toll model to the I-680 Express Lane and SR 237 Express lane facilities, and a comparison of estimated to observed express lane volumes. It should be noted that by 2035, in order to maintain the operational feasibility of implementing regional express toll lanes, it was assumed that only 3+ occupant carpools would be allowed to travel in the carpool lanes for free. This was assumed for all carpool facilities in the model region, regardless of the presence of express lanes.

In the current CMP model, transit passengers are assigned with a methodology analogous to that used by MTC, with separate assignments for each transit submode and access mode. Assignments are also performed separately for peak and off-peak conditions. A total of eighteen separate transit assignments are run to cover the full combination of transit submode and access modes as well as to estimate transit ridership for air-passengers and external home-based work transit trips from the San Joaquin (ACE, BART and San Joaquin SMART bus) and AMBAG (Caltrain and Monterey Express) model regions.

Model Validation with 2013 Traffic and Transit Volumes — The current CMP model is validated to year 2013 traffic volumes for city jurisdiction level and county-level vehicle-miles stratified by facility type. Four time periods are validated: AM peak hour and peak period (5 AM to 9 AM) and PM peak hour and peak period (3 PM to 7 PM). Daily transit boardings were validated for the year 2013 at the system level for major regional transit operators (Caltrain, BART, MUNI, VTA and AC Transit) and at the route level for VTA light rail, local bus and express bus routes.

TRANSPORTATION MODEL AND DATABASE MAINTENANCE

It is critical to maintain and update a transportation model and database on a regular basis. Elements of the CMP model are updated on an annual basis subject to availability of data used to refine different components of the models. For example, the base year of the CMP Model was changed from 2000 to 2010 and revalidated in 2013 with the availability of new traffic and transit count data. VTA has recently updated the CMP models to reflect new 2010 Census data, data from the American Community Survey as well as incorporating the new ABAG P 2013 data sets. This section describes the local data sources that are used in updating the model as well as the updating process itself.

LOCAL DATA

The CMP annual monitoring process provides a significant amount of local data that is used to update the CMP model. The two main sources of local data are described below.

Observed Traffic Volumes — The VTA CMP and Member Agencies prepare regular reports of actual traffic volumes at CMP System intersections for the PM peak hour conditions; the CMP, as part of the monitoring program, reports traffic volumes at selected freeway locations for both AM and PM peak period (3-hour) conditions. VTA has recently started to collect bicycle and pedestrian data at CMP intersections for the PM peak hour, which will be used to validate the CMP models. MTC and Caltrans also provide observed data on freeways and state highway for total volumes as well as carpool volumes. These data are used to update the countywide database of observed traffic conditions in order to verify relationships and parameters included in the CMP model.

Land Use Trip Assumptions — As part of the Land Use Impact Analysis Program, Member Agencies provide a summary of approved projects and major planning decisions, such as General Plan Amendments, made during the past year. Annual data for the Land Use Impact Analysis Program is submitted in terms of housing and development square feet by use. This data is used by the CMP to develop population and employment changes for use in refining at a more local level the socioeconomic data allocations ABAG provides at the census tract level. VTA also uses parcel data purchased from private companies to verify the base year 2010 and 2013 land use data employment values, based on application of job rates to development square footage by land use classification.

REGIONAL DATABASE AND MODELING UPDATES

CMP Statute requires that the CMP model remain consistent with the ABAG regional database and MTC model. To achieve this, the CMP model is updated on an on-going basis to remain consistent with the regional database and model. Six specific update efforts are described below.

Santa Clara County Land Use Database — To facilitate future planning, Member Agencies and VTA staff have developed an independent, locally generated, and managed land use database. This database will provide information for use in the CMP as well as help to make future ABAG projections more accurate. The database was initialized from parcel data obtained from the Santa Clara County Assessor, and will be improved as Member Agencies verify their existing land use data and as approved projects are added as part of annual land use data submittals.

As Member Agencies complete their verification, the land use database will represent the most accurate, consistent database for current and near-term land use. The database will assist ABAG by providing accurate inputs to floor area, housing, and acreage inventories for their projections. This database is available in the CMP's Geographic Information System (GIS). VTA has recently updated the model databases to reflect the recently adopted ABAG P 2013 data sets.

2010 Census Data Analysis —The Census Bureau, through the American Community Survey, has released 2010 data that was used to update the CMP models for auto ownership, trip distribution and mode choice. VTA has recently recalibrated the CMP models to reflect data from the 2010 Census and American Community Survey.

MTC Transportation Model Changes — MTC periodically issues data, analysis, and projections of information pertinent to the CMP model and assumptions, such as projections of pricing assumptions such as auto operating costs and parking costs. The CMP model and database are

modified as needed to remain consistent with those developed by MTC for its model system, which are typically distributed when the MTC Regional Transportation Plan in updated.

ABAG Data and Projections — — The most recent ABAG projections, P2013, has been updated and incorporated into the CMP model databases.

Parking Facilities and Pricing Inventory — MTC maintains an inventory of peak and off-peak parking charges at the zone level. A current and complete inventory of parking facilities and pricing is required for the internal zone system for the CMP model. The CMP model is consistent with the most recent MTC parking charges used in the RTP 2040 update, Plan Bay Area.

GEOGRAPHIC INFORMATION SYSTEMS MAINTENANCE

VTA maintains model database information in Geographic Information System (GIS) layers, or coverages. Layer information includes roadway and transit networks, bus stop and transit station locations, land-use information including parcel level data, General Plan information, key production and attraction features such as schools, shopping centers, government offices, major employers and employment centers, parks, water features, and open spaces. These GIS layers are periodically updated and refined.

COMPLIANCE AND CONFORMANCE

To be in conformance with the Congestion Management Program, Member Agencies must ensure that their models are consistent with the CMP model using the CMP Local Model Consistency Guidelines. VTA encourages the use of the CMP model by the local Member Agencies in order to ensure consistency, however, member agencies are free to develop their own local models but will be required to produce documentation to demonstrate consistency with the CMP models.

VTA must also ensure that the CMP models are consistent with the MTC regional models. To demonstrate compliance and conformance, MTC has developed a checklist of outputs that are to be produced from the CMP models and compared to a comparable MTC regional forecast year model run. CMP has prepared the checklist outputs from the most recent 2040 model runs and will provide the results in a separate submittal to MTC.

CHAPTER 7 | LAND USE IMPACT ANALYSIS ELEMENT

This chapter describes VTA's CMP Land Use Impact Analysis Program. The chapter includes the following sections:

- Statutory Requirement and VTA Policy
- Development of the CMP Land Use program
- Elements of the CMP Land Use Program
    - Development Review Program
    - Land Use and Transportation Integration Partnerships
    - Community Design and Transportation (CDT) Program
    - CMP Land Use Database
- Other VTA Activities Related to Land Use
    - VTA Activities Related to Energy and Air Quality
    - Joint Development Program
- Relationship to Regional Initiatives
    - Priority Development Area (PDA) Investment & Growth Strategy
    - Plan Bay Area and SB 375
    - MTC Resolution 3434 TOD Policy
    - AB 1358 – Complete Streets Act
- Compliance and Conformance

STATUTORY REQUIREMENT AND VTA POLICY

An underlying reason for merging the Santa Clara County Transit Agency and the Santa Clara County Congestion Management Agency and creating VTA was to better integrate land-use and transportation decision-making. Both the Transit Agency and the Congestion Management Agency were engaged in various land use and transportation integration efforts, and it was intended that these efforts be enhanced under a combined agency. This emphasis continues to the present, as one of the business themes of VTA's 2017-2022 Strategic Plan includes the integration of transportation and land use.

The CMP statute (California Government Code: 65089 (b) (4)) requires that the CMP include:

"A program to analyze the impacts of land use decisions made by local jurisdictions on the regional transportation system, including an estimate of the costs associated with mitigating those impacts."

The Santa Clara County CMA Governing Board discussed the land use impact analysis program requirement of the CMP Statute in detail during development of the 1991 CMP. It realized that the effective integration of land use and transportation had to occur on multiple levels, and that an advocacy role was also needed to influence policy development and community form. The Governing Board adopted a two-stage approach to the land use program. These stages were:

Stage I — Member Agencies utilize a consistent methodology for evaluating the impact of specific development projects on the CMP System and submit a summary of all specific projects approved to the agency as part of the CMP's annual monitoring process; the agency adds approved development projects to the countywide model and performs a cumulative transportation analysis for informational purposes.

Stage II — State law (AB 1619) vests the entity responsible for the CMP with responsibility for that county's countywide transportation plan. As part of VTA's countywide long-range transportation planning process, VTA and its Member Agencies developed land use policies and called for the creation of a new program to influence land use polices and provide incentives for planning future growth in a manner that minimizes the potential negative impacts of development on the countywide transportation system. As a result, the Community Design and Transportation (CDT) Program was created and adopted by the VTA Board of Directors in 2002 as its primary program for integrating transportation and land use. By 2004, all Member Agencies had endorsed the program through formal Council/Board Actions.

The CDT Program includes a comprehensive toolkit for Member Agencies to use in all aspects of transportation and land-use planning, and in developing both public and private development projects. It includes a foundation of key concepts, guiding principles, and specific practices and actions that Member Agencies can use to improve community form and the operation of the transportation systems.

The Stage I Land Use Impact Analysis Program was initiated as part of the 1991 CMP. The Stage II Land Use Program was developed as part of the Valley Transportation Plan 2020 adopted in 2000, and was augmented with the VTA Board adoption of the CDT Program in November 2002. Subsequent updates to VTP have continued to emphasize the importance of the CDT Program.

DEVELOPMENT OF THE CMP LAND USE PROGRAM

The CMP statute clearly intends that local jurisdictions retain their legal authority to make land-use decisions. However, the Statute also makes cities and counties more accountable for the impacts that their land use decisions have on transportation facilities than they have been in the past, both within and outside their boundaries.

Under the CMP Statute, local land use decisions may not degrade Auto Level-of-Service (LOS) below the adopted standard for VTA's CMP Roadway Network (LOS E). If a LOS standard violation is found during the monitoring process, the Member Agency within whose boundaries the violation occurs will be responsible for taking corrective actions or the Member Agency could be found in nonconformance with the CMP.

One potential problem with a strict interpretation of the CMP Statute is that it could encourage new development in outlying areas where there are large tracts of undeveloped land, and where the transportation system is relatively underutilized; that is, where LOS violations are least likely to occur and the impacts of development can be absorbed without triggering mitigation measures. This interpretation of the CMP Statute could be problematic for cities working carefully to manage urban development by encouraging infill development and reducing sprawl. Recognizing this as a potential impediment for focusing growth and infill development in major transportation corridors and cores, the State Legislature has amended the CMP statutes to allow the preparation of Deficiency Plans (called Multimodal Improvement Plans in the VTA CMP) and designation of Infill Opportunity Zones (IOZs).

The VTA CMP continues to promote the increased use of alternative transportation modes, such as transit, bicycling, and walking. In addition to encouraging infill housing and employment growth, transit-oriented development, and mixed-use development in core areas and around major transit facilities it promotes the removal of regulatory barriers. It also underscores the need to balance level of service standards for traffic with the need to build infill, transit-oriented and mixed-use developments within walking distance of transit facilities, downtowns, and town centers. The VTA CMP seeks to give greater flexibility to local governments to balance these sometimes competing needs.

LONG-RANGE OBJECTIVES

The long-term objective of the CMP Land Use Element is to develop land use and transportation initiatives that improve transportation conditions, community livability, and air quality—including the reduction of greenhouse gas emissions—while supporting community goals. For example, many of Santa Clara County's larger cities have relatively mature commercial and residential centers. In these cities, the planning emphasis has shifted from new land development to planning for balanced development within already developed centers – a form of urban revitalization.

These cities are pursuing programs of infill, adaptive-reuse, renewal, mixed-use development, and increasing their density and housing supply. This is often occurring in areas that were formerly devoted to low-density industry.

Smaller and less intensively developed cities may have different planning goals than the larger cities. However, these smaller cities are equally interested in planning objectives that ensure appropriate development, maximize the use of transportation investments and, to the extent possible, prevent unwanted traffic.

In addition to specific land-use planning efforts, VTA, the County and some cities have aggressively pursued and built new transportation facilities that could have a major impact on land-use plans. For example, the light rail system and the Caltrain line offer excellent opportunities for new transit-oriented mixed-use development. VTA is also in the process of bringing BART service to Santa Clara County, which will provide additional opportunities for transit-oriented development. In the long run, transit-oriented development projects in these transit corridors can be expected to optimize the overall benefit of transportation investments.

Application of the CMP Statute in Santa Clara County must recognize the importance of these new land use and transportation initiatives (urban revitalization and transit oriented development) and encourage these initiatives in the future. The long-range (25-year) transportation plan for Santa Clara County, Valley Transportation Plan (VTP) 2040 prepared by VTA, reaffirms VTA's commitments to land use programs and investment strategies. The CDT Program is an integral part of this plan, and land use and transportation integration will remain a key component in future updates of the long-range transportation plan for Santa Clara County.

VTP 2040's objective for integrating transportation and land use through the CDT Program includes the following aspects:

- Designing and managing the transportation system to support concentrated development in selected locations
- Reducing energy use and greenhouse gas emissions
- Providing connectivity in road, bike and pedestrian networks so travelers can choose among many routes and modes
- Using land efficiently and supporting concentrated development with strategies including land use intensification and reuse, transportation investments that minimize right-of-way requirements and limiting land area dedicated to surface parking
- Developing an urban vision that creates sense of place, human scale buildings, vibrant public spaces and as many activities as possible within easy walking distance of each other and transit stops

- Promoting street design standards that consider function and land use context, and providing interconnected multimodal options
- Supporting investments concentrated within the CDT Program's Cores, Corridors, and Station Areas
- Promoting robust partnerships with member and regional agencies

RESEARCH EVIDENCE ON THE IMPORTANCE OF CONCENTRATED DEVELOPMENT AROUND TRANSIT

Recent research at the national, state and local level has demonstrated the transportation benefits of concentrated development near transit. The following is a brief snapshot of key highlights of this research relevant to VTA's efforts in these areas.

On the residential side, a 2008 Transit Cooperative Research Program study (TCRP Report 128) noted transit-oriented development (TOD) households typically own fewer cars because they have smaller households and because they may forgo extra cars due to transit's proximity. The study found that TOD households are also almost twice as likely to not own a car, and own almost half the number of cars of other households. In addition, over a typical weekday period, the study found that 17 surveyed TOD housing projects averaged considerably fewer vehicle trips than estimated by the Institute of Transportation Engineers manual.[1] A study by researchers at the University of California Transportation Center (UCTC) in 2009 looked at parking supply versus demand at 31 multi-family housing projects near rail transit stations in the East Bay and the Portland, Oregon region, and found that parking supply exceeded demand by 25% in the East Bay and 30% in Metro Portland.[2] And a collaborative research project conducted by San Jose State University and VTA in 2010 indicated that residential TOD properties near rail stations in Santa Clara County may be 'over-parked', with supply exceeding demand by more than 20 percent on average.[3]

On the employment side, the literature review included in TCRP Report 128 notes that the location of jobs accessible by transit influences transit ridership. The report notes that "Systems that generate the highest commute ridership have a high percentage of regional jobs accessible by fast transit. For work trips, proximity to rail stations is a stronger influence on transit use than land

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Transit Cooperative Research Program (TCRP) Report 128: *Effects of TOD on Housing, Parking and Travel, 2008* (available at http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_128.pdf)

Robert Cervero, Arlie Adkins and Cathleen Sullivan, *Are TOD sites Over-Parked?*, University of California Transportation Center (UCTC) Research Paper No. 882, 2009 (available at http://www.uctc.net/research/papers/882.pdf)

San Jose State University and Santa Clara Valley Transportation Authority, A Parking Utilization Survey of Transit-Oriented Development Residential Properties in Santa Clara County, November 2010 (available at http://www.sjsu.edu/urbanplanning/docs/VTA-TODParkingSurveyReport-Vol1.pdf)

use mix or quality of walking environment. Thus, the most effective strategy to increase TOD ridership is to increase development densities in close proximity to transit. Employment densities at trip ends have more influence on ridership than population densities at trip origins. It is critical to locate jobs near transit in order to attract households to TODs."[4]

ELEMENTS OF THE CMP LAND USE PROGRAM

The Land Use Impact Analysis Program was implemented as part of the 1991 CMP, was modified in 1997, and has been augmented with the development of the Community Design and Transportation Program. Member Agencies have complied with the requirements of the Land Use Impact Analysis Program annually from 1991 to the present.

DEVELOPMENT REVIEW PROGRAM

VTA's Development Review Program encompasses two separate, yet interrelated efforts to review and comment on development and transportation projects occurring in and adjacent to Santa Clara County: 1) the review of environmental documents and development proposals submitted by Member Agencies; and 2) the review of Transportation Impact Analysis (TIA) reports for proposed projects meeting the Congestion Management Program (CMP) TIA Guideline requirements.

The objectives of the Development Review Program include improving land use/transportation coordination, promoting alternative travel modes, and encouraging a balanced approach to addressing congestion.

There are three tracks under which development review occurs:

1. Projects that require a Transportation Impact Analysis (TIA) Report per CMP guidelines, but do not require environmental clearance. For this type of project, VTA may receive a stand-alone TIA from a member agency, and the review requirements are defined by VTA Congestion Management Program standards.
2. Projects undergoing environmental clearance per the California Environmental Quality Act (CEQA). For this type of project, the public notification and review requirements are defined by the CEQA as well as member agency and VTA standards. A TIA is typically prepared during the environmental process, and the environmental document usually includes the TIA as an appendix.
3. Additional referrals sent to VTA at the discretion of the Member Agency, such as a site plan review or an administrative draft of a planning document. For these referrals, the process and deadlines are established by agreement between VTA and Member Agency staff.

[4] TCRP Report 128.

VTA staff prepares a quarterly report summarizing Member Agency projects that are submitted to VTA for review, comments submitted to Member Agencies by VTA staff, as well as projects that VTA previously commented on which were approved during the past quarter and any responses to VTA comments or conditions of approval related to transportation.

2014 TIA Guidelines Update and Relationship to Development Review

VTA requires that Member Agencies analyze the potential transportation impacts of their land use decisions on the CMP System using the Transportation Impact Analysis (TIA) Guidelines adopted by the VTA Board of Directors for all development projects that generate 100 or more net new A.M. or P.M. peak-hour trips. As part of these analyses, Member Agencies must evaluate project impacts and effects on the multimodal transportation, including roadways, transit, and pedestrian and bicycle facilities.

Over the 2012-2014 timeframe, VTA engaged in a comprehensive update of the TIA Guidelines document in response to a number of trends and changes affecting transportation and land use planning in the county and statewide:

- Progress on implementation of Senate Bill (SB) 375 and the Sustainable Communities Strategy with the corresponding emphasis on reductions in automobile trips and Vehicle-Miles-Traveled (VMT) (see “Relationship to Regional Initiatives” below);
- The 2010 updates to the California Environmental Quality Act (CEQA) Transportation checklist, which allowed agencies more flexibility in determining how to perform transportation analysis;
- The release of the 2010 Highway Capacity Manual (HCM), including new Multimodal Level of Service measures (see discussion in Chapter 4);
- Additional emphasis on Complete Streets policies in General Plan Circulation Elements (see “Relationship to Regional Initiatives” below);
- A trend for major development projects in Santa Clara County to pursue aggressive reductions in automobile trip generation (see Chapter 5).

VTA staff began this update process by identifying goals and desired outcomes as well as key areas to address, and gathering input on these topics from VTA’s Member Agencies and other stakeholders. VTA conducted an extensive outreach process of over two years incorporating input from:

- Transportation/engineering and planning staff through the Systems Operations & Management (SOM) and Land Use / Transportation Integration (LUTI) Working Groups of the VTA Technical Advisory Committee (TAC);

- An ad hoc TIA Guidelines Update Technical Working Group (TWG) consisting of Member Agency and Caltrans representatives, who provided input through two web surveys and three in-depth meetings in October 2013, January 2014, and April 2014;
- VTA Advisory Committees and the Congestion Management Program and Planning Committee (CMPP);
- Advocacy, business, development, and policy groups active in Santa Clara County; and
- Major transportation and environmental consulting firms who work in Santa Clara County.

Two of the most important goals of the TIA Guidelines Update were to 1) Emphasize the reduction of automobile trips, and 2) Improve the analysis of alternative modes.

To address the first goal, the updated TIA Guidelines include a new requirement to include a 2-page Auto Trip Reduction Statement (ATRS) at the beginning of each TIA to highlight measures by the project to reduce auto trips, in a format easy to read and understand for decision-makers and the public. VTA also added new options for projects to document trip reductions, including Target-Based Reductions for projects that establish a TDM program with a target for auto trip reduction, monitoring and enforcement; and Peer/Study-Based Reductions when studies of similar projects or similar sites occupied by the project applicant demonstrate comparable trip reductions through survey results or other data.

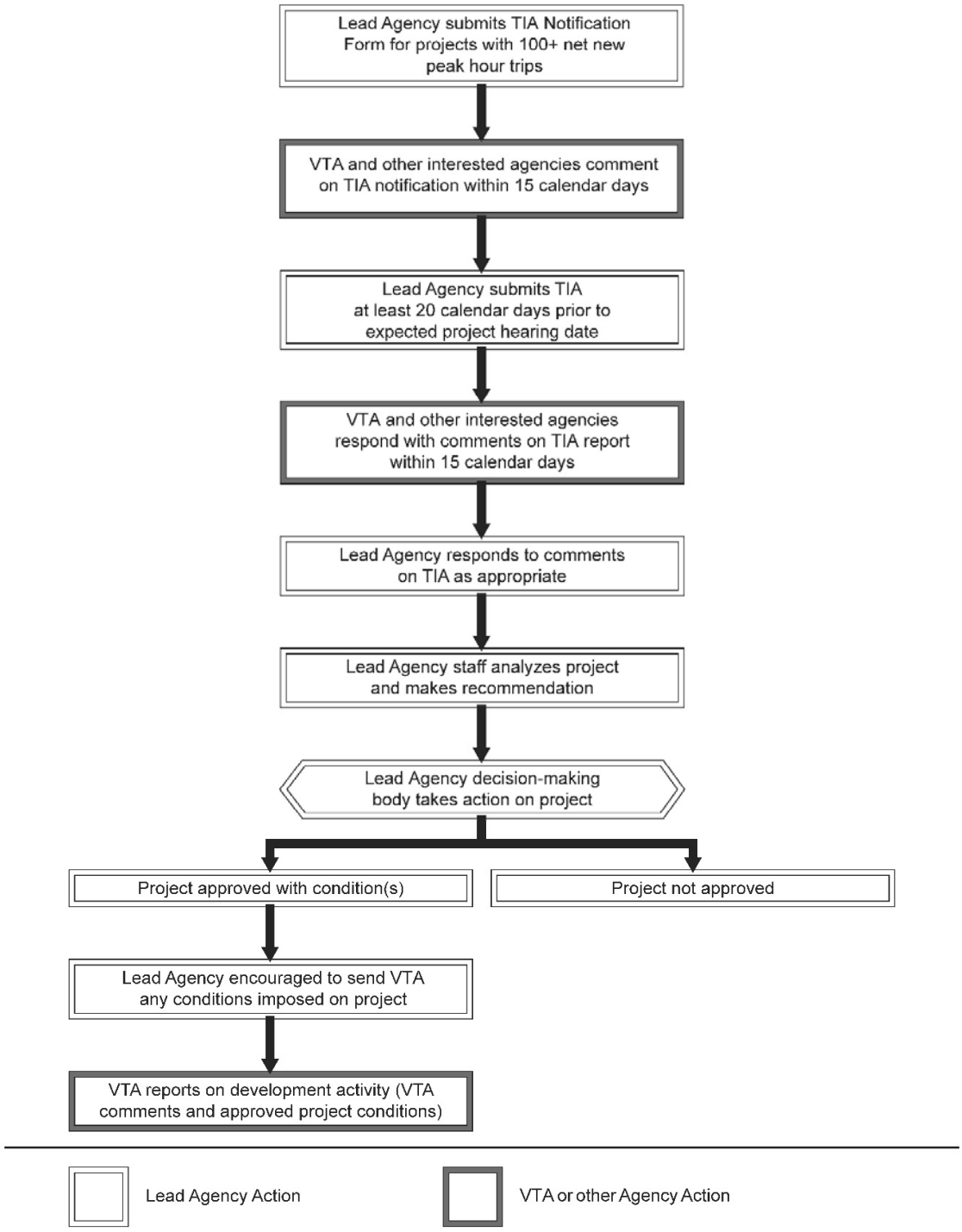
To address the second goal, VTA updated the requirements for pedestrian, bicycle and transit modes to remove the requirement to analyze demand and capacity except for projects that generate unusually large numbers of trips on these modes. For pedestrian and bicycle analyses, the updated TIA Guidelines shift to a Quality of Service (QOS)-based approach, with the specific methodology at the discretion of the Lead Agency. For transit analysis, the updated TIA Guidelines focus on transit delay and transit access/facilities. See Chapter 4 for more information on Pedestrian/Bicycle QOS and Transit Delay as Multimodal Performance Measures.

The CMP TIA Notification and Review Process is illustrated by the flow chart in Figure 7.1. The complete process is described in the CMP TIA Guidelines.

LAND USE AND TRANSPORTATION INTEGRATION (LUTI) PARTNERSHIPS PROGRAM

VTA initiated the Land Use and Transportation Integration (LUTI) Partnerships Program in response to a series of discussions with VTA Advisory Committees, the Congestion Management Program and Planning Committee (CMPP) and the Board of Directors in 2014. The purpose of

FIGURE 7.1 | TRANSPORTATION IMPACT ANALYSIS (TIA) NOTIFICATION AND REVIEW PROCESS



the program is to build on existing VTA initiatives to enhance VTA's involvement in land use decision-making. A key objective is to create opportunities for VTA and Member Agencies to work together earlier in the process of planning and development to produce more effective and meaningful collaborative outcomes. This relationship is mutually beneficial; VTA's transportation investments greatly influence many aspects of city livability and sustainability, and the local land use decisions influence the effectiveness of the various types of travel (e.g., car, walk, bike, and transit) - and both efforts attain greater value working together through each phase of development.

VTA staff offers three broad categories of outreach and assistance to Member Agencies:

- Knowledge-building: trainings, blog series, policy discussions;
- Research: development tracking and reporting on trends;
- Technical assistance: providing project-based expertise on land use, urban design, and transportation issues.

Beginning in late 2015, VTA began highlighting major areas of development throughout the county at presentations to VTA Committees and the Board, in collaboration with Member Agency staff. A key component of this effort is to identify transportation solutions to address the cumulative impacts and effects of growth on the multimodal transportation system, ultimately feeding back into VTA's long-range transportation planning efforts.

COMMUNITY DESIGN AND TRANSPORTATION (CDT) PROGRAM

The Community Design and Transportation (CDT) Program was developed to provide a unified framework for VTA's various land use activities. In 2002, the VTA Board of Directors adopted the CDT Program as its primary program to integrate transportation and land use, and adopted the *CDT Manual of Best Practices for Integrating Transportation and Land Use*. Within the next two years, every VTA Member Agency formally endorsed the CDT Program through Board or Council action, pledging to work to implement the guidelines laid out in the CDT Manual in future development. One key element of the CDT Program is the Cores, Corridors and Station Areas (CCSA) framework, which shows VTA and Member Agency priorities for supporting concentrated development in the County. The CCSA framework continues to play an important role in VTA land use activities such as the Development Review Program and VTA's participation in regional initiatives such as Plan Bay Area and the PDA Investment & Growth Strategy (see below for more details about these programs).

The CDT Program has several purposes, including providing a framework where VTA can:

- Influence the design and programming of developments as early as possible in the development process.
- Enhance the effectiveness and efficiency of VTA projects
- Be an advocate for planning and design practices that enhance community livability
- Encourage an increase in non-greenhouse gas-emitting mode shares
- Assist local jurisdictions with planning and developing projects
- Foster joint planning and project development efforts, have more meaningful interaction and coordination with cities and the county regarding land use policy
- Provide leadership through policy, planning, design, and technical innovations
- Assist member agencies with planning, design, research, education and outreach involving the interactions between transportation systems, land use and urban design
- Foster a favorable policy setting to assist decision-makers with supporting the CDT Program, and provide a venue for improved dialogue and partnerships with all stakeholders.

Partnerships and cooperation are fundamental requirements for the long-term effectiveness of the program. To be successful, the CDT Program will work to keep all stakeholders—VTA, member agencies, developers, the business community, and the public—focused on the cumulative benefits of implementing best practices. While immediate payoff opportunities may occasionally surface, incorporating CDT best practices within each new project and implementing incremental changes continually over time will yield the greatest returns. This requires active commitment from both member agencies and VTA.

VTA intends to update the CDT Manual over the coming years to reflect the most recent research and best practices in integrating transportation and land use. This effort will be undertaken in partnership with Member Agencies and other VTA stakeholders to ensure that the program is as useful and effective as possible.

CMP LAND USE DATABASE

One of the most critical aspects of the Land Use Program is gathering information on existing and planned land uses throughout the county. VTA maintains a uniform database of planning-level land use information, which was developed from 1997 to 1999 and is revised annually by Member Agencies as part of the annual CMP monitoring process.

In addition, the CMP land use database assists Member Agencies in their efforts to revise land use forecasts produced at the regional level. These regional forecasts are used in the MTC's Regional Transportation Model and must be used in the CMP countywide transportation model (according to the CMP statute). The CMP land use database structure has been designed to be consistent with the regional agency database in order to facilitate improved information exchange.

Hence, in order to maintain the land use database, the second requirement of the Land Use Impact Analysis Program is that Member Agencies provide VTA with data on two categories of land use decisions:

Approved Projects – Site-specific land use actions that have a sponsor and that have been approved for development according to a defined schedule; and

Major Land Use Planning Changes – Changes in general land use designations for which project-level approval decisions will be required before any construction can begin. Major land use planning decisions include General Plan Amendments, specific plans, area plans, and major zoning revisions.

OTHER VTA PROGRAMS AND INITIATIVES RELATED TO LAND USE

VTA ACTIVITIES RELATED TO ENERGY AND AIR QUALITY

Through partnerships between VTA and its partner agencies, VTA has initiated several activities to support the conservation of natural resources, reduction of greenhouse gases, prevention of pollution and use of renewable energy and materials. These activities also support existing legislative mandates such as AB 32 and SB 375.

Principles that inform VTA's approach to energy and air quality include:

- Look toward existing and new technology for applications in VTA operations
- Place high emphasis on demand for fuel efficient and alternative fuel vehicles
- Encourage private and public organizations to pursue green actions
- Support the development of locally produced green energy sources

VTA's activities in these areas include:

- Proactively implementing VTA's Sustainability Program
- Exploring support from private sector development through its capital and on-going operating programs

- Supporting regional and local advocacy efforts related to land use and transportation integration
- Improving transit by focusing on key corridors where local jurisdictions are committed to land use intensification and on first/last mile connections
- Supporting State and local building codes that require LEED certified construction such as insulation, energy efficient design and passive and active solar design elements

VTA JOINT DEVELOPMENT PROGRAM

VTA envisions its station areas and transit corridors as vibrant, prosperous community assets that create a strong sense of place for transit, pedestrians, and the surrounding community, and are destinations in their own right.

VTA's Joint Development Program furthers the VTP land use goal and objectives as well as the objectives of the CDT Program. The program was adopted by the VTA Board in January 2005 and is designed to secure the most appropriate private and public sector development of VTA-owned property at or adjacent to transit stations and corridors. The VTA Board of Directors adopted a revised Joint Development Policy and Implementation Plan in April 2009. The revised Joint Development Policy provides the appropriate framework to maximize the respective economic values of each real estate asset through consensus-driven, site-appropriate development that also increases transit ridership, creates vibrant community assets and enhances the long-term life of VTA's facilities.

The Joint Development Policy provides a framework for creating and pursuing the highest and best opportunities for development around station areas and corridors. The policy is intended to establish guidelines and procedures for identifying such opportunities to optimize return on investment to VTA. VTA's efforts related to Joint Development also include coordination with local jurisdictions in station area land use planning to establish development patterns that enhance transit use.

RELATIONSHIP TO REGIONAL INITIATIVES

VTA's efforts regarding land use and transportation integration work together with and reinforce initiatives that are occurring at the regional level in the San Francisco Bay Area.

PRIORITY DEVELOPMENT AREA (PDA) INVESTMENT & GROWTH STRATEGY

To encourage a shift towards higher density growth patterns, protect the environment, reduce vehicle miles traveled, and encourage investment in transit, ABAG, along with BAAQMD, MTC, and the Bay Conservation and Development Commission (BCDC) established the FOCUS Program in 2006 and 2007. FOCUS established Priority Development Areas (PDAs) with

incentives for transit oriented development and provided a bridge between local land use decisions and regional development. As part of the update of the Bay Area's Regional Transportation Plan, MTC and ABAG initiated the Priority Development Area (PDA) Investment & Growth Strategy as the successor to FOCUS. Over the past several years, VTA has been working with its Member Agencies, advocacy groups and other interested parties to craft a PDA Investment & Growth Strategy that will be a useful tool to identify needs and resources for the PDAs and allow cities to target improvements to these areas. The most recent report was completed in summer 2017 and was adopted by the VTA Board of Directors in September 2017.

On May 17, 2012, MTC and ABAG adopted the One Bay Area Grant (OBAG) program to distribute federal funds for transportation projects. As part of OBAG, MTC and ABAG adopted general programming policies for the distribution of funds, including a requirement that at least 70% of OBAG investments be directed to PDAs for projects located either in, or serving the PDAs. For future grant cycles, funding may be distributed to those local agencies that have PDAs. With each new round of OBAG funding, VTA will work with its partners to produce a PDA Investment & Growth Strategy Report that will highlight these needs and identify the resources required to address growth.

Through the CDT Program, which preceded FOCUS and the PDA Investment & Growth Strategy, VTA and its member agencies have already made a commitment to developing communities that have focused development served by transit. While several good examples of this type of development have been built in Santa Clara County and more are currently under construction, much work remains to be done. The coming updates of the CDT Manual will assist Member Agencies in these efforts. The majority of areas in the CDT Program Cores, Corridors, and Station Areas framework are included as PDAs in the PDA Investment & Growth Strategy, and some Santa Clara County cities have had other areas designated as PDAs. These locations will be supported by technical and financial assistance from both ABAG and MTC to help plan and develop into complete communities based on the goals of transit connectivity, housing availability and economic vitality.

PLAN BAY AREA AND SB 375

In July 2013, MTC and ABAG adopted 'Plan Bay Area,' which includes the region's Sustainable Communities Strategy and 2040 Regional Transportation Plan. Plan Bay Area marks the Bay Area's first long-range transportation plan to meet the requirements of California's 2008 Senate Bill 375 (Steinberg), which requires each of the State's 18 metropolitan areas to reduce greenhouse gas (GHG) emissions from cars and light trucks. Under SB 375 each region must develop a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS) that promotes compact, mixed-use commercial and residential development that is walkable and

bikeable and close to mass transit, jobs, schools, shopping, parks, recreation and other amenities.

The land use distribution of Plan Bay Area was developed to meet performance targets based on SB 375:

- Help the region achieve its GHG emissions reduction target of reducing per-capita CO2 emissions from cars and light-duty trucks by 7 percent by 2020 and by 15 percent by 2035; and
- House 100 percent of the region's projected 25-year population growth by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents.

To help achieve these goals, the 2013 Plan Bay Area envisions 80% of all new housing and 66% of all new jobs to be located in PDAs. In July 2017, the regional agencies adopted an updated RTP/SCS, Plan Bay Area 2040, which continues to emphasize concentrated housing and job growth in PDAs.

VTA, as the Congestion Management Agency for Santa Clara County, was actively involved in the development of the SCS and the RTP and served as a liaison between the regional agencies and VTA's Member Agencies in these efforts. Through VTA's own initiatives including the CDT Program, Land Use Impact Analysis Program, and Joint Development Program, VTA has long supported the goal of integrating land use and transportation planning that the SCS and RTP strives to achieve. VTA is committed to supporting local and regional efforts intended to give people more transportation choices, create more livable communities and reduce energy consumption and the pollution that causes climate change.

MTC RESOLUTION 3434 – REGIONAL TRANSIT EXPANSION PROGRAM AND TOD POLICY

As part of the 2001 update to the Regional Transportation Plan (RTP), MTC developed an associated Regional Transit Expansion Program (RTEP) that identified a list of high-priority rail and express/rapid bus improvements to improve mobility and enhance connectivity throughout the Bay Area. MTC adopted a Transportation and Land Use Platform that calls for supportive land use plans and policies to support transit expansions in Resolution 3434. In 2005, MTC amended Resolution 3434 to include a Transit-Oriented Development Policy that establishes specific housing thresholds for these transit extensions, requires station area plans, and establishes corridor working groups.

One transit extension project in Santa Clara County is identified in the MTC Resolution 3434 TOD Policy – the BART extension from Fremont to San Jose/Santa Clara. The TOD Policy calls for a minimum threshold of 3,850 housing units per station area, averaged for the corridor starting from the existing end station (Fremont) to the end of the extension (Santa Clara). The TOD

Policy specifies that to meet the corridor level thresholds, within a half mile of all stations a combination of existing and planned land uses must meet or exceed the overall corridor threshold for housing. New below-market housing units will receive a 50 percent bonus toward meeting the corridor threshold (i.e., one planned below-market housing unit counts for 1.5 housing units for the purposes of meeting the corridor threshold).[5]

VTA, as the sponsor for the BART extension project to Milpitas, San Jose, and Santa Clara, is actively working with the cities along the corridor and other stakeholders to plan for future housing and employment intensification, station access needs, pedestrian- and bicycle-friendly design, and infrastructure improvements in the vicinity of the six stations in the BART Silicon Valley extension. As of 2017, station area planning efforts have been completed for Milpitas Station, Santa Clara Station, and Diridon Station in San Jose. Planning efforts are also ongoing for the Berryessa Station and the Alum Rock Station in San Jose, involving coordination between VTA, the City of San Jose, CommUniverCity, San Jose State University, several neighborhood associations, and local land owners. VTA is also initiating a BART Phase II Transit-Oriented Development Strategy Study to develop updated and implementation-focused TOD strategies for the Alum Rock, Downtown San Jose, and Santa Clara Stations.

AB 1358 - COMPLETE STREETS ACT

The California Complete Streets Act of 2008 requires counties and cities making revisions to the circulation element of their general plans from January 2011 onward to plan for a balanced, multimodal transportation network that meets the needs of all users of the roadways. These users include bicyclists, pedestrians, motorists and persons of all ages and abilities. The intent of Complete Streets is to provide multimodal networks that are safe, convenient and well maintained with the goals of reducing greenhouse gas emissions and vehicle miles traveled and improving public health.

VTA and its member agencies support this initiative and VTA is currently working on a variety of Complete Streets efforts that will complement the update of the CDT Program. These efforts will assist member agencies in planning, designing and implementing projects that include the following key elements:

- Multimodal design – Incorporating street designs that accommodates all travel modes where appropriate
- Capacity/Continuity – Maximizing efficient use of the roadway and implementing consistent street designs on corridors that travel through multiple cites
- Technology – Using technology to improve safety and roadway operations

[5] MTC Regional Transit Expansion Program of Projects (MTC Resolution 3434) TOD Policy, July 27, 2005, Attachment D-2.

- Connectivity – Improving access for all transportation modes to major destinations
- Maintenance – Including plans for preserving the multimodal networks

As a part of VTA's Complete Streets efforts, VTA is currently leading three Complete Streets corridor studies in coordination with member agencies, along the Story-Keyes, Tasman, and Bascom corridors.

COMPLIANCE AND CONFORMANCE

Member Agencies provide data to VTA annually in the CMP Monitoring Report following the process described in the CMP Monitoring and Conformance Requirements. The data provided includes all approved development projects and major land use planning changes made during the past year. This data is used to update the CMP countywide transportation model. In order to conform to the CMP, Member Agencies must submit the Annual Land Use Monitoring Report to VTA for the year ending June 30, by December 1 of each year.

When VTA's cumulative analysis of all approved projects produces a finding of potential nonconformance caused by project-related trips on the CMP System, the Member Agency or Agencies will be advised that nonconformance – the actual violation of Auto LOS Standards on an intersection or road segment of the CMP System – is imminent. Under those circumstances, the Member Agencies may be required to identify strategies to maintain conformance. These strategies will affect projects that have not yet been approved that could further degrade the LOS on the same intersection or road segment. Member Agencies may propose to add mitigation measures, to defer approvals, or to prepare Multimodal Improvement Plans that contain system-wide or multimodal improvements.

If the analysis of a land use planning decision shows that the proposed land use changes may contribute to a future violation of Auto LOS standards, subsequent reports must demonstrate that future land use plans and/or transportation improvements will prevent LOS violations, or that an approved Multimodal Improvement Plan will be applied to achieve systemwide improvements.

CHAPTER 8 | CAPITAL IMPROVEMENT PROGRAM

This chapter describes Santa Clara County's CMP Capital Improvement Program (CIP). It contains the following sections:

- Introduction
- Capital Improvement Program Funding
- CIP Project Lists

INTRODUCTION

The Capital Improvement Program (CIP) is a list of capital projects designed to improve transportation conditions and air quality in Santa Clara County. The CIP describes major transportation projects proposed by Member Agencies and Caltrans and includes projects funded by a variety of funding sources. The CIP does not include transit projects funded solely through Federal Transit Administration (FTA) formula funds (Sections 5307 and 5309) or Transportation Development Act (TDA) Sections 4 and 4.5 funds. These projects are included in the VTA, Caltrain and ACE Short Range Transit Plans (SRTPs).

The CMP statute requires that the CMP contain a Capital Improvement Program that accomplishes the following objectives:

- Maintains or improves the performance of the multimodal system for the movement of people and goods.
- Mitigates the impacts of land use decisions on the Regional Transportation System.
- Conforms to air quality mitigation measures included in state and federal air quality plans.
- Preserves the investment in existing facilities.

LOCAL POLICIES FOR CIP DEVELOPMENT

In 1992, the Santa Clara County CMA Governing Board adopted several specific policies (in addition to the statutory requirements for CIP projects) to guide the development of the Capital Improvement Program. These policies were used in conjunction with the regional criteria for project selection and other program-specific criteria to develop the CIP. The VTA Board of Directors revised these policies as a result of the November 2001 election and January 2009 adoption of its long-range Countywide Transportation Plan, Valley Transportation Plan 2035 (VTP 2035). They are listed as follows:

- Future discretionary Federal and State programming is limited to pedestrian, bicycle and roadway projects (Adopted October 5, 2000).

- Santa Clara County's STIP submittal will be formulated to be consistent with the adopted long-range Countywide Transportation Plan.
- Project sponsors in Santa Clara County will provide at least twenty percent of total project cost in local matching funds where appropriate.
- All projects submitted for funding must be on or benefit the adopted CMP System.
- Transportation improvements should support higher density development around transit stations, thus promoting the use of transit and other alternatives to the single-occupant vehicle in Santa Clara County.
- Improvements that make existing developments more pedestrian and bicycle-friendly, support HOV and transit users, and improve passenger safety and convenience are encouraged.
- Transportation improvements should support land-use policies that encourage well-designed infill and mixed-use development.
- Whenever possible, roadway projects shall improve, or at least not reduce, outside lane widths (or bicycle lanes) to provide for safe bicycle travel.

CAPITAL IMPROVEMENT PROGRAM FUNDING

The VTA Board adopted the Valley Transportation Plan 2040 (VTP 2040) in October 2014. VTP 2040 addresses transportation-related projects and actions in Santa Clara County that involve participation by VTA and its associated agencies, impact inter-jurisdictional travel, or are regional in nature. These investments are location-specific improvements for four modes of travel: roadway (including HOV and ITS), transit, bicycle, and pedestrian. The following sections describe funding programs for the 2017 CIP.

SURFACE TRANSPORTATION PROGRAM (STP) / CONGESTION MITIGATION - AIR QUALITY PROGRAM (CMAQ)

STP funds are used to address congestion problems by funding planning, rehabilitation and improvement projects across all transportation modes. CMAQ funds are used to implement the transportation provisions of the 1990 Federal Clean Air Act and are allocated only to areas designated as non-attainment areas. The Bay Area is currently a non-attainment area.

The STP and CMAQ funding programs are part of the Fixing America's Surface Transportation (FAST) Act (Pub. L. No. 114-94). On December 4, 2015, President Obama signed this act into law—the first federal law in over a decade to provide long-term funding certainty for surface transportation infrastructure planning and investment. The FAST Act authorizes $305 billion over fiscal years 2016 through 2020 for highway, highway and motor vehicle safety, public

transportation, motor carrier safety, hazardous materials safety, rail, and research, technology, and statistics programs. The FAST Act maintains our focus on safety, keeps intact the established structure of the various highway-related programs US DOT manages, continues efforts to streamline project delivery and, for the first time, provides a dedicated source of federal dollars for freight projects.

REGIONAL IMPROVEMENT PROGRAM (RIP) AND INTERREGIONAL IMPROVEMENT PROGRAM (IIP)

Senate Bill 45 (SB-45) was signed into law in 1997. This legislation directed funds from the State Highway Account (SHA) into three funding categories:

1. Regional Improvement Program (RIP) – 75 percent
2. Interregional Improvement Program - Rural Interregional – 15 percent
3. Interregional Improvement Program - Discretionary – 10 percent

Seventy-five percent of the consolidated funds are allocated to the regions as Regional Improvement Program funds. The Metropolitan Transportation Commission (MTC) programs these funds through the State Transportation Improvement Program (STIP) process, with final approval by the California Transportation Commission (CTC).

The remaining 25 percent is allocated to the two categories of the Interregional Improvement Program (IIP). Fifteen percent is allocated to projects outside of the urbanized areas (IIP – 15 percent Category). The remaining 10 percent may be programmed on any interregional project at the discretion of Caltrans and CTC. All IIP funds are programmed by Caltrans, through the Interregional Transportation Improvement Plan (ITIP) process, with final approval by CTC. The regions may work with Caltrans for combined RIP and IIP funding of projects in the ITIP and/or petition for the nomination of particular projects in the ITIP. However, the ability to nominate projects for the ITIP rests solely with Caltrans. In the past, Caltrans has nominated and the CTC has programmed IIP funds to projects within Santa Clara County.

TRAFFIC CONGESTION RELIEF FUND

On July 6, 2000, the governor signed Assembly Bill 2928 into law. This bill established the Traffic Congestion Relief Fund (TCRF) to provide funding for specific congestion relieving transportation projects around the State. The bill made $914.5 million available for projects and to Santa Clara County; TRCF funding was prioritized for Prop. 42 funds until 2008, however Prop. 42 funds were diverted on multiple occasions and the prioritization period ended with a significant back-log of un-allocated funds. The CTC adopted a TCRP allocation plan in 2008 based on Prop. 42 payback schedules and tribal gaming receipts that were anticipated at the time, and prioritized the remaining projects into two tiers based on their delivery schedules.

The Prop. 42 payback revenues are directed to the first tier, with anything remaining in a given year, and the tribal gaming receipts directed to the second tier. VTA's BART extension project is in the first tier, and accounts for half of each year's guaranteed revenues until 2015. VTA received the final allocation in July 2015.

SENATE BILL 1

Senate Bill 1, the Road Repair and Accountability Act of 2017, was signed into law on April 28, 2017. This legislative package invests $54 billion over the next decade to fix roads, freeways and bridges in communities across California and puts more dollars toward transit and safety. These funds will be split equally between state and local investments.

2000 MEASURE A , 2008 MEASURE B , AND 2016 MEASURE B SALES TAX FUNDS

In November 2000, the voters of Santa Clara County approved Measure A, a 30-year countywide ½-cent sales tax to be collected by VTA and used to fund specific transit projects and programs. 2000 Measure A took effect in April 2006, immediately after the expiration of the 1996 Measure B ½-cent sales tax, and will continue for 30 years until 2036.
In November 2008, the voters of Santa Clara County approved Measure B, a 1/8–cent sales tax for the purpose of funding the operations and maintenance of the 16.1 mile BART extension into Santa Clara County and for providing VTA's contributions to BART's system wide capital reserve. The tax is limited to 30 years.

In November 2016, the voters of Santa Clara County approved Measure B. Revenues will fund various transportation projects in Santa Clara County. These projects range from local streets and roads repair, bicycle/pedestrian improvements, and building Caltrain grade separations to funding Phase II of the BART extension. Due to ongoing litigation, 2016 Measure B revenue is being held in an escrow account "until the legality of the tax is finally resolved by a final and non-appealable decision…" (California Revenue and Taxation Code, Rev. & Tax. Code § 7270(c).)

TRANSPORTATION FUND FOR CLEAN AIR

The Transportation Fund for Clean Air (TFCA) is generated by a $4.00 surcharge on vehicle registrations. The Bay Area Air Quality Management District (BAAQMD) administers these funds in the nine-county Bay Area. Funds are available for allocation to alternative fuels, arterial management, bicycle, and trip-reduction projects that reduce vehicle emissions.
BAAQMD returns 40% of these funds to the county in which they are collected for allocation by a "program manager." This fund is called the TFCA Program Manager Fund. VTA is the program manager for Santa Clara County and project sponsors apply directly to VTA for funding. The VTA Board of Directors allocates these funds to projects in Santa Clara County, following criteria developed by VTA and its Member Agencies and subject to approval by BAAQMD. The

remaining 60% of the funds are dedicated to a regional discretionary program managed directly by the BAAQMD.

SANTA CLARA COUNTY EXPRESS LANES REVENUE

In 2004, the State passed legislation (AB 2032, Dutra) giving VTA the authority to implement express lane operations in up to two routes in Santa Clara County. VTA completed an Express Lane Study that identified candidate routes, which are listed below as part of the Highway Program of projects.

In 2012, VTA opened the first express lane in Santa Clara County on the SR 237/I-880 connector ramp. During FY 2013, the express lane produced toll revenues of $1,049,000, exceeding the projection of $592,000, while the total expenses incurred were below projections at $535,000.

VTA estimates that express lane projects will generate approximately $1.01 billion in revenues (net of operating and maintenance expenses) through 2040 that will be used for transit services and other transportation improvements in the express lanes corridors.

2010 MEASURE B VEHICLE REGISTRATION FEE

In 2010 the voters of Santa Clara County approved a $10 increase in the motor vehicle registration fee for transportation-related projects and programs. Funds are distributed to the County of Santa Clara based on the County's percentage share of the total roadway lane mileage recorded in Caltrans' California Public Road Data report. The remaining funds are distributed to the incorporated cities within Santa Clara County based on each city's percentage share of the total county population as reported by the California Department of Finance. Roadway mileage and population shares are updated annually.

Eligible Project Categories include:

1. Pavement Rehabilitation/Reconstruction
2. Traffic Control Signals, Traveler Information & Safety Devices
3. Curb & Gutter Rehabilitation/Reconstruction
4. Roadway-Related Facilities to Improve Safety
5. Automobile-Related Environmental Mitigation including Roadway Sweeping & Litter Control
6. Intelligent Transportation System Technologies (transportation-related technologies including traffic control signals, safety and traveler information systems)

7. Countywide Environmental Mitigation related to pollution caused by autos and trucks
8. Matching funds for Federal/State/Regional transportation grants applied to any roadway transportation project included in the adopted Valley Transportation Plan

CIP PROJECT LISTS

The Capital Improvement Program is developed in accordance with the regionally adopted multimodal criteria for project selection. The criteria emphasize maintaining and sustaining the existing transportation system, improving its efficiency and effectiveness through congestion relief, safety improvements and consideration of freight movement, expanding the system, and accounting for external impacts on land use and air quality.

The CMP statute requires that capital improvement programs be submitted to the regional planning agency (the Metropolitan Transportation Commission in the Bay Area) for inclusion in the Regional Transportation Improvement Program (RTIP) and the Transportation Improvement Program (TIP). The statute then specifies that the regional agency shall:

1. Evaluate the consistency between the program and the regional transportation plans pursuant to Section 65080.
2. Find the program to be consistent and incorporate it into the regional transportation improvement program as provided for in Section 65082. If the regional agency finds the program is inconsistent, it may exclude any project in the Congestion Management Program from inclusion in the regional transportation improvement program.

The following pages contain the project lists constituting the Capital Improvement Program, listed, by mode, in Tables 8.1 through 8.8. Readers seeking additional information about a specific project should consult the project listing in the Transportation Improvement Program (http://www.mtc.ca.gov/funding/tip/index.htm).

TABLE 8.1 | CAPITAL IMPROVEMENT PROJECTS: HIGHWAY PROJECTS ($ IN THOUSANDS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
US 101 / Mabury New Interchange	SCL070004	VTA	$20,750	$0	$20,750
Total			$20,750	$0	$20,750

TABLE 8.2 | CAPITAL IMPROVEMENT PROJECTS: EXPRESS LANE PROJECTS ($ IN THOUSANDS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
US 101 Express Lanes	SCL110002	VTA	$431,000	$0	$431,000
SR 85 Express Lanes	SCL090030	VTA	$176,000	$4,800	$171,200
SR 237 Express Lanes: North 1ST Street to Mathilda Ave	SCL110008	VTA	$27,000	$1,600	$25,400
Total			$634,000	$6,400	$627,600

TABLE 8.3 | CAPITAL IMPROVEMENT PROJECTS: EXPRESSWAY PROJECTS ($ IN THOUSANDS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
San Tomas Expressway Widening	SCL110007	Santa Clara County	$56,100	$0	$56,100
Total			$56,100	$0	$56,100

TABLE 8.4 | CAPITAL IMPROVEMENT PROJECTS: LOCAL STREETS PROJECTS ($ IN THOUSANDS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
Charcot Avenue Extension over I-880	SCL090003	San Jose	$30,200	$0	$30,200
Coleman Avenue Widening from I-880 to Taylor Street	SCL090005	San Jose	$13,000	$0	$13,000
SR 237/US 101/Mathilda Interchange Modifications	SCL130001	VTA	$40,000	$0	$40,000
Total			$83,200	$0	$83,200

TABLE 8.5 | CAPITAL IMPROVEMENT PROJECTS: PAVEMENT MANAGEMENT ($MILLIONS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
Monterey Road Preservation	SCL130043	Morgan Hill	$1,690	$1,379	$311
San Jose Citywide Pavement Management Program	SCL130005	San Jose	$13,200	$11,531	$1,669
Winchester Blvd. Overlay Project	6590	Campbell	$554	$1,171	$1,725
Cupertino Pavement Management	6605	Cupertino	$879	$769	$110
Fremont Avenue Overlay	6678	Los Altos	$515	$306	$179
Street Resurfacing Project 2018	6672	Milpitas	$1,819	$1,609	$210

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
Dunne Avenue Pavement Rehabilitation Project	6701	Morgan Hill	$1,252	$857	$395
West Middlefield Road Improvements	6690	Mountain View	$1,550	$1,136	$414
Palo Alto OBAG2 Street Resurfacing	6636	Palo Alto	$1,179	$1,009	$170
Tully Road Improvement Project	6647	San Jose	$16,711	$8,599	$8,112
McKee Road Improvement Project	6648	San Jose	$16,757	$8,623	$8,134
San Jose Pavement Maintenance	6652	San Jose	$18,137	$14,597	$3,540
Santa Clara Streets and Roads Preservation	6670	Santa Clara	$3,413	$2,356	$1,057
Capitol Expressway Pavement Rehabilitation	6748	Santa Clara County	$5,648	$5,000	$648
McKean Road Pavement Rehabilitation	6747	Santa Clara County	$1,920	$1,700	$220
Uvas Road Pavement Rehabilitation	6747	Santa Clara County	$1,700	$220	$1,921
Total			$87,695	$61,176	$26,489

TABLE 8.6 | CAPITAL IMPROVEMENT PROJECTS: TRANSIT ($ in THOUSANDS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
BART - Warm Springs to Berryessa Extension	SCL110005	VTA	$2,521,899	$1,242,520	$1,279,379
BART - Berryessa to San Jose Extension	BRT030001	VTA	$4,944,676	$360,340	$4,584,336
LRT Extension to Vasona Junction	SCL090040	VTA	$176,000	$0	$176,000
Stevens Creek Bus Rapid Transit	SCL110010	VTA	$161,507	$713	$160,794
Capitol Expressway LRT Extension	SCL050009	VTA	$293,9000	$57,540	$236,360
El Camino Real Bus Rapid Transit	SCL110009	VTA	$233,700	$0	$233,700
San Jose International Airport People Mover	SCL090019	VTA	$50,000	$0	$50,000
Total			$8,381,682	$1,661,113	$6,720,569

TABLE 8.7 | CAPITAL IMPROVEMENT PROJECTS: SYSTEMS OPERATION AND MANAGEMENT PROGRAM ($ IN THOUSANDS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
Sunnyvale Traffic Signal Upgrades	6632	Sunnyvale	$2,899	$2,566	$333
Total			$2,899	$2,566	$333

TABLE 8.8 | CAPITAL IMPROVEMENT PROJECTS: BICYCLE/PEDESTRIAN AND "LIVABLE COMMUNITIES" PROJECTS ($ IN THOUSANDS)

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
New Ronan Channel and Lions Creek Trail	SCL110032	Gilroy	$1,929	$1,706	$223
Montague Expy Ped Bridge at Milpitas BART Station	SCL130040	VTA	$841	$744	$97
Bay Trail Reach 9	SCL050082	San Jose	$2,378	$675	$1,703
Coyote Creek Trail	SCL050083	San Jose	$14,769	$3,674	$11,095
Los Gatos Creek Trail Reach 5 Bridge Crossings	SCL110029	San Jose	$4,600	$1,250	$3,350
Adobe Creek/ Highway 101 Bicycle Pedestrian Bridge	SCL130041	Palo Alto	$9,500	$4,000	$4,500
San Jose Pedestrian Oriented Traffic Signals	SCL130010	San Jose	$3,472	$3,000	$472
San Tomas Aquino Spur Trail Phase 2	SCL130022	Santa Clara County	$4,594	$3,234	$1,360
San Jose Meridian Bike/Ped Improvements	SCL130004	San Jose	$1,674	$1,150	$524
St. Johns Bikeway and Pedestrian Improvements	SCL130011	San Jose	$1,500	$1,185	$315
East San Jose Pedestrian Improvements	SCL110121	Santa Clara County	$2,660	$2,128	$532
Miramonte Ave. Bike/Ped Access Improvements	6700	Los Altos	$1,000	$581	$1,581
Waverley, E. Meadow & Fabian Enhanced	6655	Palo Alto	$919	$480	$1,399

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
Bikeways					
Mt. Pleasant Bike/Ped Traffic Safety Improvements	6657	San Jose	$1,000	$860	$1,860
San Tomas Aquino Creek Trail Underpass	6634	Santa Clara	$2,449	$1,271	$3,069
Saratoga Creek Trail Phase 1	6635	Santa Clara	$3,735	$1,591	$5,326
Hetch-Hetchy Trail Phase 1	6668	Santa Clara	$790	$504	$1,250
Java Road Diet and Bike Lanes	6566	Sunnyvale	$500	$133	$633
Fair Oaks Bikeway Phase 2	6619	Sunnyvale	$783	$208	$991
Lawrence Station Area Sidewalks & Bike Facilities	6627	Sunnyvale	$500	$133	$633
Bike/Ped Infrastructure Improvements	6764	Sunnyvale	$919	$244	$1,163
Almaden Ave & Vine St Safety Improvements	SCL090004	San Jose	$1,815	$1,500	$315
Saratoga Village Sidewalk Rehabilitation	SCL130027	Saratoga	$183	$162	$21
Prospect Road Complete Streets	SCL130026	Saratoga	$4,765	$4,205	$560
Capitol Expressway ITS and Bike/Ped Improvements	SCL130037	County of Santa Clara	$9,400	$7,500	$1,900
East San Jose Bikeways	SCL130016	San Jose	$2,532	$2,000	$532
Sunnyvale/Saratoga Road Bike/Ped Safety	SCL130028	Sunnyvale	$663	$524	$139

Project Name	TIP ID	Sponsor	Total Funds	Discretionary	Local
Enhancmts.					
Maude Avenue Bikeway and Streetscape	SCL130030	Sunnyvale	$880	$695	$185
Fair Oaks Avenue Bikeway and Streetscape	SCL130029	Sunnyvale	$1,210	$956	$254
SRTS Ped Infrastructure Improvements	SCL130032	Sunnyvale	$1,900	$1,570	$330
Arastradero Road Schoolscape/Multiuse Trail	SCL130034	Palo Alto	$1,502	$1,000	$502
Jackson Ave Bicycle and Pedestrian Improvements	SCL130007	San Jose	$1,899	$1,500	$399
Eden Avenue Sidewalk Improvements	6640	Campbell	$555	$175	$582
El Camino ReaL Pedestrian Safety and Streetscape	6630	Palo Alto	$4,655	$709	$5,300
West San Carlos Urban Village	6752	San Jose	$7,932	2,168	$10,100
Santa Clara School Access Improvements	6669	Santa Clara	$1,145	$504	$1,649
Saratoga Village Crosswalks and Sidewalk Rehab	6664	Saratoga	$338	$84	$422
Peery Park "Sense of Place" Improvements	6631	Sunnyvale	$2,686	$714	$3,400
East Sunnyvale Area "Sense of Place	6617	Sunnyvale	$3,047	$810	$3,856
Homestead High School Improvements	6763	Sunnyvale	$1,000	$265	$1,265
Total			$49,890	$33,910	$16,478

CHAPTER 9 | MONITORING AND CONFORMANCE ELEMENT

BACKGROUND

State statute sections 65089.1 and 65089.2 identify a number of program elements and responsibilities pertaining to the establishment of a Congestion Management Program. Section 65089.3 charges the Congestion Management Agency with monitoring all elements of the program on a biennial basis. VTA, as the CMA for Santa Clara County, meets and exceeds this requirement.

Specifically, the CMA must monitor the level of service on the CMP roadway network (Freeways, State Highways and Principal Arterials) as well as the impacts of land use changes to determine whether Member Agencies are conforming to the CMP. The CMA must also ensure that its Member Agencies are meeting transportation impact analysis submittal requirements. Failure to conform to the CMP may result in the withholding of Member Agency Proposition 111 (1991) gas tax revenue.

Monitoring findings are released each spring in the Monitoring and Conformance Report after receiving months of input from VTA's Systems Operations & Management Working Group and other Member Agency staff. The Report is reviewed by VTA's Advisory and Standing Committees and is ultimately approved by the Board of Directors.

AUTO LEVEL OF SERVICE STANDARD

Statute 65089 (1)(A) identifies auto Level of Service (LOS)—a sliding A through F scale where LOS A indicates no traffic congestion and LOS F indicates significant congestion—as the measure to apply to CMP network operation. The statute establishes LOS E as the minimum CMP auto LOS standard. CMP facilities operating below LOS E will be considered non-conforming. CMP facilities operating below LOS E prior to 1991 are exempt from meeting the LOS standard. Further discussion of the VTA CMP auto LOS standard is provided in Chapter 3 of this document.

SCOPE OF THE MONITORING PROGRAM, RESPONSIBILITY AND METHODOLOGY

Below is a discussion of how data is collected and analyzed for conformance for each section of the Monitoring Program. In some areas the methodology is mandated by the CMA legislation. In other areas the CMA and Member Agencies have collaborated to determine the proper methodology. Detailed discussions of level of service methodology can be found in VTA's Traffic Level of Service Analysis Guidelines. Further information about the methodology for data collection in the monitoring program is included in the 2014 Monitoring and Conformance

Report. This section also indicates whether the Member Agencies or VTA are responsible for monitoring, and how often the monitoring takes place.

FREEWAYS (VTA RESPONSIBILITY, UNDERTAKEN ANNUALLY)

Each fall, VTA collects AM and PM peak period data for the freeways in the CMP network. Since 1997, the VTA has used aerial photography to collect a comprehensive set of data for every freeway segment. The aerial photographs are used to measure traffic density, which forms the basis to calculate LOS as well as speed and flow rates based on a density-speed curve.

Transition to Big Data

In 2014, VTA initiated a study that investigated freeway data collection techniques that utilize innovative new methodologies, namely Big Data.[1] VTA staff worked with a consultant to apply this methodology to the CMP Monitoring and Conformance Program. Using the 2014 monitoring study, the aerial photography method was utilized but was compared side-by-side with data collected at the same times and locations by video camera, the Caltrans Performance Measurement System (PeMS), and INRIX ('big data' from a variety of sources). This effort provided a more comprehensive data set for a lower cost than aerial photography.

This comparison assisted VTA and its Member Agencies in determining the usefulness of these data sources for future monitoring studies. No timetable has been set for the use of Big Data in the monitoring study, but VTA is implementing this technique in the near-term, with the 2017 Monitoring Program as a test run to determine whether it will be used in the future monitoring program cycles.

VTA envisions that a transition to big data could improve the Monitoring Program, not only by potentially providing more data for a lower cost, but also by widening the scope of transportation analysis in Santa Clara County. Over the coming years VTA staff will evaluate the suitability of big data to conduct research in the following areas:

- Vehicle miles traveled
- Duration of congestion
- Automobile travel times and reliability
- Congestion spillover to alternate routes

[1] Big Data is a phenomenon currently impacting a wide range of industries, defined as "a new generation of technologies and architectures designed to economically extract value from very large volumes of a wide variety of data, by enabling high-velocity capture, discovery, and/or analysis" (Big Data: Beyond the Hype, White Paper by Datastax Corporation, March 2012). In the field of transportation monitoring and analysis, Big Data methods involve aggregating traffic-related information from GPS-enabled vehicles and mobile devices, traditional road sensors and hundreds of other sources (INRIX website, accessed 9/11/2013).

- Causes of congestion
- Transit travel times and reliability
- Modal split
- Automobile trip generation

LAND USE APPROVALS (MEMBER AGENCY RESPONSIBILITY, UNDERTAKEN ANNUALLY)

Each summer Member Agencies are requested to submit land use approval data for the prior fiscal year to VTA. The data submittal identifies the parcel number, traffic analysis zone (TAZ), zoning designation/change, number of residential units added/removed and the number of commercial/industrial square feet added/removed.

VTA tallies the annual change in residential units and commercial/industrial square footage on a city and countywide basis, identifies development trends and undertakes a geographic analysis of land use changes. The data appears alongside data from previous years in the Monitoring and Conformance Report. Figure 9.1 shows the locations of residential land use approvals from fiscal year 2016. Figure 9.2 shows the locations of commercial/industrial land use approvals for the same year.

TRANSPORTATION IMPACT ANALYSIS (MEMBER AGENCY RESPONSIBILITY, CONTINUALLY AS APPROPRIATE)

Member Agencies are required to undertake a Transportation Impact Analysis (TIA) when a project is expected to produce more than 100 net new peak hour trips during the AM or PM peak hour (weekdays) or the peak hour (weekends). TIAs are required to be submitted to VTA for review and comment at least 20 calendar days before the project is considered for approval or recommended for approval. See Chapter 7 for further discussion of TIAs and the TIA Guidelines.

CMP INTERSECTIONS (MEMBER AGENCY RESPONSIBILITY PERFORMED BY VTA, UNDERTAKEN BIENNIALLY)

The operation of principal arterials and state highways located within urbanized Santa Clara County is measured by the level of service at CMP Intersections. CMP intersections are select, generally high-volume intersections located along these thoroughfares. 252 CMP intersections are currently monitored. Every other fall, the PM peak period vehicle volume data for each CMP Intersection is collected and analyzed. CMP Intersection data will next be collected for the 2018 monitoring cycle. Traditionally, data collection for CMP intersection monitoring has been a Member Agency responsibility. However, based on an agreement between VTA and the Member Agencies in 2011, data collection for CMP intersections is currently performed by VTA.

FIGURE 9.1 | APPROVED HOUSING UNITS NEAR VTA'S CORES, CORRIDORS AND STATION AREAS (2016 NET CHANGE)

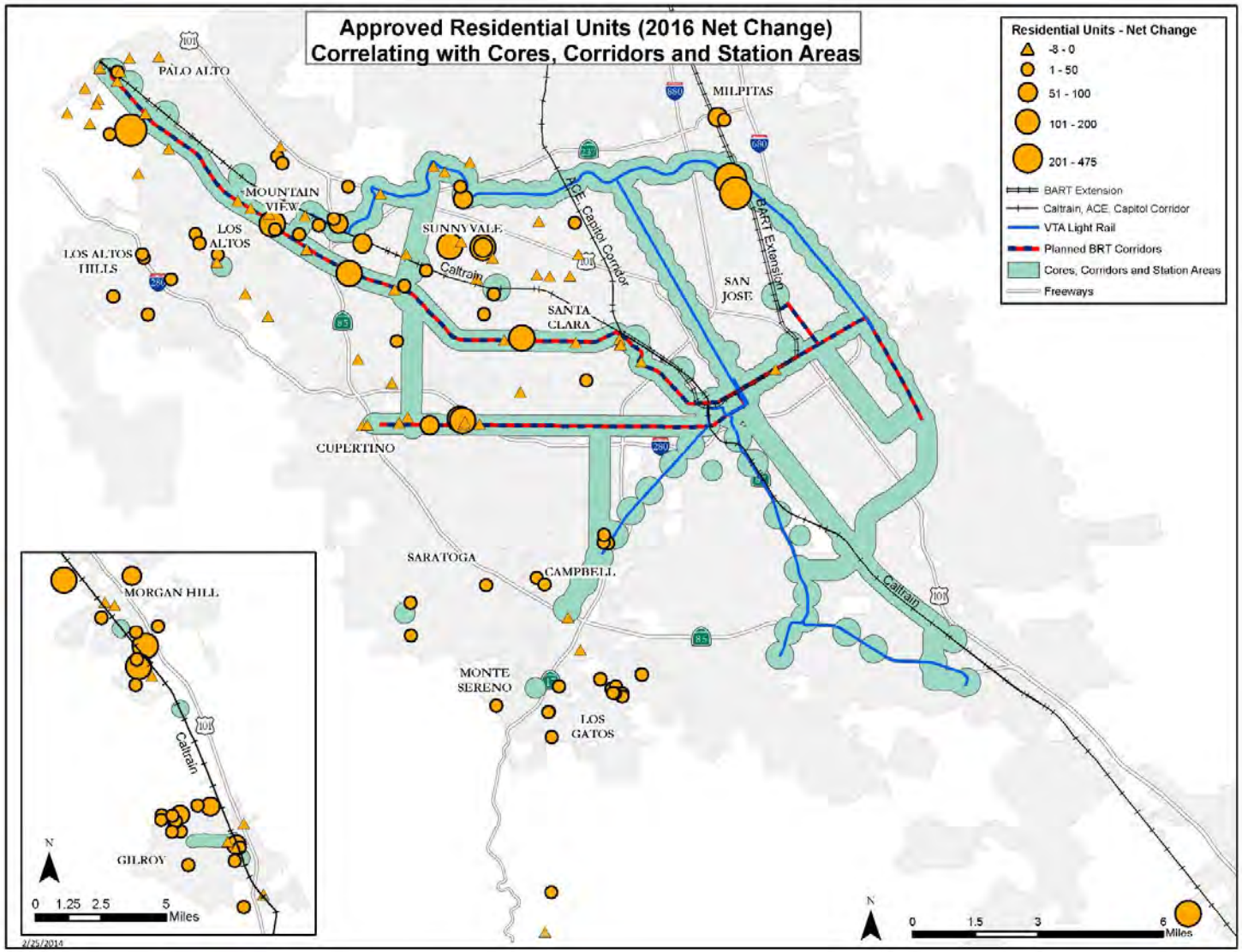
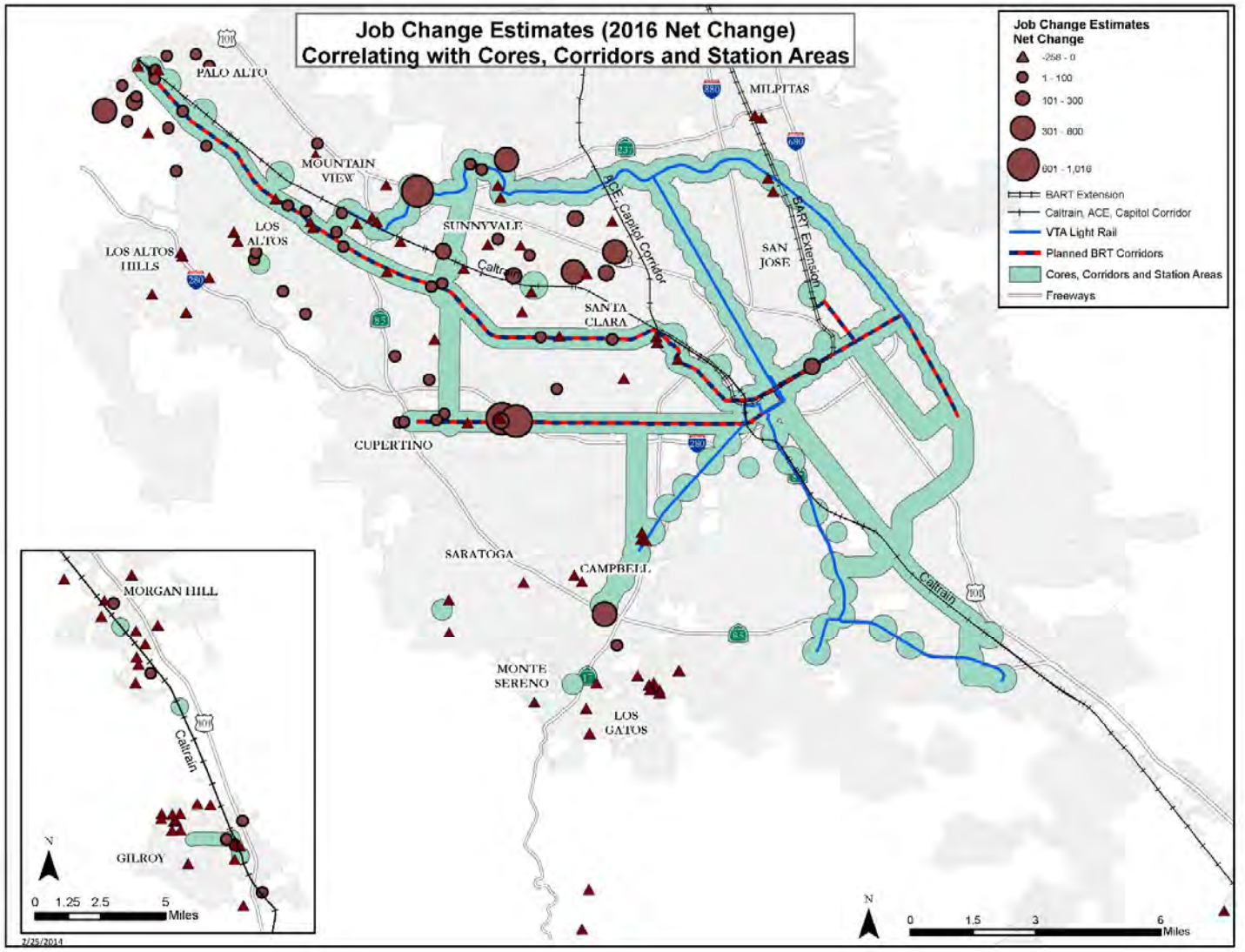


FIGURE 9.2 | JOB CHANGE ESTIMATES NEAR VTA'S CORES, CORRIDORS AND STATION AREAS (2016 NET CHANGE)



For CMP Intersections level of service is calculated in terms of Average Control Delay—the average number of seconds a vehicle must wait at the intersection. The methodology is based on the 2000 Highway Capacity Manual.

RURAL HIGHWAYS (VTA RESPONSIBILITY, UNDERTAKEN BIENNIALLY)

Every other fall, VTA uses hose counters to conduct three-day counts at twelve locations along Santa Clara County's rural highways. Counts are recorded in 15-minute intervals with the one-hour period that shows the greatest combined vehicle volume considered the peak period. Automatic hose counters are used to measure vehicle counts by the number of times the hose is depressed by traveling vehicles. The LOS procedure in the 2000 Highway Capacity Manual is used to measure the percent time-spent following and average travel speed, with appropriate inputs for peak hour and peak 15 minute traffic volumes, the percentage split between the two directions of traffic, the percentage of trucks in the traffic flow, and the type of terrain. Rural highway data will next be collected for the 2018 monitoring cycle.

MULTIMODAL IMPROVEMENT PLAN MONITORING (MEMBER AGENCY RESPONSIBILITY, UNDERTAKEN ANNUALLY)

Multimodal Improvement Plans shall be prepared by Member Agencies in situations where the CMP Traffic Level of Service standard is violated or is likely to be violated in the future. The requirements for preparing Multimodal Improvement Plans are set forth in VTA's Deficiency Plan Requirements, which were most recently updated in September 2010 and are described further in Chapter 10. Member Agencies with approved Multimodal Improvement Plans are responsible for preparing an Implementation Status Report that documents progress on the implementation of all the improvements and actions included in the Multimodal Improvement Plan. These Status Reports are to be submitted annually by the Member Agencies with approved Multimodal Improvement Plans. As part of its monitoring process, VTA will review Member Agencies' Implementation Status Reports for purposes of determining conformance with the CMP.

MONITORING AND CONFORMANCE PROCESS

The following is a brief summary of the steps in the VTA CMP Monitoring and Conformance Process over the course of the fiscal year. Table E.1 in the Executive Summary summarizes the CMP Elements, monitoring and conformance requirements, timing, and responsible agency in tabular form.

July – VTA alerts Member Agencies of monitoring requirements and deadlines for data submittal. The notification contains paper and electronic versions of the annual monitoring and conformance requirements, land use approval worksheet, certification form and supporting documents.

Fall – Member Agencies assemble land use approval data and TIA submittals. VTA collects all data for the CMP Monitoring Program between Labor Day and the Thanksgiving Holiday week. Freeway data and land use data are collected every year. Biennially, data is also collected for CMP Intersections, rural highways and bicycle and pedestrian volumes. Member Agencies with approved Multimodal Improvement Plans prepare Implementation Status Reports annually.

Winter – VTA staff receives and analyzes monitoring data. Monitoring data is presented to the Systems Operations & Management Working Group (SOMWG) for review and discussion.

Spring – VTA presents the Draft Monitoring and Conformance Report and conformance findings to the SOMWG, select advisory and standing committees and the Board of Directors for adoption.

If a Member Agency is found in non-conformance with the CMP, the agency will be notified by VTA in writing and will have 90 days to achieve conformance. If a Member Agency finds flaws with a finding of non-conformance, the agency has 60 days to submit a written response either disputing the finding by documenting any errors related to the determination of conformance or detailing how the agency will respond to the violation, for instance by developing a Multimodal Improvement Plan. Written responses must be signed by the city manager/town manager/county executive.

If a Member Agency found to be non-conforming has not achieved conformance within the 90 days following written notice, the VTA Board of Directors will make a finding of non-conformance and will notify the State Controller, who will withhold gas tax subventions from the non-conforming jurisdiction.

Summer – Following adoption by the Board of Directors, a final version of the Monitoring Report is released incorporating feedback, if any, from the committees and the Board.

RELEVANT TECHNICAL GUIDELINES

The following Technical Guidelines of the VTA Congestion Management Program are relevant to the Monitoring and Conformance process. The versions/dates listed are the most current as of fall 2015.

- Traffic Level of Service Analysis Guidelines (adopted June 2003)
- Annual Monitoring Requirements (revised April 2004)
- Deficiency Plan Requirements (adopted September 2010)
- Transportation Impact Analysis Guidelines (adopted October 2014)

CHAPTER 10 | MULTIMODAL IMPROVEMENT PLAN ELEMENT

This chapter describes the Congestion Management Program Multimodal Improvement Plan Element, and includes the following sections:

- VTA Approach to Multimodal Improvement Planning
- Multimodal Improvement Plan Requirements
- Multimodal Improvement Plan Evaluation
- Multimodal Improvement Plan Monitoring
- Local Multimodal Improvement Plans
- Compliance and Conformance

INTRODUCTION

The Congestion Management Program (CMP) Statute states that, "When the level of service on a segment or at an intersection fails to attain the established level of service standard… a deficiency plan shall be adopted pursuant to Section 65089.4."

Beginning with the 2013 CMP, VTA uses the term "Multimodal Improvement Plan" for "Deficiency Plan" as defined by state legislation. The purpose of this change is to highlight the positive role a Multimodal Improvement Plan can play in identifying measures available to Member Agencies to improve multimodal transportation options in situations where it is infeasible or undesirable to address a level of service (LOS) deficiency by expanding automobile capacity. Prior to August 2013, VTA used the term "Deficiency Plan," so this term still occurs in the Board-adopted VTA Deficiency Plan Requirements (2010) as well as two Deficiency Plans that have been adopted by cities in Santa Clara County.

To be consistent with CMP Statute, Multimodal Improvement Plans must include a list of improvements, programs, or actions that measurably improve multimodal performance and contribute to significant improvements in air quality. If a CMP System facility falls below the LOS standard and does not have an approved Multimodal Improvement Plan, then the local jurisdiction in which the facility is located is at risk of losing gas tax revenues provided from Proposition 111.

Multimodal Improvement Plans allow local jurisdictions to proceed with development projects even if adherence to CMP auto LOS standards cannot be achieved for specific facilities. In some situations, meeting LOS standards may be infeasible or undesirable. For these situations, Multimodal Improvement Plans allow local jurisdictions to adopt innovative and comprehensive

transportation strategies for improving system-wide multimodal transportation rather than strictly adhering to an auto LOS standard that may contradict other community goals, such as concentrating higher-density development near transit or maintaining the attractiveness of streets for pedestrians and bicyclists. In other words, Multimodal Improvement Plans allow Member Agencies to trade off increased congestion on one CMP facility for transportation system improvements to other facilities or services (e.g. transit, bicycling, walking, or transportation demand management).

VTA APPROACH TO PREPARING MULTIMODAL IMPROVEMENT PLANS

VTA has been proactive in the development of guidelines and standards for Multimodal Improvement Plans. The approach taken by the VTA Board has been to create a clear set of guidelines so that traffic congestion and off-setting improvements can be addressed in advance and development projects are not delayed by the process.

The Technical Advisory Committee (TAC) began the development of guidelines for the preparation of Multimodal Improvement Plans, then referred to as Deficiency Plans, immediately upon completion of Santa Clara County's first Congestion Management Program in 1991. The first Requirements for Deficiency Plans were adopted in November 1992. These standards were revised by VTA in consultation with its Member Agencies in 2009 and 2010, and new Deficiency Plan Requirements were adopted by the VTA Board in September 2010.

The following is VTA's approach to the preparation of Multimodal Improvement Plans.

- All Multimodal Improvement Plans must be one of the following three types:
    1. Mini Multimodal Improvement Plan: A Mini Multimodal Improvement Plan is prepared to address a single CMP Intersection or roadway facility, typically in conjunction with a Transportation Impact Analysis (TIA) Report for a single development project.
    2. Specific Area Multimodal Improvement Plan: A Specific Area Multimodal Improvement Plan is prepared for a CMP roadway segment or set of intersections within a localized specific area such as a downtown or special district.
    3. Areawide Multimodal Improvement Plan: An Areawide Multimodal Improvement Plan is prepared to address all the CMP System roadways or intersections included in an identified area such as an entire city or an area that covers multiple jurisdictions and/or cities.
- VTA recommends that Member Agencies prepare Areawide Multimodal Improvement Plans whenever possible. This will reduce the number of Multimodal Improvement Plans prepared and lead to implementation of comprehensive solutions to transportation problems.

- VTA requires that each Multimodal Improvement Plan include implementation of all feasible and applicable actions on the "Deficiency Plan Action List" provided in the VTA Deficiency Plan Requirements. Member Agencies must identify how all of these specific actions will be implemented as part of the Multimodal Improvement Plan.
- VTA requires that each Multimodal Improvement Plan demonstrate, to the extent practical, how the actions included in the Plan, such as improved public transit service and facilities, improved non-motorized transportation facilities, and enhanced transportation demand management measures, will improve system-wide multimodal performance and air quality.

MULTIMODAL IMPROVEMENT PLAN REQUIREMENTS

VTA's most recent document addressing the policies and procedures for Multimodal Improvement Plans is the Board-adopted Deficiency Plan Requirements, September 2010.

The CMP Statute states that "The deficiency plan shall include the following elements" (summarized from California Government Code Section 65089.4):

1. Analysis of the cause of the deficiency;
2. Analysis of the improvements needed to maintain the CMP auto LOS standard on the deficient facilities and the cost of those improvements;
3. A list of alternative improvements, programs or actions that will improve multimodal performance and improve air quality; and
4. An action plan for implementing the improvements outlined in (2) or the alternative actions outlined in (3).

The CMP statute requires congestion management agencies to use the action items from the Deficiency Action List developed by the local air quality management district. The air quality management district for Santa Clara County, the Bay Area Air Quality Management District (BAAQMD) adopted a Deficiency Plan Action List in November 1992. The BAAQMD's list is based on the Transportation Control Measures (TCMs) in the Bay Area Clean Air Plan. The most recent Bay Area Clean Air Plan was adopted in April 2017 and contains an updated list of TCMs that can guide the development of Multimodal Improvement Plans (see Appendix G for a complete list of TCMs in the 2017 Clean Air Plan). Therefore, Multimodal Improvement Plans will be a significant means of implementing TCMs and working towards improved air quality in Santa Clara County.

VTA's Deficiency Plan Requirements include the BAAQMD Deficiency Plan action list, as Appendix C of the document. Where appropriate, VTA's requirements contain edits that have

been made to the Air District's Deficiency Plan action list to reflect current standards and practices applicable to Santa Clara County.

MULTIMODAL IMPROVEMENT PLAN UPDATES

Multimodal Improvement Plans must be updated when transportation and/or development projections change significantly from the assumptions used for the Multimodal Improvement Plan. Multimodal Improvement Plan monitoring requirements are addressed later in this chapter.

MULTIMODAL IMPROVEMENT PLAN EVALUATION

Member Agencies must prepare Multimodal Improvement Plans and adopt them at a noticed public hearing. The Multimodal Improvement Plan is then submitted to VTA. According to the CMP Statute:

> "A city or county shall forward its adopted deficiency plan to the agency within 12 months of the identification of a deficiency. The agency shall hold a noticed public hearing within 60 days of receiving the deficiency plan. Following the hearing, the agency shall either accept or reject the deficiency plan in its entirety, but the agency may not modify the deficiency plan. If the agency rejects the plan, it shall notify the city or county of the reasons for that rejection." (California Government Code Section 65089.4(d))

The VTA Deficiency Plan Requirements define the criteria that will be used to approve or reject Member Agency Multimodal Improvement Plans. VTA staff will analyze Multimodal Improvement Plans submitted by Member Agencies using the adopted criteria, and present a report to the VTA Board that documents their findings and contains a recommendation to approve or reject the Multimodal Improvement Plan.

MULTIMODAL IMPROVEMENT PLAN CRITERIA

The following criteria will be used when evaluating Multimodal Improvement Plans:

1. Are all actions on the most current version of the Deficiency Plan Action List that are applicable and feasible included in the Multimodal Improvement Plan? Are the reasons why any actions found to be inapplicable or infeasible adequate?
2. Are sufficient actions included in the Multimodal Improvement Plan to compensate for the deficient facility's unacceptable LOS? Are these actions on the Deficiency Plan Action List or have they been approved by the BAAQMD? Is the technical analysis of physical improvements included in the Multimodal Improvement Plan adequate?

3. Does the Multimodal Improvement Plan include a workable program to guarantee implementation of all actions and improvements included in the Multimodal Improvement Plan?
4. Are the costs for implementation of the Multimodal Improvement Plan actions reliably estimated? Does the Multimodal Improvement Plan include an adequate method for financing the actions and improvements?
5. Are the Multimodal Improvement Plan actions and improvements consistent with all appropriate regional and local plans? (i.e. the Regional Clean Air Plan, the Regional Transportation Plan, the Regional Transportation Improvement Program, the BAAQMD's Deficiency Plan Action List and any subsequent requirements, and applicable General Plans).
6. Did the local jurisdiction consult with all appropriate neighboring jurisdictions and agencies when preparing the Multimodal Improvement Plan?
7. Does the Multimodal Improvement Plan include a monitoring program that will assess whether Multimodal Improvement Plan actions and improvements have been implemented?
8. Did the Member Agency prepare an adequate environmental analysis of the Multimodal Improvement Plan?

In accordance with CMP statute, VTA will consider Multimodal Improvement Plans at a noticed public hearing. If a Multimodal Improvement Plan is rejected, VTA will provide a written report that documents its reasons for rejecting the Multimodal Improvement Plan.

MULTIMODAL IMPROVEMENT PLAN MONITORING

Multimodal Improvement Plans must be monitored as part of the CMP Monitoring and Conformance Program. Member Agencies will monitor implementation of Multimodal Improvement Plan actions by preparing a Multimodal Improvement Plan Implementation Status Report. This status report will be based on the implementation schedule included in the Multimodal Improvement Plan.

If a Member Agency is not meeting the implementation schedule it set forth in a Multimodal Improvement Plan, VTA may require the Member Agency to expedite the implementation of their Multimodal Improvement Plan, or the Member Agency could be found in nonconformance with the CMP and lose gas tax revenues generated by Proposition 111.

As part of its CMP Monitoring and Conformance Program, VTA performs an evaluation of the multimodal performance of the CMP Transportation System which helps evaluate the overall effectiveness of VTA and Member Agency efforts to improve the system, including the Capital Improvement Program and the adopted Multimodal Improvement Plans. It must be

emphasized that it will be difficult to measure quantitatively the effect of individual actions or even of individual Multimodal Improvement Plans, especially since most of the actions are designed to achieve maximum effectiveness over the long term. VTA uses several types of quantitative data to analyze overall CMP effectiveness. The data may include LOS data submitted to the CMA by Member Agencies as part of the LOS monitoring program, pedestrian and bicycle count data collected as part of the monitoring program, and modeling data, such as vehicle miles traveled and mode shares, gathered from VTA's Countywide Transportation Model.

LOCAL MULTIMODAL IMPROVEMENT PLANS

To date, two Multimodal Improvement Plans have been developed by cities and approved by the VTA Board of Directors. Both were adopted as "Deficiency Plans." The City of Sunnyvale developed a Citywide Deficiency Plan which was approved by the VTA Board in January 2006, and the City of San Jose developed the specific area North San Jose Deficiency Plan that was approved by the VTA Board in June 2007. Two other cities in Santa Clara County are in the process of developing Multimodal Improvement Plans; the City of Mountain View is preparing a citywide plan, and the City of Santa Clara is preparing a plan for northern Santa Clara associated with the City Place development project. Other cities in Santa Clara County such as San Jose are considering developing Multimodal Improvement Plans to address LOS deficiencies associated with development projects or land use plans. Further information about specific Multimodal Improvement Plans in Santa Clara County is provided in the CMP Monitoring and Conformance Report. VTA will work with local agencies that develop new Multimodal Improvement Plans, and as they are adopted these plans will be monitored per CMP requirements.

COMPLIANCE AND CONFORMANCE

In order to be in conformance with the Congestion Management Program, Member Agencies must:

- Prepare Multimodal Improvement Plans for facilities that violate CMP auto LOS standards or that are projected to violate LOS standards using the adopted VTA Deficiency Plan Requirements.
- Submit Multimodal Improvement Plan Implementation Status Reports as part of the CMP Monitoring process.

APPENDIX A | GLOSSARY

2016 Measure B: A 30-year, half-cent countywide sales tax to enhance transit, highways, expressways and active transportation (bicycles, pedestrians and complete streets) adopted in November 2016.

AB-32: Assembly Bill 32 (Nunez) The California Global Warming Solutions Act of 2006. AB-32 was signed into law by Governor Arnold Schwarzenegger on September 27, 2006. The bill required the California Air Resources Board to adopt regulations that require the reporting and verification of statewide greenhouse gas emissions and to monitor and enforce compliance with the regulations.

ABAG: Association of Bay Area Governments. The regional planning agency for the nine counties and 101 cities and towns of the San Francisco Bay region.

ADT: Average Daily Traffic. Average number of vehicles passing a specified point during a 24-hour period.

AQAP: Air Quality Attainment Plan. The plan for attainment of state air quality standards, as required by the California Clean Air Act of 1988. Air Quality Attainment Plans are adopted by air quality districts and subject to approval by the California Air Resources Board.

Approved Project: Any land use project that is expected to generate trips on the designated CMP System. "Approved projects" include such land use approvals as planned development zonings, planned development permits, site and architectural permits, conditional permits, and actions that represent final land use approval and create a land use entitlement.

Automobile Level of Service: Automobile Level of Service (commonly shortened to "auto LOS") describes the operations of roadway segments or intersections in terms of vehicle speed, volume and capacity, and traffic delay. Auto LOS measurements are given by letter designations, from A (least congested) to F (most congested). Procedures to analyze Auto LOS for CMP purposes are defined in the VTA Traffic LOS Analysis Guidelines. Auto LOS evaluates operations for all common motor vehicle types, including automobiles, light and heavy trucks, and motorcycles. In addition, although congestion also affects transit vehicles operating in general purpose lanes, transit operations are affected by additional factors and are typically evaluated separately from auto LOS.

BAAQMD: Bay Area Air Quality Management District. The regional agency created by the state legislature for the Bay Area air basin (Alameda, Contra Costa, a portion of Solano and Sonoma, Marin, Napa, San Francisco, San Mateo, and Santa Clara counties) that develops, in conjunction with MTC and ABAG, the air quality plan for the region. BAAQMD has an active role in approving the TCM (see definition below) plan for the region, as well as in controlling stationary and indirect sources of air pollution.

Baseline LOS: 1991 CMP level of service. Traffic volumes used to calculate the baseline LOS include existing 1991 intersection volumes, and new trips generated from projects approved as of April 17, 1991 and funded transportation improvements.

Big Data: A phenomenon currently impacting a wide range of industries, defined as "a new generation of technologies and architectures designed to economically extract value from very large volumes of a wide variety of data, by enabling high-velocity capture, discovery, and/or analysis" (Big Data: Beyond the Hype, White Paper by

Datastax Corporation, March 2012). In the field of transportation monitoring and analysis, Big Data methods involve aggregating traffic-related information from GPS-enabled vehicles and mobile devices, traditional road sensors and hundreds of other sources (INRIX website, accessed 9/11/2013).

Caltrans: California State Department of Transportation. As the owner/operator of the state highway system Caltrans is responsible for the safe operation and maintenance of the highway.

Capital Priorities: A process used by MTC to evaluate and prioritize transit projects in the region. All sources of transit funding, including FTA grants, state programs, and other sources are considered. This process involves all of the transit operators in the region, including bus, rail, and ferries.

Carpooling: A carpool is formed with a minimum of two people who commute on a regular basis. Carpoolers generally live and work in close proximity to each other and share common commuting patterns and schedules.

CAP: Clean Air Plan. A set of guidelines that are designed to improve air quality, protect public health, and protect the climate.

CDT Program: VTA's Community Design & Transportation (CDT) Program, adopted by Board Resolution No. 02.11.35, is VTA's primary program designed to integrate transportation infrastructure improvements and land use development.

CEQA: California Environmental Quality Act. This act sets environmental standards designed to enhance environmental quality and to control environmental pollution throughout the state of California.

CIP: Capital Improvement Program. A seven year program established by CMP to create projects to maintain or improve the auto level of service and transit performance standards, and to mitigate regional transportation impacts identified by the CMP Land Use Analysis Program, which conforms to transportation-related vehicle emissions air quality mitigation measures.

CMA: Congestion Management Agency: The CMA is a countywide organization responsible for preparing and implementing the county's Congestion Management Program. In Santa Clara County, VTA is the designated CMA.

CMAQ: Congestion Mitigation and Air Quality Improvement Program. A federal funding program established by ISTEA and continued in TEA-21 and SAFETEA-LU specifically for projects and programs that contribute to attainment of national ambient air quality and safety standards. The funds are available to non-attainment areas based on population and the severity of pollution. Eligible projects will be defined by the State Implementation Program (SIP), the State's air quality plan.

CMIA: Corridor Mobility Improvement Account. A State Funding program for projects on the California State Highway System that: reduce travel time or delay, improves connectivity of the State Highway System between rural, suburban and urban areas, or improves the operation and safety of a highway or road segment; improves access to jobs, housing, markets and commerce; and begin construction before December 2012.

CMP: Congestion Management Program. A multi-jurisdictional program to manage traffic congestion. (This is required of every county in California that has urbanized areas of at least 50,000 people). Unless specified, CMP will mean the Santa Clara Valley Transportation Authority's Congestion Management Program.

Commute: A trip that consists of traveling between home and work.

Commute Alternatives: An alternative mode of commuting to a single-occupancy vehicle, including using public transit, bicycling, and walking to work.

Compressed Work Week: A work schedule for an employee that eliminates at least one round-trip commute either weekly or every other week. An example would be working forty hours in a compressed week (e.g. four ten-hour days) or a work plan that allows one day off every other week.

CTC: California Transportation Commission. A state agency that sets state spending priorities and allocates funding for highways and transit. The Governor of California appoints CTC members.

Deficiency Plan: See *Multimodal Improvement Plan.*

Express Lanes: High-occupancy toll lanes that combine the characteristics of HOV lanes and toll roads by allowing carpools, vanpools, and buses free access, while charging for single-occupant vehicles or drive alone use. In other areas outside Santa Clara County, Express Lanes may be called high-occupancy toll (HOT) or managed lanes.

Farebox Revenues: These are revenues collected from transit riders.

FCR: Flexible Congestion Relief. One of the state's funding programs for local or regional transportation projects that will reduce congestion. State highway projects, local roads, and rail guideway projects are all eligible.

FHWA: Federal Highway Administration. The federal agency responsible for the approval of transportation projects that affect the defined federal highway system. Administratively, it is under US DOT (Department of Transportation) and is the sister agency of FTA (see definition below).

Flexible Work Hours: This is a form of alternative work schedule. It is a policy that gives employees the option of varying their starting and stopping times each workday. Most policies specify a core period in the middle of the workday (e.g. 10:00 a.m. to 4:00 p.m.) when all employees are required to be present. The intent is to allow employees flexibility in their work hours to meet individual needs and provide an incentive to use commute alternatives such as carpooling or transit.

Floating Car Data: The floating car technique is a method used to estimate the average speed on a segment of highway. Traffic speeds are collected by driving with the stream of traffic and recording speed and travel time.

FTA: Federal Transit Administration. A component of the U.S. Department of Transportation, delegated by the Secretary of Transportation to administer the federal transit program under the Urban Mass Transportation Act of 1964, as amended, and various other statutes.

HCM: Highway Capacity Manual. A manual published by the Transportation Research Board (TRB) that contains concepts, guidelines, and equations to calculate the level of service on highways and intersections. In 2010 the manual was updated to include new level of service/quality of service measures for transit, pedestrians, and bicycles.

HOV: High Occupancy Vehicle Lane. A lane on a street or highway reserved for the use of high occupancy vehicles either all day or during specified periods (for example, during rush hours). Buses, carpools, and/or vanpools are allowed to use HOV lanes.

HSR: High Speed Rail. The project which is an intra-state high-speed rail link currently being planned by the California High Speed Rail Authority to help meet the anticipated increase in travel demand between the Bay Area and Southern California.

IIP: Interregional Improvement Program. This is a state funded program created by SB-45. IIP funds may be awarded to projects outside of the urbanized areas and for interregional projects. All IIP funds are programmed by Caltrans, via the Interregional Transportation Improvement Plan (ITIP) process, with final approval by CTC.

Indirect Source Control Measure: The federal Clean Air Act defines indirect source as "...a facility, building, structure, installation, real estate property, road or highway which attracts or may attract mobile sources of pollution." An indirect source control measure is a rule or ordinance established to reduce the mobile source emissions associated with specific activity centers such as those noted above.

Internal Trips: Trips expected to have both their origin and destination within a single development. An example of this is would be a development that has both office and residential space. In this example, internal trips between home and work would be counted as one trip when calculating trip generation.

IRRS: Interregional Road System. On February 1, 1990, Caltrans submitted a plan to the state legislature that identified a set of projects that "will provide the most adequate interregional road system to all economic centers in the State." The statute defined eligible routes, and specified that these new routes be located outside the boundaries of urbanized areas (urbanized areas have populations of 50,000 or more), "except as necessary to provide connection for continuation of the routes within urban areas." From this plan, Caltrans suggests projects, consistent with the Fund Estimate in its PSTIP, to the CTC for programming in the STIP.

ISTEA: Intermodal Surface Transportation Efficiency Act. In 1991, Federal legislation passed a bill that restructured the way funding was allocated to highway projects and included funding transit projects in urban areas. Key ISTEA components included increased flexibility in the programming of projects and a level playing field between highway and transit projects with a consistent matching ratio of 80% to 20%, respectively. There were ties to the Federal Clean Air Act and the Americans with Disabilities Act, and some major New Rail Starts (Section 3) funds earmarked for the Bay Area Region. ISTEA funding expired in 1997, and was followed by TEA-21, and then SAFETEA LU.

ITIP: Interregional Transportation Improvement Program. The ITIP is a four-year planning and expenditure program adopted by the CTC and updated in even numbered years. The ITIP covers rural highways and key interregional improvements including intercity rail.

Lead Agency: The local jurisdiction or agency responsible for approving a project's environmental analysis as required under CEQA and/or Transportation Impact Analysis report per CMP requirements.

LOS: Level of Service. This is a measure used by transportation professionals to grade performance of transportation facilities. LOS is graded on a scale of A (the best performance) to F (the worst performance).

Major Bus Stop: Per VTA Transit Sustainability Policy, a bus stop that is served by at least six public transit buses per hour per direction during peak periods.

Major Transit Stop: a site containing an existing rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods (California Government Code 21064.3).

Member Agency: A local jurisdiction that is a signatory of the CMA's Joint Powers Agreement. This includes all cities within the county, Santa Clara County, and the Santa Clara Valley Transportation Authority.

Mode Split: The share of all trips to and from a project site taken by each of the major transportation modes (automobile, carpool, transit, bicycle and pedestrian).

MPO: Metropolitan Planning Organization. A federally required transportation planning body responsible for the Regional Transportation Plan (RTP) and the Transportation Improvement Program (TIP) in its region. The governor designates an MPO in every urbanized area with a population of over 50,000.

MTC: Metropolitan Transportation Commission. The metropolitan planning organization for the nine-county San Francisco Bay Area.

Multimodal Improvement Plan: VTA terminology for "Deficiency Plan" as defined by CMA statute. Multimodal Improvement Plans are plans to identify offsetting measures to improve transportation conditions on CMP facilities in lieu of making physical traffic capacity improvements such as widening an intersection or roadway.

Obligation: An action by an administrative agency to approve the spending of money to a specific grant recipient.

OPR: The Governor's Office of Planning and Research, created by statute in 1970, serves the Governor and his Cabinet as staff for long-range planning and research, and constitutes the comprehensive state planning agency.

Parking Management Program: In the workplace context, parking policies that favor carpools and vanpools, including creating established parking charges for commuter parking, and preferential parking for carpool or vanpool vehicles. Other parking management programs include policies designed to reduce the total number of cars driving to work, such as the reduction of free or low-cost off-street parking at employment centers.

PDA: Priority Development Area. These locations were identified for concentrated development as part of Plan Bay Area, the Metropolitan Transportation Commission's 2040 Regional Transportation Plan for the nine-county Bay Area.

Peak Hour: The highest morning or evening hour of travel reported on a transportation network or street.

PMS: Pavement Management System. Required by Section 2108.1 of the Streets and Highways Code, any jurisdiction that wishes to qualify for funding under the STIP must have a PMS that is in conformance with the criteria adopted by the Joint City/County/State Cooperation Committee.

Preferential Parking: This concept involves assigning the most desirable parking spaces, such as those closest to building entrances, for the exclusive use of carpool and vanpool vehicles. In addition, parking charges may be

partially reduced or eliminated for carpools and vanpool vehicles. These vehicles may also be exempted from any hourly parking limits that exist.

Pre-Tax Commuter Benefit: Federal tax code allows the use of tax-free dollars to pay for transit commuting and parking costs. The monthly benefit amount varies from year to year based on adopted legislation.

Program of Projects: This annual program includes Section 9, Section 3 Rail Modernization (Fixed Guideway Modernization), and STP/CMAQ federal funding for transit projects. MTC is the designated recipient for these federal funds acting on behalf of the individual sponsors.

Proposition 108: Passed by California voters in June 1990, this bond measure provides up to $1 billion for rail projects programmed in the 1990 STIP. (In 1992 and 1994 state voters turned down bond funding measures for projects programmed in the 1990 STIP). The state has continued the original programming of the 1990 STIP, but the failure of funding the additional bond measures has reduced the STIP money available.

Proposition 116: Passed by California voters in June 1990, this bond measure provided $1.9 billion in bonds for rail projects. Requirements for air quality and service integration was included in the legislation, and projects were subject to review by the California Transportation Commission (CTC) before allocation.

PSR: Project Study Report. Chapter 878 of the Statutes of 1987 requires that any project that increases state highway capacity, prior to programming in the STIP, complete a report that has a detailed description of the project scope and estimated costs. The intent of this legislation was to improve the accuracy of the schedule and costs shown in the STIP, and thus improve the overall accuracy of the estimates of STIP delivery and costs.

Quality of Service (QOS): A metric used to evaluate how well a transportation facility serves its users. Several different QOS methodologies are currently used by transportation professionals, often with a focus on bicyclists, pedestrians or transit passengers.

Rail Modernization: This is a federal funded grant under Section 3(h) of the Federal Transit Act. The funds are made available to local transit agencies to improve fixed guideway systems that have been in service for at least seven years.

RHNA: Regional Housing Needs Allocation. The minimum amount of housing that will be needed to support projected housing growth, at all income levels, by the end of the specified allocation period (currently 2006 - 2014).

Ridesharing: Sharing of one vehicle by two or more commuters. While the concept of ridesharing applies primarily to carpools and vanpools, it can be applied to shuttle bus service as well.

RTIP: Regional Transportation Improvement Program. A list of proposed transportation projects submitted to the CTC by the regional transportation-planning agency (for the Bay Area - MTC), as a request for state funding. The individual projects are first proposed by local jurisdictions, and then submitted by the regional agency for submission to the CTC. The RTIP has a four-year planning horizon and is updated every two years.

RTP: Regional Transportation Plan. A multimodal blueprint to guide the region's transportation development for a 25-year period. Updated every four years, it is based on projections of growth and travel demand coupled with financial assumptions. Required by state and federal law.

SAFETEA LU: Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy of Users. As an offshoot of ISTEA and TEA-21, Congress approved $244.5 billion to fund federal highways, public transportation, highway safety, and motor carrier safety programs for fiscal year 2005 through 2009.

SB-1: The Road Repair and Accountability Act of 2017 – was passed by a two-thirds majority in the California Legislature and signed into law by Governor Jerry Brown. As the largest transportation investment in California history, SB 1 is expected to raise $52.4 billion for transportation investments statewide over the next decade. Most of the funding will be directed to tackling the enormous backlog of maintenance and repairs on local streets, roads and public transit systems. Funding will also be available for mobility improvements and expanding bicycle and pedestrian access.

SB-45: Senate Bill 45 (Kopp) Governor Wilson signed SB-45 into law at the end of the 1997 legislative session. This legislation consolidated several state transportation funding programs into three funding programs and devolved state transportation programming responsibility to the county and MPO level.

SB-375: Senate Bill 375 (Steinberg). This bill became law on January 1, 2009. SB 375 was enacted after AB-32 to help meet the greenhouse gas emission goals of AB 32 by addressing the transportation and land use components of greenhouse gas emissions. SB 375 requires each of the state's 18 metropolitan areas to reduce greenhouse gas emissions from cars and light trucks.

SB-743: Senate Bill 743 (Steinberg). This bill became law in September 2013, and directs the Governor's Office of Planning and Research (OPR) to develop a new approach for analyzing the transportation impacts under CEQA. SB 743 also creates a new exemption for certain projects that are consistent with a Specific Plan and, eliminates the need to evaluate aesthetic and parking impacts of TOD projects, in some circumstances.

SCS: Sustainable Communities Strategy. A requirement of all California MPO's as set forth by SB-375. The SCS is a document that outlines the region's long-range plan for integrating transportation, housing, and land use in order to reduce greenhouse gas emissions.

SHOPP: State Highway Operations and Protection Plan. A program created by State legislation that includes state highway safety and rehabilitation projects, seismic retrofit projects, landscaping, some operational improvements, and bridge replacement. SHOPP is a four-year program of projects adopted separately from the STIP cycle. Both new (Prop 111) and old state gas tax revenues and federal funds are the basis for funding this program. The legislature and Governor have made seismic retrofit the state's highest priority and in practice have used other STIP moneys for these projects.

SIP: State Implementation Plan. A compilation of the federal air quality plans from around the state produced by the state Air Resources Board.

SOV: Single Occupancy Vehicle. A motor vehicle occupied by one employee for commute purposes.

STIP: State Transportation Improvement Program. The STIP is a four-year planning and expenditure plan adopted by the CTC for the State Transportation System, and is updated in even years. The STIP is composed of the approved RTIPs, and Caltrans' ITIP.

STP: Surface Transportation Program. A new flexible funding program established by ISTEA. Many mass transit and highway projects are eligible for funding under this program. Ten percent of the projects in this program must be transportation enhancement projects, and 10% must be safety projects.

TCM: Transportation Control Measure. A measure intended to reduce pollutant emissions from motor vehicles. Examples of TCMs include programs to encourage ridesharing or public transit usage, city or county trip reduction ordinances, and the use of cleaner burning fuels in motor vehicles. MTC has adopted specific TCMs, in compliance with the federal and state Clean Air Acts.

TDA: Transportation Development Account. A state law enacted in 1971, this fund collects ¼ of 1% of all retail sales in each county to fund transit, paratransit, bicycle and pedestrian improvements. The funds are collected by the state and allocated by MTC to fund projects and programs throughout their jurisdiction.

In Santa Clara County, the transit agency is the only eligible applicant for Article 4 allocations, and Article 4.5, which provides funding for community and paratransit services. This provision allows MTC to allocate another 5% of the total TDA funds that Santa Clara County claims for ADA paratransit services. Additionally, Article 3 funds (4% of the total revenue) are allocated annually for bicycle/pedestrian projects, which are nominated by the VTA.

TDM: Transportation Demand Management. This is a term used to describe policies and programs (non-engineering solutions) to reduce the number of cars on the road. Examples of transportation demand management include flextime, ridesharing, and telecommuting.

TEA-21: Transportation Equity Act for the 21st Century. TEA-21 is the successor legislation to ISTEA. Congress enacted TEA-21 in mid-1997. The legislation covers the six-year period 1997/98 to 2002/03, and extends and expands many of the funding programs developed under ISTEA.TEAQ: Transportation Energy and Air Quality (TEAQ). TEAQ is VTA's Program to address Climate Change and energy issues that will involve smarter transportation planning, collaboration with local agencies, pursuit of funding, and the use of alternative fuel sources.

Telecommuting: A system of either working at home or at an off-site workstation with computer facilities that link to the worksite.

TFCA: Transportation Fund for Clean Air. TFCA Funds are generated by a $4.00 surcharge on vehicle registrations. The funds generated by the fee are used to implement projects and programs to reduce air pollution from motor vehicles. Health and Safety Code Section 44241 limits expenditure of these funds to specified eligible transportation control measures (TCMs) that are included in BAAQMD's 1991 Clean Air Plan, developed and adopted pursuant to the requirements of the California Clean Air Act of 1988. BAAQMD manages 60% of the funds via a regional discretionary program. The remaining 40% are returned to each county based on annual vehicle registrations.

TIP: Transportation Improvement Program. A federally required document produced by the regional transportation planning agency (MTC in the Bay Area) that states investment priorities for transit and transit-related improvements, mass transit guideways, general aviation and highways. The TIP is the MTC's principal means of implementing long-term planning objectives through specific projects.

TMA: Transportation Management Association. An organization of developers, property managers, employers and public officials who cooperatively provide and promote programs that mitigate traffic congestion, assist commuters, and otherwise encourage improved travel in a given area.

Transit Priority Area: an area within one-half mile of a major transit stop [see definition above] that is existing or planned, if the planned stop is scheduled to be completed within the planning horizon included in a Transportation Improvement Program adopted pursuant to Section 450.216 or 450.322 of Title 23 of the Code of Federal Regulations. (California Government Code 21099 (7))

Transportation Demand Forecasting Model: An analytical tool that predicts travel patterns based upon the spatial relationship between various types of land uses and connecting transportation facilities (e.g., roadways and transit).

Transportation Facility: Any part of the designated CMP System including roadways, intersections, freeways, and bicycle, pedestrian and transit routes.

TRO: Trip Reduction Ordinance. A regulation passed by local government requiring employers, developers, and/or property owners to participate or assist in financing transportation management efforts. In many instances, such ordinances specify a target reduction in the number of vehicle trips expected from a development based on standardized trip reduction rates.

TSM: Transportation Systems Management. The use of low-cost capital improvements to increase the efficiency of road transportation and transit services. TSM measures included changing traffic signal timings to optimize the flow of traffic moving through a roadway section, or installing ramp meters at freeway on-ramps to regulate the number of vehicles entering onto the freeway at one time.

Vanpooling: Commuting in a seven- to 15-passenger van, with driving undertaken by commuters. The riders on a monthly basis usually pay for some portion of the van's ownership and operating cost. The van may be privately owned, employer-sponsored with the company owning and maintaining the vehicle, or it may be provided through a private company that leases vehicles.

Vehicle Employee Ratio: The reciprocal of AVR. A ratio of vehicles arriving at a worksite during the peak period, divided by the number of employees reporting to work on the same day.

Vehicle Occupancy: The number of people riding in a vehicle at one time.

Vehicle Trip: A one-way movement of a vehicle between two points (e.g. origin and destination).

VMT: Vehicle Miles Traveled. A measure of the extent of automobile use within a specific geographic area over a given period of time. Travel demand forecasting (modeling) is typically used to analyze VMT at the project,

countywide and regional levels, although other methods such as spreadsheet analysis may be used for individual projects in some circumstances.

Worksite: Any place of employment, base of operation or predominant location of an employer. All buildings or facilities operated or occupied by the employer within the city and within a radius of 1.5 miles of a single centrally located building or facility operated or occupied by the same employer shall be deemed a worksite.

Attachment W

UPDATE FROM THE ITE TRANSIT AND TRAFFIC IMPACT STUDY COMMITTEE

How Should Public Transit Be Evaluated for a Regional Attractor?

The Case Study of the San Francisco 49ers Football Stadium

By Michelle DeRobertis, M.S., P.E., Richard W. Lee, Ph.D., AICP, and Bhanu Kala, M.S., P.E.

Engineers are sometimes asked to develop solutions to problems that perhaps should not be solved. Imagine a bridge over the Grand Canyon; while it would be very challenging and even immensely rewarding technically to achieve such a feat, most everyone would agree that it is not a good idea for many reasons. While this example may be extreme, it illustrates the dilemma that we transportation engineers often face: we are given a land use plan or development site and asked to essentially, "make it work."

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Thus charged, engineers often end up tinkering with the transportation network to ameliorate a land use plan that fundamentally cannot be served by that network. The negative externalities caused by poor land use-transportation integration include automobile dependency and its numerous environmental impacts; recurrent congestion; suppression of transit, bicycle, and walk trips; increased obesity levels; and increased household transportation costs.

The premise of this paper is that we as a profession do not have adequate procedures to analyze whether or not a major land use change is appropriate in the context of the transportation system. This stems from past over-reliance on auto level of service (LOS) as the only measure of effectiveness.[1,2] This single-minded focus on automobiles (even in congested cities) caused us to ignore, nay abdicate, our responsibility for how to consider all other modes. Furthermore, the lack of the concept, let alone practice, of providing multiple layers of public transit modes within a single metropolitan area has essentially made transportation engineers codependents and facilitators of the bad land use decisions caused by economic pressures. See Figure 1.

The standard practice for evaluating the appropriateness of land use decisions with respect to the transportation system is the transportation section of Environmental Impact Reports/Statements (EIR/EIS). Though project specific, the recommendations contained in an EIR/EIS influence a region's form and development for decades. What does our profession need to improve the scope and quality of our analysis and recommendations and as a result do our job better?

This paper does not purport to delineate all of the answers; rather it aims to raise the issue by presenting a case study of the transportation assessment of a recent major land use decision in the San Francisco Bay Area in California, USA. At a minimum, we hope to illustrate by way of a counter-example that:

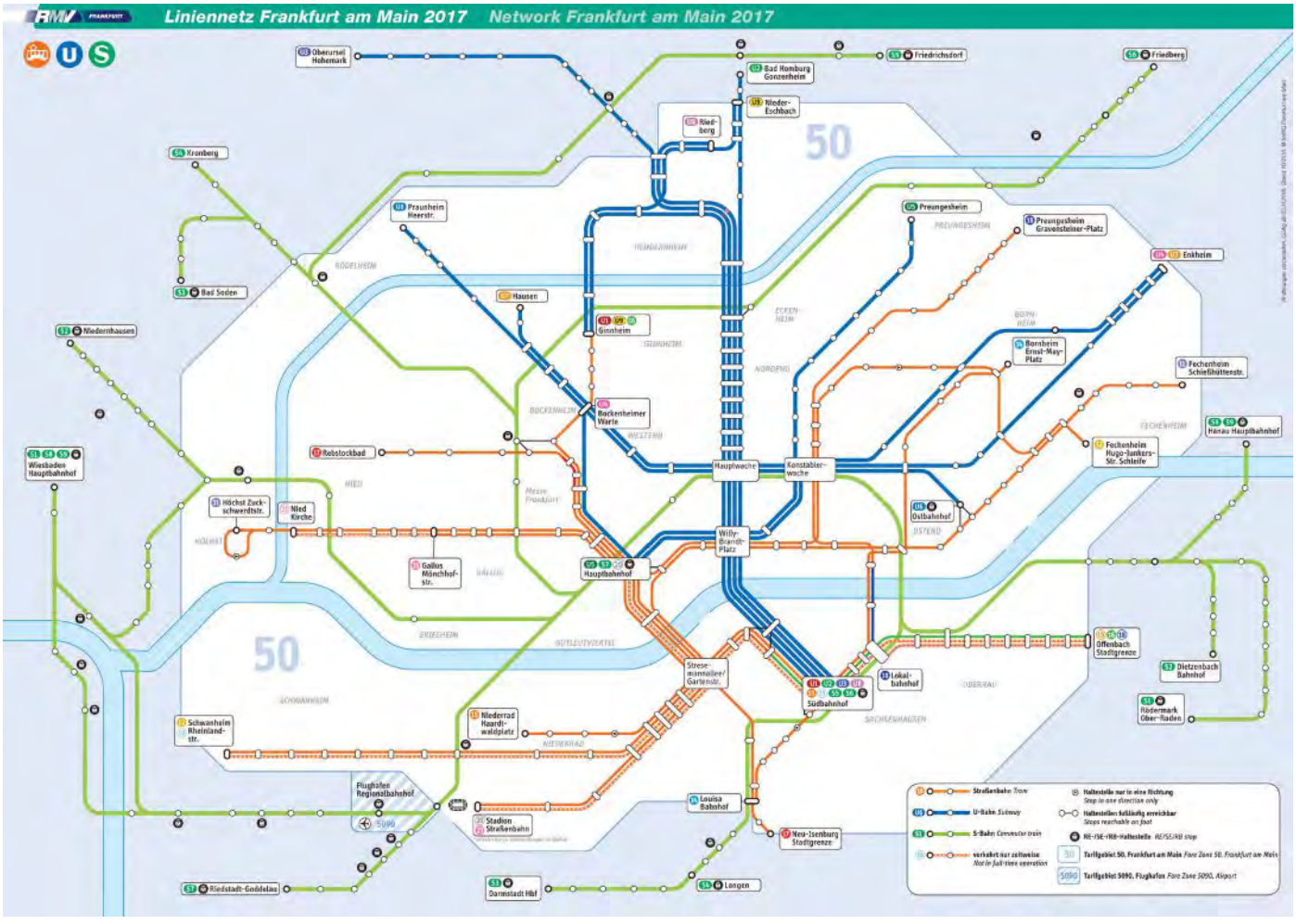

Figure 1. Even moderately-sized cities in Germany have several complementary rail modes of transit. This figure illustrates the rail modes available in Frankfurt, population 700,000: tram/light rail (orange), subway (blue), suburban commuter rail (green), and regional intercity rail (not depicted).

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a) addressing transit directly in a traffic impact study (TIS) would result in better land use decisions and better urban design as a whole; and
b) that we need better tools and procedures to adequately conduct such analyses.

Case Study Description

The San Francisco 49ers football stadium was relocated from Candlestick Park in San Francisco, CA, USA to another county 40 miles away in the City of Santa Clara, CA. It opened in 2014. The 70,000–80,000 seat stadium is clearly a multicounty and regional trip attractor; fans come from throughout northern California.

The county and regional rail transit options near the site are depicted in Figure 2. The project site is conveniently served by Santa Clara County light rail (VTA LRT). However, VTA LRT trains have a 3-car maximum, with about 300 passengers per train. While this can serve some of the demand (estimated at 4,500 fans, thus 15 full train sets), the LRT network only serves roughly 25 percent of Santa Clara County. Furthermore, Santa Clara County is a small portion of the regional draw of the 49ers stadium. Yet VTA LRT was assumed to be able to handle the bulk of the project's public transportation needs since, as described below, the regional rail services have shortcomings.

There are three multi-county heavy rail providers in Santa Clara County, all of which the EIR cited as serving the site: ACE, connecting San Jose to San Joaquin County through southern Alameda County; the Capitol Corridor, an inter-regional Amtrak train that runs between Sacramento and San Jose through Contra Costa and Alameda Counties; and Caltrain commuter rail that connects San Francisco, San Mateo, and Santa Clara Counties. Only two of these three have stations that are close enough (¼ mile) to the stadium so that patrons can easily walk: ACE and Capitol Corridor. However, both of these rail providers run infrequently, even during normal peak hours: ACE only runs weekdays and only has six trains: three in the morning in the peak direction and the reverse in the afternoon. Capitol Corridor has headways of 90 minutes or more. Furthermore, Capitol Corridor leases the track from the Union Pacific Railroad (UPRR), therefore enhancing its service is extremely complicated due to the needs of freight. Thus, both heavy rail services would need to provide special trains outside normal service operation in order to serve the project.

The third heavy rail service, Caltrain, in theory has the greatest potential to serve the site, since: a) its train capacity is approximately 800 seated passengers compared to LRT at 300; b) it has much more frequent headways; and c) has service until midnight and on weekends. Moreover, it serves San Francisco and the Peninsula, the historic core of the 49ers fan base. However it is located two miles from the site and therefore is dependent on connecting service. Since provision of an estimated 23 shuttle buses

City of Santa Clara, CA, USA

Figure 2. Map of the county and regional rail transit options near Levi's Stadium in Santa Clara, CA, USA, home of the San Francisco 49ers football team.

was deemed " impractical," the best available option for station access would be three coordinated 3-car train sets of VTA LRT, limiting access by Caltrain because of LRT capacity constraints.

The stadium markets itself as being Leadership in Energy and Environmental Design (LEED)-certified. Given that 38 percent of greenhouse gas (GHG) emissions in California are due to transportation, shouldn't *realistic* public transit access be part of a LEED score? How can our profession help LEED certification include this aspect of sustainability?

Transportation Analysis in the EIR

Let's take a look at what the transportation section of the EIR did (and did not) address.[3]

Setting

The setting section described existing transit services available in the vicinity of the project site along with their service frequencies, headways, operating hours, and the nearest transit access points.

The transportation setting section did not include:

- An assessment of the "Quality" of the transit service under existing and future conditions for any of the public transit modes: e.g., local bus, light rail, and the regional rail services.
- A travel time comparison of transit versus vehicle modes.
- Most importantly, there was no direct comparison of the project alternative sites of their ability to accommodate the expected project trips by the existing public transit service.

Regarding the first point, it must be noted that a *Transit Quality of Service* (QOS) manual exists, but was not used.[4] To be fair, in ITE Transit and Traffic Impact Study Committee's review of 64 TIS guidelines in the United States and Canada, we found that transit QOS is rarely assessed by any methodology. Why not? There appears to be a disconnect between the transit community and the TIS community that must be bridged. If the QOS manual had been used, it would have shown that the existing regional train service fell into the "worst" category. While the third edition dispensed with the LOS rating system contained in the second edition, if LOS were calculated, the transit LOS that ACE and Amtrak provided to the site in terms of headways and service hours was in fact LOS E and F.[5] Regardless of whether it is given a letter grade (per the 2nd edition) or a verbal description (per the 3rd edition), wouldn't such an analysis have been useful information for the public and decision makers in evaluating a $1.3 billion project attracting patrons from a 60+ mile radius?

Impacts

The transportation section did not address transit let alone identify any impacts to transit. The EIR merely stated that there should be a "Transportation Management Plan" (TMP) to analyze transit service. Thus the TMP contained the transit analysis, not the EIR. Curiously, the TMP's findings were not cited as impacts in the draft EIR, nor were any recommendations cited as mitigation measures.

Instead, all of the transportation impacts and project mitigation measures identified in the EIR were traffic-related, i.e., intersection and freeway segment operations. Furthermore, since the traffic impacts would occur only for a few days per year, no mitigation measures were planned.

The lack of an assessment in the EIR of the ability of the existing transit network to serve a major traffic generator raises the question: Where in the chain of events did this failure occur?

Mitigation/Recommendations

Since the EIR did not identify any transit-related impacts, the EIR included no discussion of mitigation measures to accommodate transit demand whatsoever. Neither did it cite transit improvements as a strategy to help mitigate vehicular congestion by providing alternatives to driving. This despite a statement in the Final EIR (FEIR) that "a critical element in providing transit service to the stadium site will be the LRT operations."

Only under "Response to Comments" did the FEIR state the following:

- "The City is prepared to work with VTA in evaluating the demand on the light rail and bus systems and in preparing an analysis of operating conditions needed to support transit ridership assumed in the EIR including an assessment of design and infrastructure needs of the system at a level necessary to support stadium operations to the satisfaction of VTA and the City."
- "The details of how the complex transportation system for the stadium will be managed will be described in a Transportation Management and Operations Plan (TMOP)…. The TMOP will be a mitigation measure required as a condition of approval of the project."

Note that these are not EIR mitigation measures and thus are not the financial responsibility of the project sponsor. Moreover, only the preparation of the TMOP is required, not implementation of its findings, i.e., the necessary physical and operational changes to transit that would be necessary to handle project impacts. The FEIR assumed that implementation of the to-be-developed TMOP would accommodate additional transit demand during event days, and that the additional transit capital and operating costs necessary to accommodate demand would occur without any funding mechanism identified.

In short, the FEIR was approved without knowing whether nor how the project's transit demand could be adequately met. Is this the best we can do as a profession? Shouldn't the EIR have stated upfront that any transit service enhancements are not possible without funding for new train sets and operations? Shouldn't the EIR scope include addressing financial responsibility for additional capital and operating costs as mitigation of project impacts?

TMP/TMOP

The draft TMP included what many might assume should be in the transportation section of the EIR: an estimation of the expected transit demand and recommendations for how to improve transit service to accommodate project-generated transit trips. Its mission was to develop a plan to "to make it work" and included recommendations for special game-day trains by ACE and Amtrak, and a fleet of VTA shuttle busses to serve areas not served by rail transit.

Of all the transit improvements identified in these two documents, the project was only required to contribute to VTA the cost of "a second platform at the Great America station, so (VTA) could better handle the loads. They also built a combination of permanent and temporary fencing along the rail ROW in front of the stadium to prevent pedestrian intrusions."[6]

Professional transportation planners need a mechanism to evaluate land use projects of various scales, (e.g. local, citywide, or regional) to ensure that its accessibility by public transit is of an appropriate scale and capacity.

Neither the EIR, the TMP, or the TMOP included any of the following:

- Improvements to transit capacity, frequency or travel times as mitigation for project traffic or transit impacts.
- Identification of the operational and capital costs of VTA for both their LRT service and to provide a fleet of game-day shuttle buses.
- Identification of the operational and capital costs for ACE and Capitol Corridor to serve the site outside their normal hours of operation.
- Identification of financial responsibility for providing these additional transit services which implement the recommendations of the TMOP.

Epilogue

Two years after its opening, how well this site is served by public transit can now be reviewed, as well as the cost to do so. After a game, up to 10,000 people have to wait in line for a train that holds 300. Despite ridership being roughly double that which was predicted, VTA costs greatly exceed revenue; even local newspapers have been covering the public subsidy to serve the stadium:

- Both the *San Jose Mercury* and *Silicon Valley Business Journal* (SVBJ) reported that VTA's extra costs include running 80 LRT cars on weekends instead of the usual 20, 200 extra staff to sell tickets and monitor the crowds, 40 contract security workers, and special game-day shuttle busses.[7,8]
- VTA lost $30,000 per event ($30 per passenger) just providing shuttles in 2014/15.[7]
- SVBJ reported that while the question of total public cost is still unclear, it's very clear that, despite the stadium having hundreds of millions of dollars in revenue, VTA loses money serving the stadium. Of the $4 million cost to provide stadium service the first year, only $600,000 was recovered in fares.[8]
- The *San Francisco Chronicle* reported that VTA lost $500,000 a year just running LRT stadium service due to extra trains, extra drivers, and overtime pay.[9]

For calendar year 2016, VTA estimated that fares covered approximately one-third of the costs incurred to serve the site; thus its deficit was $1.5 million to serve the 23 events at the stadium.[10]

Potential Parallel: Parking Revenue and Public Safety

It should be noted that the stadium receives roughly $12–$20 million a year in parking revenue. The agreement with the stadium owners calls for "the 49ers to reimburse the City of Santa Clara for extra police and fire protection and pass along a share of parking revenue and tickets."[11] The team paid the city $2.4 million in FY 2014/15 for the costs to provide additional police/security guards on game days. Apparently police departments are not expected to just "absorb the cost." Should there also be a project contribution for needed game-day public transit? "We're sending people to the Niners games with taxpayer money," [VTA spokesperson] Hendler-Ross said. "And the 49ers have not stepped up to help us recover the costs. We think they could be doing something more to offset this service."[9] However, since the City of Santa Clara does not operate public transit service, they have little incentive to require developers to help pay for it.

Conclusion

The analysis contained in the TMP and TMOP attempted to make the best of a bad land use decision. But at what point could/should it have been predicted that it just was not a good site from the perspective of public transit? As engineers are trained to take a given problem and devise the best solution, this is in fact what the TMP/TMOP for the 49ers stadium did. Yet this approach ignores the transportation–land use connection. It also ignores the social/political question of who is financially responsible for bad land use decisions. In this case, the problem that they attempted to solve could have been resolved by matching the regional-scale land use project to transportation infrastructure of a regional scale. However, the lack of professional guidance on both: a) how to consider transit service in a TIS, and b) what constitutes appropriate transit service for various sizes and scales of land uses, has led to inappropriately-located sites with respect to the transportation infrastructure, particularly transit.

ITE Transit and Traffic Impact Study Committee Recommendations

To improve future analyses, our recommendations fall into two distinct areas of responsibility:

1. **Regional decision makers:** Regional policies are needed which identify appropriate locations for large traffic generators that draw from throughout and beyond the region. Clearly this should be done in conjunction with the long-range transit plan for the region as a whole. This would ensure that projects such as stadiums, airports, and medical campuses choose locations that are served by appropriately-scaled mass transit (e.g. commuter and regional rail). At present, there is no professional guidance to help identify optimal locations for regional generators from the standpoint of transit accessibility; instead we attempt to make the best of suboptimal locations. Another constraint is that, in California at least, long-range transit planning—and funding—is done county-by-county, despite the fact that crossing county borders is a daily fact of life for many.
2. **Profession-wide:** Professional transportation planners need a mechanism to evaluate land use projects of various scales, (e.g., local, citywide, or regional) to ensure that its accessibility by public transit is of an appropriate scale and capacity. Quality of service standards for various modes of transit in various land use contexts would greatly assist in this regard.

At the very least, we as a profession should develop a consensus of what (and how) transportation studies of regional traffic generators such as 80,000-seat sports stadia (stadiums) should address. **itej**

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Richard W. Lee, Ph.D., AICP *is a member of the ITE Committee on Transit and Traffic Impact Studies and a principal of Transportation Choices for Sustainable Communities Research and Policy Institute. He is a transportation consultant and academic with a longstanding interest in sustainable transport and human-scale cities, with more than 30 years of diverse experience in transportation/urban planning including rail and bus transit projects and smart growth transportation studies. Richard holds a masters and doctorate in city and regional planning from the University of California, Berkeley. He is a member of ITE.*

Bhanu Kala, M.S., P.E. *is a member of the ITE Committee on Transit and Traffic Impact Studies and is a registered civil and traffic engineer with CDM Smith in San Francisco, CA, USA. He has 12 years of experience in transportation planning and traffic engineering. His expertise includes long-range transit plans, economic studies, traffic operations, transportation engineering and impact studies, environmental studies, access management studies, transit planning, and traffic simulation modeling. Bhanu successfully worked on bus rapid transit and rapid ride projects from the conceptual planning level to the design and construction phases throughout the United States. He is a member of ITE.*

Attachment Z

BOARD OF DIRECTORS 2018

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January 12, 2018

Ezequiel Castro, Acting Chief
Division of Rail and Mass Transportation
Office of State Transit Programs and Plans (MS 39)
P.O. Box 942874
Sacramento, CA 94274-0001

Subject: 2018 Transit and Intercity Rail Capital Program Application for Peninsula Corridor Electrification Expansion

Dear Mr. Castro,

The Peninsula Corridor Joint Powers Board (JPB/Caltrain) is pleased to submit the enclosed application for the 2018 Transit and Intercity Rail Capital Program (TIRCP). The JPB requests $631.5 million for the Peninsula Corridor Electrification Expansion Project (EEP).

The TIRCP grant funds will contribute to maximizing the benefits of Caltrain's current electrification project, the Peninsula Corridor Electrification Project (PCEP), which is a fully funded and under construction. PCEP provides a transformational foundation on which the future evolution of the Peninsula Corridor will be built. PCEP will replace 75 percent of the existing diesel fleet with electric trains (EMUs) and will install the electrification infrastructure necessary to support their operation. The EEP, as outlined within this grant application, includes procurement of an additional 96 EMUs, supporting the TIRCP program's goals by completely eliminating diesel powered passenger service from Caltrain's mainline and increasing capacity of the system to accommodate regional growth. EEP also achieves a key goal of the draft 2018 State Rail Plan: full electrification of Caltrain. This grant request leverages Caltrain's ability to take advantage of the near-term opportunity to grow service by purchasing additional EMUs under the existing PCEP EMU contract and, provides strong links to ongoing planning work on regional, interregional, and statewide rail planning. This is a unique and important opportunity for Caltrain to leverage ongoing investments in a way that maximizes near-term benefits and creates the potential for Caltrain to be a key part of a future, fully integrated statewide rail network.

Specifically, this grant request supports full electrification and expansion of the Caltrain fleet, modification of platforms, creation of critical new ridership enhancements, and advancement of planning efforts key to development of the Caltrain Business Plan, which supports the future vitality of the Peninsula Corridor. Full conversion and expansion of Caltrain's mainline fleet from diesel to electric trains will increase system-wide ridership in order to further reduce greenhouse gas emissions and aid in improving regional air quality. The planning efforts included in this application emphasize the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's long term growth in a way that supports regional needs and the service and connectivity goals of the draft 2018 State Rail Plan.

The Project will also fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor: extension of High-Speed Rail Service to the Salesforce Transit Center in San Francisco. Finally, conversion of mainline operations to all-electric service will free up Caltrain's limited remaining diesel fleet for deployment to support increased service to Gilroy and support extending passenger rail service south to Salinas.

Please consider this letter a certification that I have approved the cost estimates used in the JPB's application.

Sincerely,

Jim Hartnett
Executive Director

PROJECT NARRATIVE

A. Project Title Page

Project Title: Peninsula Corridor Electrification Expansion Project
The Peninsula Corridor Electrification Expansion Project (EEP) includes a series of incremental investments in the 51-mile Caltrain Corridor between the 4th and King Station (San Francisco) and the Tamien Station (San Jose). These investments are focused on expanding and fully converting Caltrain's mainline diesel fleet to electric trains. This investment builds on and leverages the existing Peninsula Corridor Electrification Project (PCEP) and supports the goals of the Transit and Intercity Rail Capital Program (TIRCP), providing increased capacity and service flexibility, supporting state and interregional connectivity, and reducing greenhouse gas emissions through elimination of diesel service from the mainline Peninsula Corridor. In addition to providing immediate, direct benefits, the EEP also represents an incremental step within a larger program of development that will evolve the Peninsula Corridor in a way that supports the ridership, service levels, and connectivity goals contemplated in the draft 2018 State Rail Plan.

The central component of Caltrain's 2018 TIRCP application is the purchase of 96 additional Electric Multiple Units (EMU). This procurement will fully exercise all available options under Caltrain's current contract with Stadler and will provide sufficient EMUs to fully electrify Caltrain's mainline fleet, while also sustaining and expanding capacity to accommodate growing demand. In addition to requesting funds for the purchase of EMUs, Caltrain is also requesting a smaller amount funding for a series of associated projects that will equip the corridor to receive and operate a fully electrified fleet in a way that allows the railroad to reap the maximum benefit from its investments. The EEP has been segmented into the following elements, each of which are tied to distinct greenhouse gas (GHG) reduction benefits:

- Initial Capacity Increase
  - Exercise of options on the JPB's existing contract with Stadler for the procurement of 40 additional EMUs to increase capacity of the electrified system by expanding the 6-car EMU sets already under procurement to a total of 17, 8-car sets
  - Minor modification (lengthening) of platforms at select stations to accommodate the operation of 8-car EMUs
  - The implementation of improved wayside bicycle facilities throughout the system to complement Caltrain's program of on-board bike carriage and reduce pressure to add onboard capacity
  - Planning funds equivalent to 1 percent of the total EMU cost estimate to support the critical development of plans and policy agreements that ensure that the Caltrain corridor and additional EMUs are used in a way that maximizes their utility and meets the goals and service levels identified in the draft 2018 State Rail Plan.

- Caltrain System Enhancements
  - Installation of a Broadband Communications System that will attract additional ridership by providing customer facing Wi-Fi as well as enhanced reliability by creating the capability to conduct remote diagnostics and optimize ongoing maintenance

- Full Conversion of the Caltrain Mainline Fleet
  - Exercise of additional options on the JPB's existing contract with Stadler for the procurement of 56 additional EMUs to facilitate the operation of a fully electrified fleet of 8-car EMUs

The project elements described above support and relate to a range of additional enhancements and services. There are additional benefits, which while discussed in the application, are not part of Caltrain's direct funding request and are not used to quantify greenhouse gas benefits. They include:

- Creation of additional storage and maintenance capacity
- Potential redeployment of diesel fleet to support San Jose-Gilroy/Salinas service
- Potential use of EMU fleet to support enhanced future Caltrain service levels as part of a larger program of rail enhancements on the Peninsula Corridor

As described above, the Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional EMUs while also providing strong linkages to ongoing planning work in the corridor. In cases where additional agreements, planning or decisions may be required to confirm project details, the application makes reference to ongoing planning processes and in particular emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit. It is assumed that any allocations of funding received as a result of this application – particularly those related to project elements with later implementation dates – may be conditionally tied to outcomes of the Business Plan or other planning and agreement processes.

All of the project elements described in this application assume and build on the infrastructure and equipment currently being constructed and procured through Caltrain's in-progress PCEP. Similarly, the projects contemplated in this application also represent incremental investments that support the long-term evolution and growth of the corridor towards and beyond the 2022, 2027 and 2040 service visions contemplated in the draft 2018 State Rail Plan. While the EEP is presented in this application as a "standalone" project, it is, in reality, part of a series of incremental improvements to the corridor that leverage a wide spectrum of local, regional, state and federal funding sources.

Applicant Name
The Peninsula Corridor Joint Powers Board (JPB), which owns and operates the Caltrain commuter service from San Francisco to Gilroy.

Project Priority
The JPB is submitting a single application for TIRCP. Scalability and timing of individual project elements are discussed within the application.

Project Purpose and Need

Overview – The Evolution and Modernization of the Caltrain Corridor
Stretching between San Francisco and San Jose, the Peninsula Corridor has hosted passenger rail operations since the 1860's. When the Peninsula Corridor Joint Powers Board was created and assumed responsibility for the Peninsular corridor and Caltrain passenger rail service in 1992, the railroad had

experienced many decades of deferred maintenance and much of the rail line's infrastructure dated back to the early 1900's. Since that time, the JPB has invested hundreds of millions of dollars in the railroad to bring it up to a "State of Good Repair." With the implementation of advancements such as Baby Bullet service, which decreased travel times between San Jose and San Francisco to approximately one hour, Caltrain has evolved into one of the premier regional transit systems in the San Francisco Bay Area and has experienced a near-tripling of its weekday ridership over the last 12 years. While much work has been done to improve the railroad, the system is currently running at operating capacity, burdened by the limitations of the aging diesel train technology that is reaching the end of its useful life. Today, Caltrain primarily uses five-car and six-car consists powered by diesel push/pull locomotives with limited operating performance. The majority of Caltrain's diesel fleet is at or beyond its useful life and will be retired as part of the ongoing PCEP.

The Caltrain corridor service demand is unique compared to many other U.S. commuter rail systems in that the northbound and southbound peak ridership demand is relatively balanced. The morning peak ridership is split with approximately 60 percent and 40 percent of total ridership on northbound and southbound trains, respectively. In addition to the bi-directional peak, the seat turnover is high due to multiple destination centers along the corridor between the cities of San Francisco and San Jose, including Genentech in the City of South San Francisco, Google in the City of Mountain View, Facebook in the City of Menlo Park, and Stanford University in the City of Palo Alto.

As the Bay Area's economy has boomed and population has continued to grow, commute traffic and congestion between major employment centers in San Francisco and Silicon Valley have grown as well. Caltrain is a critical commute alternative to the heavily congested U.S. 101 and Interstate 280 corridors that connect the economic centers of San Francisco, with over 550,000 employees, and Silicon Valley, which has the largest concentration of high-tech companies in the world. Today, along the most congested segments of the corridor, many passengers are faced with standing room only conditions for some or all of their trips. This condition applies to northbound and southbound trains and both the AM and PM peak periods. These capacity limitations are a source of frustration for Bay Area employers that are struggling to connect residents and employees to job centers in a way that avoids increasing traffic congestion and helps reduce greenhouse gases. Without the ability to accommodate these commuters on Caltrain, many companies have been forced to supplement public transportation by operating private corporate shuttles in dense urban areas where the shuttles struggle to share facilities with public transit.

The growing mobility needs of the corridor and the region have prompted a series of plans and projects to improve the Caltrain corridor through expanded service and modernized infrastructure and systems. In 2017, after decades of plans to electrify, Caltrain finally secured full funding for PCEP, a foundational step in the long-term development of the railroad and the immediate precursor to the EEP improvements described in this application.

When complete, the initial PCEP will mark a first step in the transformation of the 154-year-old Caltrain corridor from a diesel-based service to a modernized electric rail system. The funded "base" PCEP encompasses nearly $2 billion of investment, including the installation of an overhead catenary system and traction power facilities between San Francisco and San Jose, as well as the purchase of 96 high performance Electric Multiple Unit (EMU) trains. With an electrified system between San Francisco and San Jose that enables faster acceleration and improved vehicle performance, Caltrain will be able to

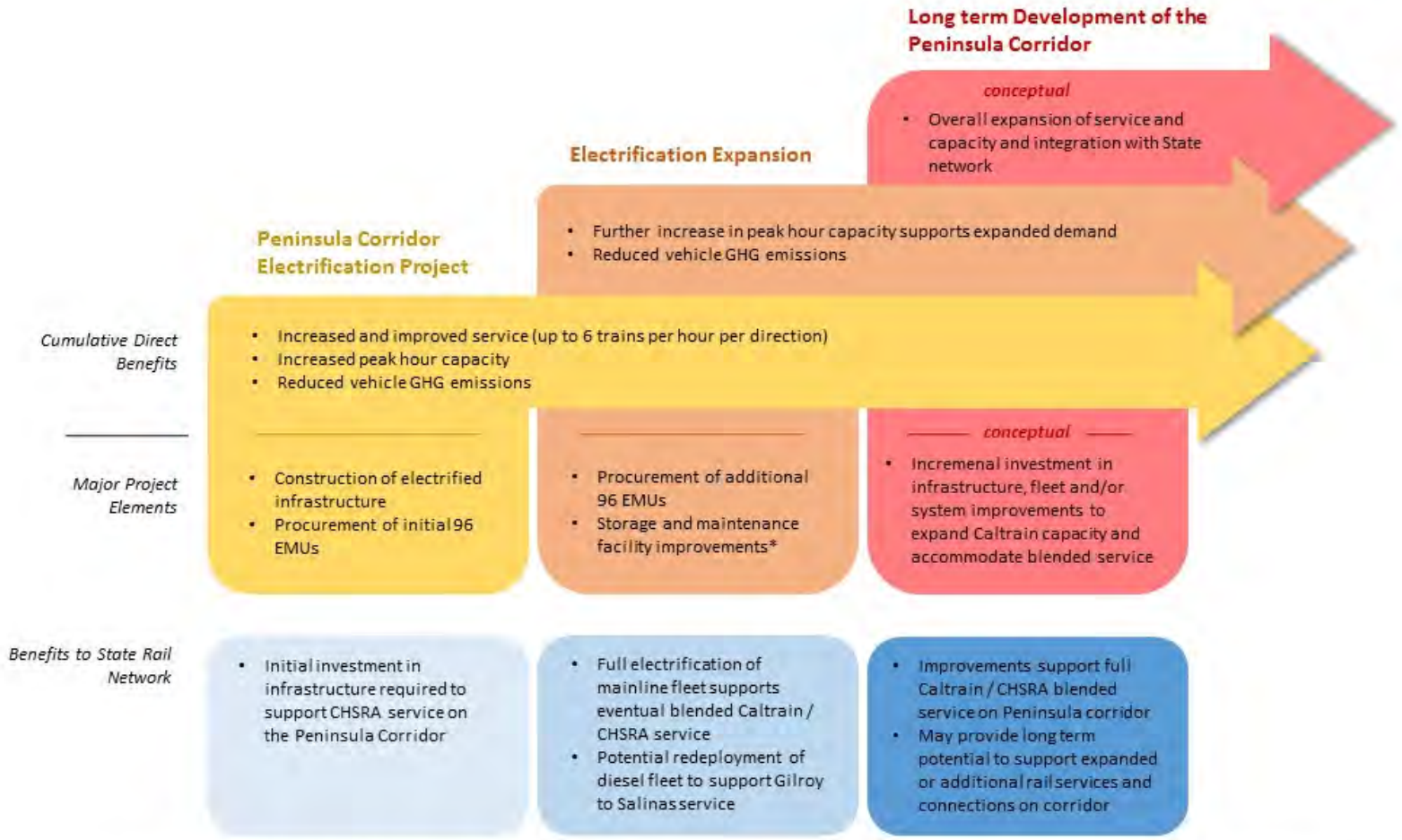
increase capacity and serve more riders. Not only will PCEP improve performance and increase ridership, it will provide substantial environmental benefits to the region's air quality by reducing diesel pollution, greenhouse gases, and removing cars from the Bay Area's most congested roadways. All of these benefits have been described extensively through Caltrain's existing planning documents, including the 2015 PCEP EIR as well as Caltrain's 2015 application to TIRCP.

While the funded PCEP delivers substantial independent benefits, it is also a significant step in the longer-term evolution and improvement of the Caltrain Corridor. Even as Caltrain has advanced its original plans for electrification, the demands on the corridor and the railroad have continued to rapidly evolve. In the five years between 2012, when the initial planning definition of the current PCEP was set, and 2017, when the project achieved full funding, Caltrain's weekday ridership jumped by a staggering **47%**. Growing demand has further highlighted the importance of the Caltrain corridor and underscored the need for it to do more. During the past two years, the Bay Area Council[1], SPUR[2], and the State of California[3] have all released major studies that emphasize the strategic importance of the Caltrain corridor and the larger Northern California rail network in supporting the Bay Area's mobility needs, economic growth, and long term sustainable development. The importance of the corridor and the need for it to continue its growth and evolution has been expressed most clearly in the draft 2018 State Rail Plan. This document shows how the Caltrain corridor and service can evolve into a key link of the state's rail network, ultimately facilitating daily passenger volumes above 200,000 by 2040.

Caltrain recognizes the importance of the Peninsula Corridor and the tremendous opportunity and responsibility that the management of this asset entails. The infrastructure and rolling stock currently included within the base PCEP, along with the incremental expansion contemplated in this application, are the first, logical investment in the corridor's larger, ongoing program of improvement and development. **Figure 1** provides a conceptual mapping demonstrating how both the funded PCEP and the EEP fit into an overall program of improvement on the corridor. The detailed planning for the long-term evolution of the corridor will be completed in 2018 through the Caltrain Business Plan, as discussed further in this application.

[1] "The Northern California Megaregion; innovative, connected and growing" Bay Area Council Economic Institute, 2016. http://www.bayareaeconomy.org/files/pdf/The_Northern_California_Megaregion_2016c.pdf
[2] "The Caltrain Corridor Vision Plan" SPUR, 2017. http://www.spur.org/sites/default/files/publications_pdfs/SPUR_Caltrain_Corridor_Vision_Plan.pdf
[3] "Rail and the California Economy" UC Berkeley in partnership with the California Department of Transportation, 2017 http://www.dot.ca.gov/californiarail/docs/Rail_CAEconomy_Book_Report_V28_LowResPages.pdf

Figure 1: The Incremental Modernization and Development of the Peninsula Corridor – Overall Program



**As described elsewhere in application, modifications to existing storage and maintenance arrangements will be required to support a full 192 EMU fleet. The factors influencing potential storage needs and the range of opportunities and possible solutions are complex and are not yet ripe for a decision. Storage needs will be evaluated further in in 2018 to determine the range of options that could be possible. Key factors that remain to be resolved include the potential to share storage and maintenance facilities with other rail operators as well as the ultimate use and deployment of the diesel fleet.*

Peninsula Corridor Electrification Expansion Project (EEP) – Proposed Scope

The EEP includes elements that build on the existing PCEP, delivering independent benefit while also building incrementally towards the long-term evolution of the corridor. Individual scope elements of the expansion included in Caltrain's application are described below.

Caltrain is primarily applying for funding to exercise its remaining options under the agency's contract with Stadler for the purchase of an additional 96 Electric Multiple Unit (EMU) train cars. When fully deployed, adding these cars to the base EMU order under PCEP will allow Caltrain to operate a completely electrified mainline fleet of 192 EMU vehicles configured in consists of up to 8-cars in length[4]. Full electrification of Caltrain's mainline fleet yields multiple significant benefits including:

- Reduced GHG emissions resulting from the cessation of mainline diesel operations
- Increased flexibility to operate more attractive service and increase ridership to address increasing capacity demands
- The ability to support the development of state and interregional services including;
    - Fulfilling a necessary precursor to allow for blended Caltrain/California High-Speed Rail operations on the San Jose to San Francisco corridor
    - Allowing for potential increase in Gilroy service and the possible redeployment of Caltrain's diesel fleet on an inter-regional San Jose to Salinas service in coordination with the Transportation Agency for Monterey County (TAMC)

It is critical to note that while Caltrain could theoretically achieve many of the benefits of full electrification with the purchase of fewer EMUs (e.g. only purchasing those EMUs needed to fully electrify its fleet with 6-car EMU consists), doing so would reduce the railroad's peak hour seated capacity from its currently planned levels for mixed diesel electric service. This reduction in peak hour seated capacity would damage the ability of the system to attract and carry riders. As discussed above, Caltrain has experienced dramatic recent increases in ridership growth since initial planning for PCEP occurred in 2012. Initial ridership projections for electrification used in both the PCEP EIR and Caltrain's previous (2015) TIRCP application were developed using 2013 base data and showed an estimated weekday ridership demand in 2020 of 69,000 riders. These projections were revisited in 2017 using updated base ridership and a revised project schedule. Adjusted ridership projections based on the same prototypical electrified service Caltrain analyzed in its 2015 environmental document now project weekday ridership of nearly 90,000 passengers in the corridor by 2025. Because the two sets of ridership projections have different near-term horizon years, 2020 for the 2013 projections and 2025 for the 2017 projections, some level of interpolation is required to develop a direct horizon year to horizon year comparison. Interpolating the 2013 projections from 2020 to 2025 yields a value of roughly 79,000 weekday riders, whereas the 2017 projections show an estimated 2025 ridership demand of over 89,000 riders – a 10,000 rider per weekday difference.

While this strong projected ridership underscores the tremendous benefits of electrified service as a mobility solution, it also points to the critical nature of increasing the system's seated capacity. Full electrification with 8-car EMU consists (rather than 6-car consists) will allow the railroad to sustain and grow capacity while also achieving the service benefits of full electrification. The addition of 96 EMUs requested in this application will provide Caltrain with a total electrified fleet of 192 EMUs (the

[4] The potential for alternative EMU consist configurations will be further explored in the Caltrain Business Plan.

equivalent of 24, 8-car consists), and will allow the system to more fully maximize the ridership, service, and capacity potential of an electrified corridor.

Given the ultimate need to fully electrify the mainline fleet and the system's pressing capacity challenges, Caltrain has organized its request for EEP funding into a series of sub-elements that each deliver independent benefit. These include:

1. **EEP Elements to Increase Capacity:** Work on these project elements can begin immediately and benefits will be tied to the 2022 timeframe along with the start of PCEP revenue service, slated for 2022. These project elements are necessary to support the expanded ridership demand that the electrified system is anticipated to generate. They include:
    a. Exercising options on the JPB's existing contract with Stadler for the procurement of 40 additional EMUs to increase capacity of the electrified system by expanding 6-car EMU sets already under procurement to 8-car sets. Exercising these options by early 2019 will allow the PCEP to begin service with 17, 8-car EMU trainsets.
    b. Funding for limited platform modifications (lengthening) to support the operation of 8-car trains. More complex platform modifications, including pursuit of level boarding, will be analyzed as part of the planning work described below. These improvements require significant additional analysis and are not part of this application for funding. During the interim period, 8-car consists can also be addressed through operational practices at platform locations where modifications are challenging.
    c. Implementation of improved wayside bicycle facilities throughout the system to complement Caltrain's program of on-board bike carriage and reduce further degradation of Caltrain's onboard seated capacity. Caltrain will seek to enhance ridership and safeguard capacity on the electrified system by implementing a robust wayside bike parking program as defined through its recently adopted "Bicycle Parking Management Plan"[5]. Nearly 7,000 passengers a day access the Caltrain system by bicycle, with most of these riders choosing to bring their bike on board the train. In order for Caltrain to maintain this high rate of cycle usage while also preserving overall system capacity, it is essential that the agency provide a viable system of bike parking amenities at its stations as an attractive supplement and alternative to having passengers bring their bike on board the train.
    d. Planning funds equivalent to 1 percent of the total EMU cost estimate to support the critical development of plans and policy agreements that ensure that the Caltrain corridor and additional EMUs are used in a way that maximizes their utility and meets the goals and service levels identified in the draft 2018 State Rail Plan. This planning would support work related to:
        - The Caltrain Business Plan and the long-term development of the Peninsula Corridor
        - Planning for storage and maintenance needs related to the expansion of the electrified fleet
        - Detailed planning for the long-term evolution of passenger rail services between San Jose, Gilroy and connecting to Salinas, in coordination with TAMC
        - Ongoing planning related to service and capacity expansion with California High-Speed Rail on the Caltrain corridor, including planning and design work related to

[5] http://www.caltrain.com/Assets/_Planning/Bicycle+Access+and+Parking+Plan/Bicycle+Parking+Management+Plan+-+Final.pdf

additional infrastructure requirements, a potential new signal system and additional platform modifications and level boarding
- Significant terminal planning activities in San Francisco and at San Jose Diridon
- Planning associated with a potential Dumbarton Rail connection in Redwood City
- Planning activities supporting the coordination and integration of Caltrain ticketing and fare payment systems with state standards and programs

2. **EEP Elements to Improve the System:** Caltrain is also seeking to enhance ridership and support the experience of its customers. Work on this element will begin immediately and will deliver benefits starting in 2022. This EEP element includes implementation of a broadband communications program that will include both customer facing Wi-Fi and communications systems that support remote vehicle diagnostics and improved fleet maintenance outcomes. This system will be installed in conjunction with the PCEP and will become operational in 2022 when the electrified system begins revenue service.

3. **EEP Elements to Fully Convert the Mainline Diesel Fleet:** This group of EEP components is required to fully convert the Caltrain mainline fleet to an all-EMU service. These project elements can begin procurement later (in 2021 or 2022) and will deliver benefits by 2027 (at the latest). Minimally, the full conversion of the mainline diesel fleet will deliver GHG and secondary air quality benefits related to the cessation of diesel operations on the main line. These benefits are quantified in Caltrain's application through the California Air Resources Board's (CARB) Calculator Tool for the California State Transportation Agency's (CalSTA) TIRCP GHG Reduction Fund. The full conversion of the mainline fleet also provides a range of secondary benefits and opportunities as described throughout the application. Project elements include:
    a. Exercising of remaining options on the JPB's contract with Stadler for the procurement of 56 additional EMUs to fully convert the mainline diesel fleet and complete the fleet of 192 EMUs. When complete, this procurement will yield a total EMU fleet size equivalent to 24 8-car EMU sets.
    b. As noted elsewhere in the application, Caltrain will need to modify its existing storage and maintenance facilities to accommodate a 192 vehicle EMU fleet. Caltrain acknowledges this issue and is applying for planning funds that will support the complex analysis and agreements that will be required to achieve a resolution on the long-term configuration of storage and maintenance facilities for the corridor. Key issues that impact storage and maintenance requirements and must still be decided include:
        - The ultimate configuration of the Caltrain 192 EMU fleet and the timing of deployment activities
        - Decisions and timing related to the decommissioning and/or redeployment of the diesel fleet
        - Decisions related to the potential for sharing future maintenance facilities with California High-Speed Rail or other rail operators
        - Ongoing terminal planning at both Salesforce Transit Center/4th & King in San Francisco and San Jose Diridon as these plans relate to current Caltrain storage and maintenance facilities at 4th & King and the Central Equipment Maintenance & Operations Facility (CEMOF)

Beyond Electrification –Planning for the Long-Term Evolution of the Corridor:

The PCEP and EEP elements contemplated in this 2018 application are incremental steps in the long-term development of the corridor. There is significant additional planning and analysis required to fully scope the service vision and associated long term needs of the Caltrain corridor and identify the appropriate set of legal agreements and projects that need to be put in place to optimize the future of the railroad to the level contemplated in the draft State Rail Plan's 2040 horizon. Caltrain has developed the comprehensive framework to conduct this planning through its "Business Plan" (see scope materials for the Business Plan presented to the JPB in **Attachment D**) along with other related planning efforts. Funding to support these planning efforts has been requested as part of this application.

While much planning work remains, Caltrain's 2018 TIRCP application discusses both the direct benefits of the individual project elements (quantified in this application through the CARB Calculator Tool for TIRCP) as well as the broad conceptual benefits related to a larger, cumulative program of corridor enhancements and service. The conversion and expansion of Caltrain's fleet is central to this larger program of improvements and benefits. The conceptual "cumulative" benefits that would result from a larger program of corridor improvements are described in the application in addition to the direct benefits anticipated to result from the immediate expansion project.

Peninsula Corridor Electrification Expansion Benefits

Direct Benefits

The direct benefits of the EEP and supporting activities in this application include:

- **Increased Ridership based on Capacity Improvements and System Enhancements**
  Capacity improvements related to the expanded EMU fleet and wayside bicycle program will allow Caltrain to accommodate increases in projected future ridership levels and further reduce greenhouse gas emissions. Similarly, overall ridership growth will be enhanced by the addition of on-board Wi-Fi as a long-requested customer amenity.

- **Improved Regional Air Quality and Reduced Greenhouse Gas Emissions related to Vehicle Changes**
  Electrified trains produce substantially less air pollution compared with diesel trains, even when the indirect emissions from electrical power generation are included. The reduction of greenhouse gas emissions will significantly improve regional air quality and will help meet the State's emission reduction goals.

- **Safety**
  While this benefit is not quantified through the CARB Calculator Tool for TIRCP, the implementation of broadband service and associated systems will do more than just provide customer facing Wi-Fi. Broadband communications will also increase safety and decrease maintenance costs for the railroad. Broadband permits more precise train positioning, and can more precisely help control traffic, schedules, and maintenance. In addition, on-board real-time video surveillance permits operators to monitor and assess critical/abnormal situations in passenger coaches, on tracks or platforms, or security breaches. Finally, preventative maintenance is improved by permanently and remotely monitoring infrastructure and rolling stock to detect potential issues earlier and address them prior to causing operational delays. EMUs with

connected sensors in China have found 20-25 percent increase in maintenance efficiency with smart sensors/remote monitoring.

Cumulative Benefits

The cumulative benefits of the larger program of corridor improvements that include and assume the EEP are significant. Realization of these benefits is contingent on the outcome of additional planning and policy work as well as potential supplemental investments in the corridor. These benefits have not been explicitly quantified as part of this application. Cumulative benefits include:

- **Increased Service and Increased Ridership**
  Electrified trains can accelerate and decelerate more quickly than diesel-powered trains, allowing Caltrain to run more efficiently. In addition, because of their performance advantages, electric trains will enable more frequent and/or faster train service to more riders. When included in a long-range program of additional corridor improvements, a fully electrified and expanded Caltrain fleet has the capability of supporting service levels on the corridor that match those contemplated in the draft 2018 State Rail Plan horizon year 2040. Caltrain has modeled a conceptual, higher-intensity, 220 train per day Caltrain schedule that also accommodates High-Speed Rail and is conceptually representative of the level of service an improved corridor could support by 2040. Initial ridership modeling for this expanded service was conducted in 2017 and showed projected 2040 ridership demand of over 140,000 riders per weekday. Planning for potential expanded service on the Caltrain corridor and conducting additional ridership modeling will be a central component of the Caltrain Business Plan and related planning work described previously.

- **Coordinated Interregional and State Rail Service**
  A fully electrified Caltrain system fulfills a necessary prerequisite allowing for the development of key portions of the interregional and state rail network, and for supporting and enhancing economic vitality on the Peninsula, throughout the Bay Area, and the entire State of California. Fully electrifying the Caltrain fleet is a key step in preparing the Peninsula Corridor for blended Caltrain/California High-Speed Rail operations. Similarly, the timely expansion of the full Caltrain fleet will allow for the potential redeployment of the remaining diesel fleet to support improved Gilroy service and/or interregional connections in coordination with TAMC to extend rail service to Salinas.

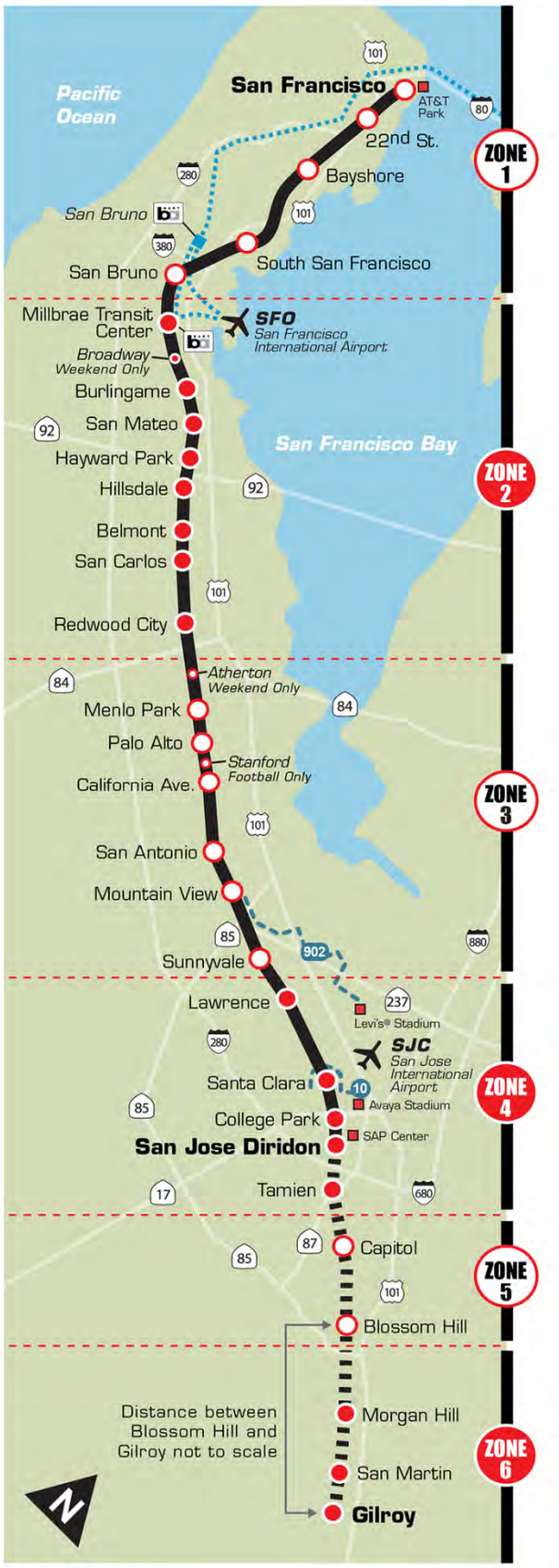
Project Location

The EEP location is coterminous with the extent of the existing electrification project and covers the 51-mile existing Caltrain rail corridor between the 4th and King Station (San Francisco) and Tamien Station (San Jose). The cumulative impacts of the project that relate to the long-range development of the corridor are broader and extend from San Francisco's 4th and King Station at the northern terminus to the Gilroy Station at the southern terminus, with planning work also considering an extension of service further south to Salinas.

The EEP serves several disadvantaged and low-income communities, benefitting the entire corridor and substantially benefitting those located between San Francisco and San Jose. Their locations are noted below with their census tract numbers:

- Disadvantaged Communities
  - South San Francisco, San Francisco – 6081602300
  - San Bruno, San Bruno – 6081604200
  - Tamien, San Jose – 6085503113
  - Gilroy, Gilroy – 6085512603
- Low-Income Communities not within ½ mile of Disadvantaged Communities
  - South San Francisco, San Francisco – 6081602300
  - San Bruno, San Bruno – 6081604200
  - Millbrae, Millbrae – 6081604400
  - Burlingame, Burlingame – 6081605500
  - San Mateo, San Mateo – 6081606300
  - Redwood City, Redwood City – 6081610202
  - Tamien, San Jose – 6085503113
  - Capitol, San Jose – 6085503204
  - Morgan Hill, Morgan Hill – 6085512314
  - Gilroy, Gilroy – 6085512603
- Low-Income Communities within ½ mile of Disadvantaged Communities
  - Redwood City, Redwood City – 6081610202
  - Morgan Hill, Morgan Hill – 6085512314

A project map noting the project limits can be found at the right, and maps of the stations serving disadvantaged and low-income communities can be found in **Attachment E**.



Project Mode
Commuter Rail

Multi-Agency Coordination
The Caltrain corridor is the spine of the transportation network on the San Francisco Peninsula and plays a vital role in connecting to other transit services providing mobility to residents throughout the Bay Area.

Caltrain is in regular coordination with the California High-Speed Rail Authority related to the on-going planning and design efforts for the San Francisco to San Jose Project Section of the California High-Speed Rail system. Coordination efforts between the two agencies include regular meetings and conference calls to plan the future implementation of Blended Service. These efforts have intensified in the last 6 months as the two agencies have begun renewed planning work around the long-range evolution of the Peninsula Corridor. Operational concepts developed through this work have formed the basis for the "cumulative" service scenario discussed in this application.

More generally, Caltrain directly connects to four existing rail systems serving the Bay Area and Northern California: Altamont Corridor Express (ACE), Capitol Corridor, Amtrak, and BART. Caltrain coordinates its planning with these agencies through a variety of different venues including at specific stations where services overlap as well as through more general planning venues including the growing Northern California "megaregional" planning efforts that the State has taken a lead in organizing. Caltrain has also focused its planning coordination efforts intensively around the San Jose Diridon Station, a critical piece of infrastructure where multiple rail services connect and coordinate.

Finally, Caltrain has committed to the development of a comprehensive and transparent planning framework for the future of the long-term development of the railroad through the Caltrain Business Plan. Caltrain kicked off its stakeholder engagement for the Business Plan with an all-day workshop in September of 2017 that included participation by high level staff members from the State, the California High-Speed Rail Authority, Capital Corridor, ACE, BART, and TAMC among others. This initial stakeholder outreach was deliberately broad, open, and inclusive and was intended to set the tone for the planning work to come as part of the Caltrain Business Plan.

In the future, as part of the Business Plan as well as other related planning work, Caltrain will coordinate closely with other transit and rail agencies. Ongoing coordination with the California High-Speed Rail Authority and TAMC will be of particular importance as these agencies look to develop service across infrastructure that is shared with Caltrain.

Green House Gas (GHG) Reductions
Using the CARB Calculator Tool for TIRCP, the EEP component focused on an additional 40 EMUs and support elements such as planning, bike improvements, and platform modifications will achieve direct greenhouse gas emissions of 891,952 metric tons; the broadband communications element will achieve direct greenhouse gas emissions reduction of 98,4264 metric tons; and the additional acquisition of 56 EMUs will achieve direct greenhouse gas emissions reduction of 197,917 metric tons, for a **total reduction of 1,188,133 metric tons**. A copy of the CARB Calculator Tool for TIRCP used to calculate this data is included in both pdf and excel form as **Attachment C.**

Funding

Caltrain is requesting $631.5 million in TIRCP funds in support of the EEP as part of the overall Peninsula Corridor modernization and development program. This program includes realized and future matching funds of at least $4.7 billion in local, regional, state, and federal funds in support of the overall program of rail improvement in the corridor. TIRCP funds requested in 2018 would specifically be used for the expansion elements identified throughout this application. **Table 1** on the following page describes the funding sources assumed as part of an overall program of improvements in the Peninsula Corridor.

The overall Peninsula Corridor modernization and development program begins with the funded (and in construction) PCEP. This $2 billion program includes $20 million in already received funding from TIRCP leveraged against a wide array of local, federal and state funds.

The next increment of investment in the corridor includes the EEP elements described in this application. Caltrain is requesting $631,500,000 in TIRCP funding to fund these incremental improvements. The direct benefits these expansion elements create rely on the existing investment in the original PCEP.

The larger program of long-term development for the Peninsula Corridor will be defined in 2018 through the Caltrain Business Plan. The program will include those infrastructure, fleet and systems elements necessary to support the State Rail Plan's 2040 Vision including increased levels of service and connectivity and the introduction of High-Speed Rail service to the corridor. This program will build on the investments made in the corridor through the PCEP and the EEP elements described in this application and will minimally include the following conceptual additional elements- all of which require additional planning and agreements:

- Reconfigured maintenance and storage facilities sufficient to store and maintain the expanded electrified fleet (potentially to be developed as joint facilities with California High-Speed Rail or other operators)
- Infrastructure and systems improvements necessary to support the introduction of high-speed rail service onto the corridor as well as the expansion and improvement of Caltrain services. These elements could include:
    - Improvements to underlying track structure;
    - Expansion of traction power facilities;
    - Signal system enhancements;
    - Limited standing (at station) overtakes and/or limited running overtakes;
    - Station modifications and level boarding;
    - Terminal modifications at both the North Terminal (San Francisco) and South Terminal (Santa Clara through Tamien) areas.
- Improvements and/or agreements related to the Union Pacific Railroad (UPRR) owned San Jose through Gilroy corridor sufficient to allow for improved services including potential future San Jose to Salinas service.
- Potential additional fleet expansion (above 192) based on the long-term target service levels and operating plan identified through the Caltrain Business Plan

In addition to these core infrastructure improvements, the long-term development of the Caltrain corridor will likely also include significant additional secondary improvements. Most notably these could include station facility upgrades, first- and last-mile facilities and the separation, improvement and/or closure of existing at-grade crossings. These elements will be identified and described through the Caltrain Business Plan process in 2018. The Business Plan will also identify additional funding mechanisms including self-

generated revenues, value capture strategies and the potential for new voter approved measures in the 2020 timeframe or beyond.

Table 1: Peninsula Corridor Modernization and Development – Overall Program

Program	Overall Peninsula Corridor modernization and development	Total by Source
Peninsula Corridor Electrification Project (PCEP)		
Fund Sources		
Transit and Intercity Rail Capital Program		$20 million
Other State Funds		$730 million
Federal Funds		$978 million
Regional/Local Funds		$252 million
Subtotal by Project		**$1,980 million**
Peninsula Corridor Electrification Expansion Project (EEP)		
Fund Sources		
Transit and Intercity Rail Capital Program		$631.5 million
Subtotal by Project		**$631.5 million**
Long term development of the Peninsula Corridor		
Fund Sources		
Local Funds- Remaining Measure A (Caltrain)	*Existing*	$83 million
Local Funds- Remaining Measure A (Grade Seps)	*Existing*	$200 million
Local Funds – Measure B (Caltrain)	*Existing*	$314 million
Local Funds – Measure B (Caltrain)	*Existing*	$700 million
Local Funds – Potential San Mateo County Ballot Measure	*Caltrain has submitted over $2 billion in funding requests to the initial "Get Us Moving" call for projects*	$1,140 million
Local Funds – San Francisco Potential Ballot Measure	*Caltrain is engaged with San Francisco to ensure that potential ballot measure includes appropriate funds*	$314 million
Other Funding Sources	*To be identified through the Caltrain Business Plan*	
Subtotal by Project		**$2,751 million**
Overall Program Funding		**$5,363 million**

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B. Project Costs & Funding

The total capital cost of the PCEP, which is underway, is $2 billion. This includes the procurement of 96 initial EMUs, the infrastructure (poles/wires) design build contract, contingency, and owner's costs such as program management, project management, and engineering oversight. The EEP for the expansion of the fleet and associated improvements is $631.5 million. The total combined costs for these foundational elements in a larger program of corridor modernization and development is $2.61 billion. Leveraged funding from other Federal, State, and Regional/Local sources can be found in **Table 3**. The JPB is requesting $631.5 million in TIRCP funds to support the EEP as described in **Table 2** below.

Table 2: Electrification Expansion TIRCP Elements Project Costs (in Thousands)

Project Element	Cost
Capacity Improvements	
Procurement of 40 Electric Multiple Units (EMUs)	$224,700
Minor Platform Modifications	$8,000
Wayside Bike Parking Improvements	$3,500
Planning and Agreement Support	$6,000
Subtotal	**$242,200**
System Enhancements	
Broadband Communications	$14,000
Subtotal	**$14,000**
Full Fleet Conversion	
Procurement of 56 Electric Multiple Units (EMUs)	$375,300
Subtotal	**$375,300**
TOTAL	**$631,500**

Table 3: PCEP & Electrification Expansion Leveraging Funding (in Thousands)

Funding Sources	Initial PCEP	Current EEP	Total
FEDERAL			
FTA Formula Funding	$330,677		$330,677
Section 5309 Core Capacity	$647,000		$647,000
STATE: Greenhouse Gas Reduction Funds			
Transit and Intercity Rail Capital Program (TIRCP)	$20,000	$631,500	$651,500
Low Carbon Transit Operations Program (LCTOP)	$9,000		$9,000
STATE: Non-Greenhouse Gas Reduction Funds			
Proposition 1B PTMISEA	$8,000		$8000
Proposition 1A and High-Speed Rail Non-Prop 1A	$713,000		$713,000
REGIONAL/LOCAL			
Carl Moyer Program	$20,000		$20,000
MTC Bridge Tolls	$39,430		$39,430
JPB Members	$193,145		$193,145
Total by Project	**$1,980,252**	**$631,500**	**$2,611,752**

Project Funding

Caltrain received an executed Full Funding Grant Agreement for a Core Capacity Grant from the Federal Transit Administration (FTA) committing $647 million to PCEP in May 2017. The PCEP received a project rating of Medium High. Of the $647 million, an appropriation of $72.9 million from prior year budgets (FY14-FY16) and another $100 million in FY17 are currently available to the project.

In addition to the Core Capacity funding, over $1 billion in local, regional, and state funding for the PCEP is committed through a regional nine-party Memorandum of Understanding (MOU) agreement signed in late 2012 between the following funding partners:

- California High-Speed Rail Authority (CHSRA)
- Metropolitan Transpiration Commission (MTC)
- Peninsula Corridor Joint Power Board (PCJPB)
- San Francisco County Transportation Authority (SFCTA)
- San Mateo County Transportation Authority (SMCTA)
- Santa Clara County Transportation Authority (VTA)
- City of San Jose
- City and County of San Francisco
- Transbay Joint Powers Authority (TJPA)

The MOU is the result of a collaborative effort between the CHSRA, MTC, and San Francisco Bay Area local agencies to identify early investment projects along existing rail corridors that improve service, safety, and efficiency, and create linkages between the state high-speed rail system and local passenger rail service. A copy of the MOU is available upon request.

To supplement the original funds committed in the 9-Party Regional Funding MOU, additional fund sources were committed by seven of the funding partners to help fully fund the PCEP. The JPB received $113 million from CHSRA, and a total of $98 million from the JPB member agencies and MTC. These additional fund sources were committed in August 2016 through a supplemental agreement to the MOU (seven party supplemental MOU). Part of the additional funding included leveraging $9 million Low Carbon Transportation Operations (LCTOP) formula funds allocated to the JPB.

Table 4: Electrification Expansion Project Schedule

Milestone Number	Milestone Description	Start Work Date	Completion
Capacity Improvements			
1.1	Procure initial 40 EMUs to achieve conversion of 17, 6-car EMU consists to 17, 8-car consists	FY19	FY2022
1.2	Minor modification of platforms	FY19	FY2022
1.3	Implementation of wayside Bike Parking Program	FY19	FY19-FY22
1.4	Planning and policy support	FY19-FY22	FY19-FY22
System Enhancements			
2.2	Implementation of Broadband communication system	FY19	FY2022
Full Fleet Conversion			
3.1	Additional 56 EMUs to achieve conversion of remaining mainline diesel fleet to 8-car diesel consists	FY2021	FY2027*

*Conservative delivery assumption used. Depending on timing of order delivery of final 56 EMUs could occur earlier

C. Eligibility

Using the CARB Calculator Tool for TIRCP, the EEP elements funded through this application will achieve a greenhouse gas emissions reduction of **1,188,133 metric tons**.

Caltrain's EEP elements included in this application are eligible for TIRCP funding as they involve:

1. Acquisition of electric rail cars, and the facilities to support them, that expand, enhance, and improve Caltrain's existing rail system and its connectivity to future transit systems, including the California High-Speed Rail system sharing a blended corridor between San Jose and San Francisco;
2. Caltrain's intercity and commuter urban rail projects that increase service levels and are expected to generate increased ridership by developing a robust wayside bike parking and sharing system and adding Wi-Fi to on-board amenities; and
3. Rail integration implementation by pursuing planning activities that enable and enhance shared-use corridors between Caltrain and High-Speed Rail and an extension of rail service to Salinas.

Based upon the CARB Calculator Tool for TIRCP, the EEP is expected to reduce 1,188,133 metric tons of GHG's. This GHG reduction is based upon increased ridership due to the increased carrying capacity of larger rail consists, increased ridership due to amenity improvements associated with broadband communications, including Wi-Fi, and the GHG benefit of fully converting Caltrain's mainline service to an all-electric operation.

D. Project Benefits

Caltrain's Electrification Expansion Project builds upon the existing PCEP to fully realize the corridor's potential for increasing ridership and reducing greenhouse gas emissions. All of the project elements described in this application assume and build on the infrastructure and equipment currently being constructed and procured through Caltrain's in-progress PCEP and represent incremental investments that support the long-term evolution and growth of the corridor towards and beyond the 2022, 2027 and 2040 service visions contemplated in the Draft 2018 State Rail Plan.

All stations along the line, including ten serving disadvantaged and/or low-income communities (South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Redwood City, Tamien, Capitol, Morgan Hill, and Gilroy), will experience more frequent and faster journeys with increased overall capacity on the congested corridor between San Jose and San Francisco, which will be able to carry more riders during peak travel periods. Cities and areas along the segment of the corridor between San Francisco and San Jose, including seven of the aforementioned disadvantaged and/or low-income communities, will see a reduction in greenhouse gas emissions and pollutants from reduced vehicle miles traveled with the capacity expansion of zero emission electric vehicles.

Full electrification of the Caltrain system fulfills a necessary prerequisite for development of key portions of the State and regional transit and intercity rail services, particularly in preparing the corridor for blended service with High-Speed Rail, as well as potential redeployment of the remaining diesel fleet to support interregional connections in coordination with the TAMC's Salinas Rail Extension. The EEP builds on the foundational elements of Caltrain's current PCEP and represents a key step towards future capacity improvements integral to the success of intercity, interregional, and State rail services.

Expected Benefits and Metrics for Tracking and Reporting Progress
Caltrain intends to provide periodic reports consistent with CalSTA's requirements upon award of a TIRCP grant. Consistent with the CARB's Funding Guidelines, Caltrain will provide quarterly reports upon award and implementation of a TIRCP funding allocation, and annual reports once Project outcome tracking begins when the project elements are operational.

Quarterly reports will include any necessary updates on all the metrics provided in this application, including but not limited to total project cost, total GGRF funds awarded in each reporting cycle, estimated total project GHG emission reductions, indicated benefits to AB 1550 populations (disadvantaged communities, low-income communities, and low-income households), and estimated project co-benefits and indicators including:

- VMT reductions (miles)
- Criteria Air Pollution Reductions (tons)
- Fuel Use Reductions (gallons)

Upon delivery and operation of the proposed project, Caltrain will utilize the following metrics to measure the quantified benefits expected through the EEP:

- **Capital Improvements that Result in New or Expanded Transit Service or Increase Mode Share on Existing Transit Service (*Capacity improvements including purchase of 40 EMUs and development of associated infrastructure to lengthen consists and wayside bike parking program*)**

- Days of operation per year (days/year) based on evaluation of service schedule.
- Average daily ridership (unlinked trips/day) as calculated during Caltrain's extensive ridership count conducted once a year around February, based on the following:
  - Monthly Total Ridership and Average Weekday Ridership (AWR) based on Fare Media Sales using a ridership model, along with other Caltrain performance statistics measures, as included in each Caltrain Board of Directors monthly agenda packet
  - National Transit Database (NTD) Ridership as reported Monthly and at Fiscal Year (FY) end to NTD
  - Annual Count Ridership as calculated through an extensive onboard ridership census of passengers used to validate the monthly ridership estimation derived from fare media sales.

- **New Vehicle(s) for Existing Transit Service (*Full conversion of mainline Caltrain fleet through purchase of 56 additional EMUs)***
  - Fuel/energy consumption or vehicle miles traveled (gallons/year by fuel type, kWh/year, scf/year, or vehicle miles traveled/year) based on an evaluation of fueling, utility, mileage, or other operating records
  - Change in fuel/energy consumption or annual vehicle miles traveled (gallons/year by fuel type, kWh/year, scf/year, or vehicle miles traveled/year) based on an evaluation of fueling, utility, mileage, or other operating records

Primary Evaluation Criteria

Greenhouse Gas Emissions (GHG) Reduction
Based on CARB's Calculator Tool for TIRCP, **the EEP is expected to reduce 1,188,133 metric tons of greenhouse gas (GHG) emissions**. A copy of the CARB Calculator Tool for TIRCP used to calculate this data is included in both pdf and excel form as **Attachment C**.

The GHG reduction is tied to project components and quantified in the following ways:

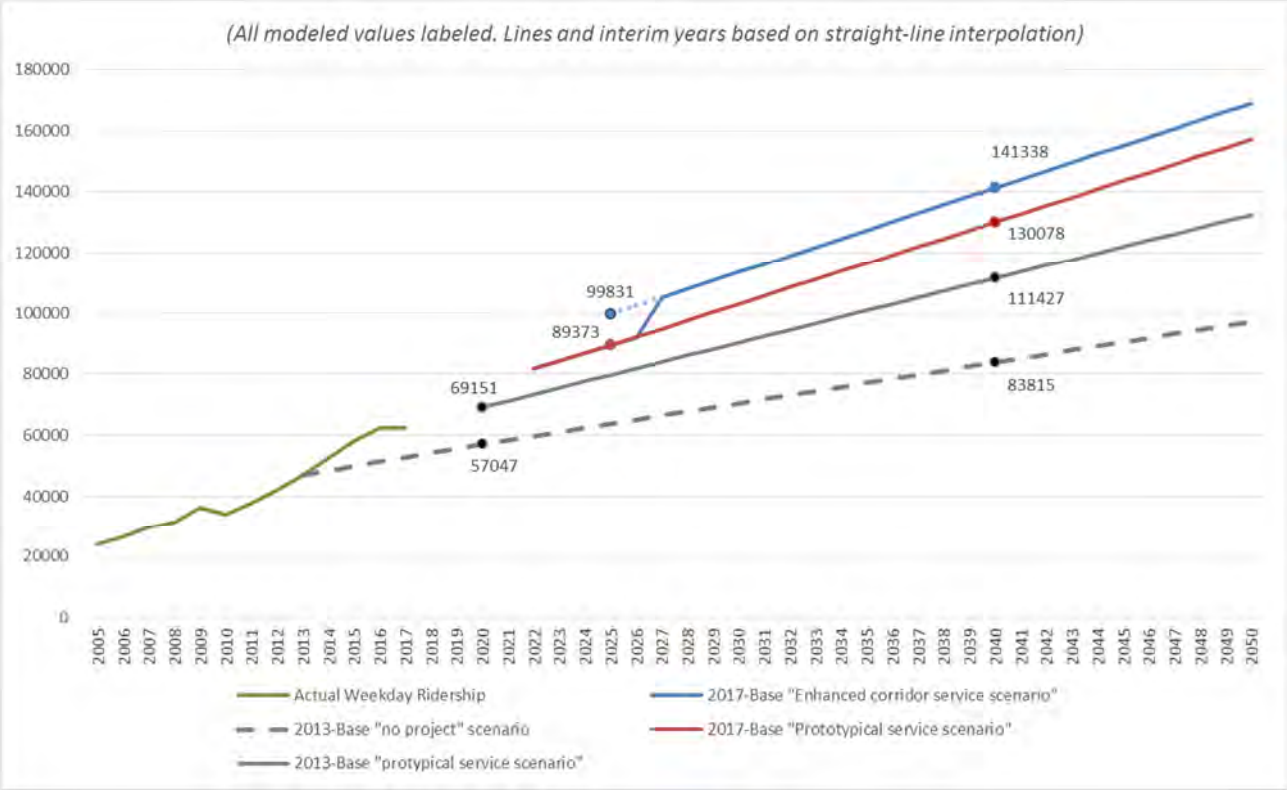
- **Capacity Expansion:** The expansion of Caltrain's seated capacity to be able to accommodate the updated levels of service demand **ridership** modeled in the corridor and the protection of this capacity from further degradation through onboard bike carriage (the increment of benefit claimed is equivalent to the increment of ridership in excess/above the benefit previously modeled in Caltrain's 2015 TIRCP application). Expansion of Caltrain's electrified fleet will increase the number of train cars Caltrain can run, increasing capacity to accommodate modeled ridership demand. This results in a direct reduction of vehicle miles travelled (VMTs) on Peninsula roadways. The reduction of greenhouse gas emissions is not only good for regional air quality, but will also help meet the State's emission reduction goals.
- **System Enhancements:** An additional increase in **ridership** associated with the installation of customer facing Wi-Fi on the Caltrain service.
- **Full Fleet Conversion:** The **conversion** of Caltrain's diesel fleet operating between San Francisco and San Jose to a fully electric operation and the elimination of diesel Caltrain service from the mainline. Electrified trains produce substantially less corridor air pollution compared

with diesel trains, even when the indirect emissions from electrical power generation are included.

Ridership

Ridership projections for the PCEP were initially completed in 2013 for the 2015 PCEP EIR (and were also used in the 2015 Caltrain TIRCP application). Ridership projections have been updated for this application. A comparison of prior and current projections (along with interpolated interim years) is shown visually in **Figure 2**. Documentation of the ridership projections and calculations are included in **Attachment F**.

Figure 2: Comparison of Prior (2013) and Current (2017) Weekday Ridership Modeling and Service Scenarios



As **Figure 2** indicates, ridership on the Caltrain service grew significantly faster between 2012 and 2017 than the baseline growth rate implicit in the 2013 "no project" projection. Thus, while the base PCEP was planned to a forecast ridership of 69,000 weekday riders in its opening year spanning to 111,000 in 2040, revised ridership projections suggest that demand for Caltrain's services is on pace to be significantly higher. Caltrain uses the Santa Clara Valley Transportation Agency's (VTA) travel demand ridership model to forecast future demand. The lines shown in **Figure 2** describe projections based on the following assumptions:

- 2013-Base "No Project" Scenario: This line shows projections developed in 2013 using the VTA travel demand ridership model that assume the continuation of Caltrain's 92-train per weekday

diesel schedule through 2040. No service to Salesforce Transit Center (Transbay Terminal) is assumed since it is precluded by the diesel technology.

- 2013-Base "Prototypical Service" Scenario: This line shows projections developed in 2013 using the VTA travel demand ridership model that assume Caltrain's implementation of PCEP in 2020 (the start year for the project at the time) and the start of a 114 train per weekday "prototypical schedule." By 2040 these projections also assumed that 2 out of 6 Caltrain trains per peak hour were serving the Salesforce Transit Center (Transbay Terminal).
- 2017-Base "Prototypical Service" Scenario: This projection has been updated using the VTA travel demand ridership model and calibrated to factor in a revised baseline of demand. It assumes the same 114 train per weekday prototypical service modeled in 2013. The 2040 out year projections assume additional Caltrain service to the Salesforce Transit Center (Transbay Terminal) consistent with current operational simulations (The 2017 projections assume that 4 our 6 trains per hour will serve the terminal in 2040).
- 2017-Base "Enhanced Corridor Service" Scenario: This projection is shown for illustrative purposes only (benefits are not quantified for this application). It reflects initial modeled ridership of a conceptual "enhanced" 220 train per weekday schedule assumed to go into effect in 2027. This kind of conceptual service is indicative of what an "enhanced" Caltrain corridor could support as part of its long-term evolution and development. Further study, service refinement and ridership analysis of these kinds of "enhanced" service concepts will be conducted through the Caltrain Business Plan.

These revised ridership modeling results tie to claimed GHG benefits for both the **Capacity Expansion** and **System Enhancement** components of the EEP as follows:

- **Capacity Expansion – Relationship to Ridership:** Updated ridership projections show a significant projected increase in demand for Caltrain service. This increase in demand significantly exceeds the planning horizon used to develop the PCEP as well as the ridership projections used to develop estimates of GHG benefits claimed in Caltrain's 2015 TIRCP application. They demonstrate that there is significant, robust demand for service in the Caltrain corridor.

  VTA's travel demand ridership model is not capacity constrained, however, meaning that its projections do not take into account the effect of crowding on trains. Caltrain believes that the system will need additional capacity to accommodate the projected increase in ridership growth. **Specifically, Caltrain is tying its request for capacity expansion funding as part of the EEP to the benefit of the incremental increase in ridership demand projected between the 2013 and 2017 model runs.**

  While VTA's travel demand ridership model is capacity-blind, there is ample evidence that crowding on transit can be a significant deterrent to realizing latent ridership demand. Expansion of Caltrain's electrified fleet from 6- to 8- car train sets will directly increase ridership on each Caltrain trip between San Francisco and San Jose. In addition to the clear ridership benefits of increasing capacity by adding 33 percent more train cars, there are noticeable impacts to ridership resulting from customer experience related to crowding. Crowding has been shown by numerous transit and rail studies to greatly influence modal choice due to its significant effect on the perception and valuation of travel time, with indications that the higher the perceived cost of a combination of route and mode (e.g., longer travel time, more crowded conditions), the less likely

a person would choose it for a given trip. When the passenger load (the ratio between passengers to seats) is at 1.0, perceived travel time is 10 percent longer for seated passengers and 90 percent longer for standing passengers. When the passenger load is 1.4, this increases to 30 percent longer for seated passengers and 110 percent longer for standing passengers.[6] For passengers sitting, the crowding multiplier increases the value of travel time from 1.0 to 1.63 as the density of standing passengers increases from zero to six passengers per square meter, whereas for passengers standing these figures are 1.53 and 2.04, respectively.[7] Other studies have found that the time multiplier for standing passengers averages 2.32.[8] Additionally, crowding has actual impacts on travel time due to increased time needed for boarding and alighting, resulting in longer dwell times, and with high average occupancy levels increasing the probability of trains being full, and therefore, not being able to pick up passengers waiting at stops and stations, further increasing waiting time and travel time variability.

Developing an improved wayside bicycle system in line with Caltrain's recently adopted "Bicycle Parking Management Plan" is also essential to preserving capacity and growing ridership on the system. Nearly 7,000 passengers a day access the Caltrain system by bicycle, with most of these riders choosing to bring their bike on board the train, often resulting in capacity constraints and issues with crowding as discussed above as the bike cars fill up early on peak trains. In order for Caltrain to maintain this high rate of cycle usage while also preserving overall system capacity, it is essential that the agency provide a viable system of bike parking amenities at its stations as an attractive supplement and alternative to having passengers bring their bike on board the train with them. In the absence of such as system as a viable alternative for bicycles Caltrain will risk having to degrade its on-board capacity and remove seats to accommodate bikes.

Expanding the capacity of Caltrain's fleet is essential to realizing the full ridership demand and GHG benefits of the corridor.

- **Caltrain System Enhancements – Relationship to Ridership:** Caltrain will also seek to enhance ridership by improving the experience of its customers. After Amtrak launched free Wi-Fi internet service on all Capitol Corridor trains in 2011, an on-board survey and study of its impacts was conducted in 2012. This study found that Wi-Fi as an amenity increased ridership in a number of ways. The overall expected number of Capitol Corridor trips increased by 2.7 percent, with new riders expected to make 8.6 percent more trips than if Wi-Fi were not available – indicating that Wi-Fi both increases ridership and is a potentially significant draw in attracting new, choice riders.[9] For the purpose of GHG benefits analysis, Caltrain has assumed that the addition of free Wi-Fi to its system will result in a 2.7 percent increase in ridership above the 2017 modeled ridership results.

Integration with State Rail and Transit Operations

The Caltrain corridor is the spine of the transportation network on the San Francisco Peninsula and plays a vital role in connecting to other rail and transit services providing mobility to residents throughout the

[6] http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_165ch-04.pdf
[7] http://www.hydeparkandwoodhouseonline.com/wp-content/uploads/2014/01/NGT-travel-and-comfort.pdf
[8] http://www.tandfonline.com/doi/abs/10.1080/01441647.2010.519127?journalCode=ttrv20
[9] https://link.springer.com/article/10.1007%2Fs11116-014-9532-7

Bay Area. Caltrain directly connects to four regional and interregional rail systems serving the Bay Area and beyond: ACE, Capitol Corridor, Amtrak, and BART; VTA (San Jose) and MUNI light rail (San Francisco) in the two biggest cities in the Bay Area; three bus systems serving Santa Clara, San Mateo, and San Francisco Counties as well as longer-distance bus services; and approximately 50 private and public shuttles.

Supported by the planning activities to be funded through this application, Caltrain is committed to the development of a comprehensive and transparent planning framework for the future of the long-term development of the railroad through the Caltrain Business Plan, in order to fully realize the potential ridership and emissions benefits related to electrification on the Caltrain corridor and beyond. Where needed, Caltrain coordinates its planning with transit and rail agencies through a variety of different venues, including at specific stations where services overlap as well as through more general planning venues including the nascent Northern California "megaregional" planning efforts that the State has taken a lead in organizing. Caltrain has focused its planning coordination efforts intensively around the San Jose Diridon Station, a critical piece of infrastructure where multiple rail services connect and can coordinate to provide a more seamless experience for riders accessing the regional, interregional, and State transit and rail network. Long range plans related to San Jose's Diridon Station include VTA's extension of BART to Silicon Valley, TAMC's Salinas Rail Extension, and California's High-Speed Rail system. At the northern terminus, long range plans include connecting Caltrain to the Salesforce Transit Center (Transbay Terminal) in downtown San Francisco through the Downtown Extension Project.

The California High-Speed Rail Authority's (CHSRA) 2016 Business Plan, "Connecting and Transforming California," introduced the Central Valley to Silicon Valley line (connecting an interim stop just north of Bakersfield to San Jose Diridon) as the initial operating segment of the California High-Speed Rail system in 2025[10]. The Valley to Valley line was chosen based on the available funds to the California High-Speed Rail Authority at the time of the publication of the Business Plan. In the event additional funds would become available, an option to extend the Valley to Valley line to San Francisco and Bakersfield was included. Extending service to the San Francisco market by way of the Caltrain Corridor is crucial for High-Speed Rail's ridership. Under the medium ridership scenario the 2016 Business Plan projects ridership to be about 3 million annually in 2025 for the Valley to Valley line. However, if the Valley to Valley line is extended to San Francisco and Bakersfield, ridership increases to about 5.3 million annually in 2025. Extending the initial operating segment of the California High-Speed Rail system is only possible with the completion of the Caltrain PCEP as California High-Speed Rail and Caltrain would share the electrified tracks. Without the electrification project, San Jose would remain the northern terminal for High-Speed Rail and the ridership increase potential to be realized with rail service to San Francisco would not occur.

The Business Plan highlights the connection between electrifying Caltrain and implementing High-Speed Rail to operate the future Caltrain/California High-Speed Rail blended system between San Jose and San Francisco. The 2016 Business Plan discusses the close coordination and integration between Caltrain and California High-Speed Rail on page 25: "The San Francisco to San Jose Project Section will connect the cities of San Francisco, Millbrae (San Francisco Airport), and San Jose on an electrified corridor utilizing a blended system which will support modernized Caltrain commuter rail service and high-speed rail

[10] http://www.hsr.ca.gov/docs/about/business_plans/2016_BusinessPlan.pdf

service on shared track. This approach minimizes impacts on surrounding communities, reduces project cost, improves safety and expedites implementation."

Caltrain's Short Range Transit Plan (SRTP) details Caltrain's commitment to ongoing planning for longer range improvements focused on expanding system capacity and preparing for the shared use of the Peninsula Corridor by both Caltrain and High-Speed Rail Service in a "Blended System."[11]

Improve Safety
The new EMUs to be procured as part of the EEP will incorporate crash energy management (CEM) to improve passenger safety on the trains. The CEM element will allow Caltrain's new vehicles to be designed and fabricated in a way that will enhance crashworthiness and limit the severity of impact in occupied spaces. The EMUs will also be equipped with the Positive Train Control (PTC) system being installed on the Caltrain corridor.

Implementation of a Broadband Communications System to support remote diagnostics and improved fleet maintenance outcomes will have the additional benefit of improving safety on the Caltrain corridor due to more efficient operations with improved communications and system control. On-board real-time video surveillance can monitor and assess critical/abnormal situations in coaches, on tracks or platforms, or security breaches. Finally, preventative maintenance is improved by permanently and remotely monitoring assets (assets including infrastructure and rolling stock, remotely monitoring could be video or smart sensors) to detect potential issues earlier and address them prior to causing operational delays.

Secondary Evaluation Criteria

Implementation of Sustainable Communities' Strategies
The Metropolitan Transportation Commission's (MTC) Plan Bay Area 2040 (PBA 2040), the Regional Transportation Plan and Sustainable Communities Strategy for the San Francisco Bay Area 2017–2040, details electrification and extension of Caltrain as fulfilling the region's Key Transportation Strategies, Investments, and Projects. Strategy 2, *Modernize,* includes Caltrain's Electrification as a key component of the Transit Modernization and Efficiency goal, and Strategy 3, *Expand*, includes the Bay Area segment of the California High-Speed Rail Project (including the extension up the shared corridor with Caltrain to San Francisco) as the largest transportation expansion project, as well as the Caltrain Downtown San Francisco Extension project. Plan Bay Area 2040 goes on to detail that it "invests almost $24 billion – 10 percent of its funding and 15 percent of discretionary funding – to increasing transit capacity throughout the region's core by connecting jobs and people between San Francisco and Silicon Valley via transit expansion and modernization projects" with electrifying and modernizing Caltrain noted as one of the major projects (page 66)[12].

Beyond the Bay Area, and beyond the bounds of PBA 2040, expansion of capacity on the Caltrain Corridor linking San Francisco, San Jose, and Gilroy is a key component of multiple significant interregional and state projects serving Northern California as well as the entire State of California.

[11] http://www.caltrain.com/Assets/_Planning/Strategic+Plan/Strategic+Plan+FY2015+-+FY2024/Caltrain+Short+Range+Transit+Plan+-+FY2015-FY2024+-+Final.pdf
[12] http://2040.planbayarea.org/cdn/farfuture/u_7TKELkH2s3AAiOhCyh9Q9QlWEZIdYcJzi2QDCZuIs/1510696833/sites/default/files/2017-11/Final_Plan_Bay_Area_2040.pdf

Benefits to Disadvantaged Communities, Low-Income Communities, and Low-Income Households
The EEP will help reduce significant levels of diesel fumes that affect seven AB 1550 communities served by Caltrain stations between San Francisco and San Jose. The project, which is designated to replace the existing diesel fleet with electrical trains from San Francisco to San Jose, will immediately lead to a reduction of diesel exhaust emissions throughout the corridor. This will provide aid to communities that suffer from the highest level of pollution surrounding 10 of the Caltrain stations. This is significant, since the aforementioned communities fall above the 75th percentile level in the state. Correspondingly, communities that scored high in asthma and are affected by outdoor air pollution will experience a decrease in emissions that trigger negative health conditions. Disadvantaged communities at close proximity to the San Bruno and Redwood City stations are especially impacted by pollutants and will benefit from cleaner air.

Additionally, increased capacity and service during peak hours and the implementation of a wayside bikeshare system will improve connectivity to other travel modes that will facilitate smoother transfer points and better overall travel trip for low-income households. The improved travel amenities such as attractiveness of on-board Wi-Fi and the new wayside bike system will attract and retain new riders who may choose this transit service rather than drive in the congested corridor, thus serving disadvantaged and low-income communities while reducing traffic congestion.

Project Priorities
As further detailed under the ***Primary Evaluation Criteria***, **Integration with State Rail and Transit Operations**, the EEP is a major priority of Caltrain in pursuit of full electrification and expansion of the corridor between San Francisco and San Jose, and provides the necessary foundation for a major priority of CHSRA's High-Speed Rail Project. CHSRA's 2016 Business Plan notes that extending the initial operating segment of the High-Speed Rail system is only possible with the completion of electrification of Caltrain as High-Speed Rail and Caltrain would share the electrified tracks. Caltrain is in regular coordination with the California High-Speed Rail Authority related to the on-going planning and design efforts for the San Francisco to San Jose Project Section of the California High-Speed Rail system. These efforts have intensified in the last 6 months as the two agencies have begun renewed planning work around the long-range evolution of the Peninsula Corridor. Operational concepts developed through this work have formed the basis for the "cumulative" service scenario discussed in this application.

Similarly, ongoing coordination with TAMC will be of particular importance as TAMC pursues its Salinas Rail Extension to deliver rail service south beyond Gilroy. Full electrification of the Caltrain fleet is a necessary prerequisite for the redeployment of the remaining diesel fleet to support improved Gilroy service and to extend rail service to Salinas. The impacts of the EEP on other regional, interregional, and State transit and rail projects is further discussed under **Section E, Project Impacts.**

Geographic Equity
The EEP seeks to equitably distribute system benefits by implementing Wi-Fi and a wayside bike parking and sharing program along the entire system, and by providing additional capacity between San Francisco and San Jose in response to increased ridership and capacity demands on that segment, ultimately improving service throughout the entire system and distributing benefits to all who access Caltrain. Implementation of a wayside bike parking and sharing program will also improve bike capacity, allowing Caltrain to expand the footprint of riders it serves by allowing more passengers to use bicycles as a mode fitting their first and last mile needs. Caltrain's Short Range Transit Plan (SRTP) underscores Caltrain's Vision to provide an equitable distribution of system benefits throughout the corridor[13]. The SRTP's Goals, Objectives and Standards detail seven focus areas for Caltrain's Vision, with Focus Area 7, Social Responsibility, detailing Caltrain's goal to provide an inclusive and equitable system by striving for an equitable distribution of system benefits and project impacts throughout the corridor.

Consistency with Sustainable Communities' Strategy
MTC has issued a determination that the elements in Caltrain's application are consistent with Plan Bay Area 2040 (PBA 2040), the region's Sustainable Communities Strategy. MTC notes that the potential expansion of Caltrain diesel service to Salinas, outside of the 9-county Bay Area, is not included in PBA 2040. While this consideration is discussed in Caltrain's application, it is not a direct part of the Caltrain funding request and will be the subject of further discussions, planning, and agreements of which MTC will be a part. Beyond the Bay Area, as detailed extensively in the sections above and throughout this application, expansion of the Caltrain Corridor linking San Francisco, San Jose, and Gilroy is a key component of multiple significant interregional and State projects serving Northern California as well as the entire State of California.

Freight Benefits
Caltrain is committed to maintaining freight's existing agreed upon usage of the corridor as identified through planning, agreements and processes developed as part of the planning for PCEP. The EEP does not create any additional benefits or impacts to freight operations.

Non-State Supplemental Funding Commitments
Caltrain's request of $631.5 million in TIRCP funds would specifically be used for the EEP elements identified throughout this application. The realized and future funding commitments for the overall development and modernization of the Peninsula Corridor are currently $2.61 billion (including this request). Of that $2.61 billion, the program includes the leveraging of at least $1.23 billion in local, regional, and federal funds in support of State's commitments.

Caltrain received an executed Full Funding Grant Agreement for a Core Capacity Grant from the Federal Transit Administration (FTA) committing $647 million to PCEP in May 2017. Caltrain has also received FTA formula funding in support of the PCEP in the amount of $331 million. MTC has committed nearly $60 million in regional funding to the PCEP, with the JPB members contributing an additional $193 million. Much of the local and regional funding for the PCEP Expansion project is committed through a regional nine-party agreement (MOU), which includes a State funding partner, signed in late 2012 between the following funding partners:

[13] http://www.caltrain.com/Assets/_Planning/Strategic+Plan/Strategic+Plan+FY2015+-+FY2024/Caltrain+Short+Range+Transit+Plan+-+FY2015-FY2024+-+Final.pdf

- California High-Speed Rail Authority (CHSRA)
- Metropolitan Transpiration Commission (MTC)
- Peninsula Corridor Joint Power Board (PCJPB)
- San Francisco County Transportation Authority (SFCTA)
- San Mateo County Transportation Authority (SMCTA)
- Santa Clara County Transportation Authority (VTA)
- City of San Jose
- City and County of San Francisco
- Transbay Joint Powers Authority (TJPA)

The sources and specific amounts of funding committed to the overall Peninsula Corridor modernization and development program can be found detailed in **Section B, Project Costs & Funding.**

The larger program of long-term development for the Peninsula Corridor will be defined in 2018 through the Caltrain Business Plan. The program will include those infrastructure, fleet, and systems elements necessary to support the State Rail Plan's 2040 Vision, including increased levels of service and connectivity and the introduction of High-Speed Rail service to the corridor. As part of development of the Business Plan, Caltrain will explore the following funding sources and potential revenue options:

- San Mateo Measure A remaining funds for Caltrain and Grade Separations
- Santa Clara Measure B
  - $314 million in support of Caltrain Corridor Capacity Improvements including expansion of ridership capacity, level boarding, and increased train service
  - $700 million in support of Caltrain Grade Separations including separating tracks from roadways; safety improvements for pedestrians, bicyclists, and autos; and reduction of traffic congestion
- Potential future sales tax measures in San Francisco and San Mateo Counties
- Additional funding mechanisms including self-generated revenues, value capture strategies and the potential for new voter approved measures in the 2020 timeframe or beyond.

Multi-Modal Integration

As discussed above in the ***Primary Evaluation Criteria*** **Integration with State Rail and Transit Operations** section, the Caltrain corridor plays a vital role in connecting to other transit services to enhance the mobility of Bay Area residents. The EEP significantly improves existing integration with other modes, including airports, transit, and intercity rail services, by expanding capacity on Caltrain. Caltrain directly connects to the San Francisco International Airport; four rail systems serving the Bay Area and beyond (ACE, Capitol Corridor, Amtrak, and BART); VTA and MUNI light rail in the two biggest cities in the Bay Area; three bus systems serving Santa Clara, San Mateo, and San Francisco Counties as well as longer-distance bus services; and approximately 50 private and public shuttles. Long range plans also include connecting Caltrain to the Salesforce Transit Center (Transbay Terminal) in downtown San Francisco through the Downtown Extension Project, VTA's extension of BART to Silicon Valley, TAMC's Salinas Rail Extension, and California's High-Speed Rail system, which will share Caltrain's tracks as part of the blended system.

Caltrain also has the most extensive bicycle access program among passenger railroads in the nation. Nearly 7,000 passengers a day access the Caltrain system by bicycle, with most of these riders choosing to bring their bike on board the train. The EEP will include implementation of improved wayside bicycle facilities throughout the system to complement Caltrain's program of on-board bike carriage in order for Caltrain to maintain this high rate of cycle usage while simultaneously preserving overall system capacity.

Financial Plan for Expansion of Service

The service levels that have been assumed and quantified in this application are broadly consistent with those analyzed in Caltrain's existing SRTP and in the financial plan it developed to support its full funding grant agreement with FTA for the PCEP. Looking forward, the Caltrain Business Plan is currently under development and is slated for completion at the end of 2018. Through development of the Caltrain Business Plan, Caltrain will develop a transparent and comprehensive framework for the railroad's growth that will ensure state, and all other, funding is used to maximum benefit to support a financially sustainable system. Caltrain kicked off its stakeholder engagement for the Business Plan with an all-day workshop in September of 2017 that included participation by high level staff members from the State, the California High-Speed Rail Authority, Capital Corridor, ACE, BART and TAMC, among others. The work undertaken through Caltrain's Business Plan will support ongoing financial viability of Caltrain.

Estimated Useful Life of Project

The majority of the capital investments in the EEP have a many-decades useful life, with each individual project component having the following useful life:

- Electric Multiple Unit (EMU) train cars have an estimated useful life of 30 years.
- Implementation of a robust wayside bike parking and sharing program also has an ongoing useful life for as long as the infrastructure is maintained. In this case Caltrain is committed to sustaining its initial investment in bike parking in perpetuity alongside its electrified service and the benefits associated to this project element have been tied to the EMU lifecycle.
- Implementation of a broadband communications program including both customer facing Wi-Fi as well as communications systems that support over-the-rail diagnostics and improved fleet maintenance outcomes have an ongoing useful life corresponding to the maintenance of the system. The bulk of the costs assumed in Caltrain's application relate to the installation of initial Wi-Fi equipment. Caltrain is committed to maintaining this equipment and replacing or upgrading it in place to maintain continuity of service. As such the assumed useful life of the initial investment is 15 years.

E. Project Impacts

The Caltrain corridor is the spine of the transportation network on the San Francisco Peninsula and plays a vital role in connecting to other transit services providing mobility to residents throughout the Bay Area. Caltrain directly connects to four existing rail systems serving the Bay Area and Northern California: ACE, Capitol Corridor, Amtrak, and BART. In order to ensure planning of future projects is coordinated among agencies to provide maximum benefit to riders and the overall rail network, Caltrain works closely with these agencies through a variety of different venue,s including at specific stations where services overlap, as well as through more general planning venues including the nascent Northern California "megaregional" planning efforts that the State has taken a lead in organizing. Caltrain has also focused its planning coordination efforts intensively around the San Jose Diridon Station, a critical piece of infrastructure where multiple rail services connect and coordinate.

Caltrain also coordinates regularly with local, regional, and State agencies to support long range planning, including connecting Caltrain to the Salesforce Transit Center (Transbay Terminal) in downtown San Francisco through the Downtown Extension Project, VTA's extension of BART to Silicon Valley, TAMC's Salinas Rail Extension, and California's High-Speed Rail system. A fully electrified Caltrain system fulfills a necessary prerequisite allowing for the development of key portions of the interregional and state rail network. Fully electrifying the Caltrain fleet is a key step in preparing the Peninsula Corridor for blended Caltrain/California High-Speed Rail operations. Similarly, the timely electrification and expansion of the full Caltrain fleet will allow for the potential redeployment of the remaining diesel fleet to support improved Gilroy service and/or interregional connections in coordination with TAMC to extend rail service to Salinas.

Primary Evaluation Criteria

- **Greenhouse Gas Emissions (GHG) Reduction**
  As a necessary precursor to allow for blended Caltrain/California High-Speed Rail operations on the San Jose to San Francisco corridor, Caltrain's EEP will support California High-Speed Rail in achieving significant greenhouse gas reductions throughout the State by operating electrified High-Speed Rail services and reducing vehicle miles travelled. Similarly, as a necessary precursor for replacing Caltrain's existing diesel fleet with electric vehicles in order to redeploy the diesel fleet to TAMC in support of the Salinas Rail Extension, Caltrain's EEP will lay the groundwork for reducing greenhouse gas emissions and vehicle miles travelled in Monterey County.

- **Increase Ridership**
  Extending service to the San Francisco market by way of the Caltrain Corridor is crucial for High-Speed Rail's ridership. Under the medium ridership scenario, the 2016 Business Plan projects ridership to be about 3 million annually in 2025 for the initial operating segment of California High-Speed Rail, with the Central Valley to Silicon Valley line terminating at San Jose's Diridon Station. However, if the Valley to Valley line is extended to San Francisco and Bakersfield, ridership increases to about 5.3 million annually in 2025. Extending the initial operating segment of the California High-Speed Rail system is only possible with the completion of the Caltrain PCEP as High-Speed Rail and Caltrain would share the electrified tracks. Without the electrification project San Jose would remain the northern terminal for high-speed rail and the ridership increase that can be attributed to service to San Francisco would not be realized. As

discussed previously in this application, Caltrain has modeled a higher intensity, 220 train per day schedule that also accommodates High-Speed Rail and is conceptually representative of the level of service an improved corridor could support by 2040.

- **Integration with State Rail and Transit Operations**
  In order to fully realize the greenhouse gas emissions reductions and ridership benefits described above, close coordination between transit and rail agencies operating throughout and beyond Northern California is required. Caltrain is committed to participating in the Northern California "megaregional" planning efforts that are developing under State direction and organization, and Caltrain will continue to coordinate closely with other transit and rail agencies as part of the Business Plan as well as other related planning work, some of which will be funded through this application. Ongoing coordination with the CHSRA and TAMC will be of particular importance as these agencies look to develop service across infrastructure that is shared with Caltrain.

- **Improve Safety**
  The planning and coordination described above to ensure full integration of Caltrain with existing and planned interregional and State rail services will prioritize safety as a key goal for Caltrain's impacts in the region and in the overall regional, interregional, and Statewide rail network.

Secondary Evaluation Criteria

- **Implementation of Sustainable Communities' Strategies**
  As detailed under **Section D, Project Benefits,** MTC's Plan Bay Area 2040 (PBA 2040) details electrification and expansion of Caltrain as fulfilling the region's Key Transportation Strategies, Investments, and Projects in fulfillment of its goal to increasing transit capacity throughout the region's core by connecting jobs and people between San Francisco and Silicon Valley via transit expansion and modernization projects. The Bay Area segment of the California High-Speed Rail Project, including the extension up the shared corridor with Caltrain to San Francisco, is the number 1 ranked project in PBA 2040's Key Transportation Strategies, Investments, and Projects, and is the largest transportation expansion project in "Strategy 3. Expand." The project to extend Caltrain into Downtown San Francisco to the Salesforce Transit Center (Transbay Terminal) is detailed as a vital factor in achieving "Strategy 3. Expand." Expansion of Caltrain's electrified fleet to expand capacity is a necessary precursor to blended service with California High-Speed Rail operatoins. Beyond the Bay Area, and beyond the bounds of PBA 2040, expansion of capacity on the Caltrain Corridor linking San Francisco, San Jose, and Gilroy is a key component of multiple significant interregional and state projects serving Northern California as well as the entire State of California – notably, TAMC's Salinas Rail Extension.

- **Benefits to Disadvantaged Communities, Low-Income Communities, and Low-Income Households**
  - The California High-Speed Rail system will serve 12 disadvantaged and low-income communities throughout the entire Phase 1 corridor, and Caltrain's electrification and expansion will support connecting residents all over the State with job centers in Silicon Valley and the Bay Area. The progressive California High-Speed Rail system is programmed to be interwoven with existing transit networks including Caltrain and the entire State rail, transit, and express bus network. In order to be implemented, California

High-Speed Rail requires the completion of Caltrain's electrification project and track improvements. This collaboration between transit and rail will provide a better quality of service to disadvantaged low-income riders who will benefit from seamless transfer points.

- The Salinas Rail Extension project will extend service beyond Gilroy to serve 3 cities and disadvantaged and/or low-income communities south of Caltrain's Gilroy Station. This proposed passenger rail project is expected to help resolve inadequate transportation options in Monterey County to connect riders from Pajaro, Castroville, and Salinas north to San Jose and San Francisco on Caltrain, and northeast to destinations along the way to and including Sacramento on Capitol Corridor, as well as facilitating a connection to faster service throughout the State on High-Speed Rail.

- **Project Priorities**

  As described more thoroughly under the ***Primary Evaluation Criteria*** discussion, Caltrain is committed to coordinating closely with other transit and rail agencies operating throughout and beyond Northern California. The planning funds requested in this application will support the critical development of plans and policy agreements, including Memoranda of Understanding (MOUs), that ensure that the Caltrain corridor and additional EMUs are used in a way that maximizes their utility and meets the goals and service levels of the statewide rail network identified in the draft 2018 State Rail Plan. This planning would support work related to:

  - The Caltrain Business Plan and the long-term development of the San Francisco Peninsula Corridor
  - Detailed planning for the long-term evolution of passenger rail services between San Jose, Gilroy and connecting to Salinas, in coordination with TAMC
  - Ongoing planning related to capacity expansion and service blending with CHSRA on the Caltrain corridor including planning and design work related to additional infrastructure requirements, a potential new signal system and platform modifications and level boarding
  - Major terminal planning activities in San Francisco and at San Jose Diridon in coordination with ACE, Capitol Corridor, Amtrak, VTA, and eventually BART
  - Planning associated with a potential Dumbarton rail connection at Redwood City, potentially in coordination with Capitol Corridor to fully realize the benefits of their station and routing relocation at an improved Ardenwood Intermodal Station on the Alameda County side of the Dumbarton corridor, as well as with ACE.
  - Planning activities supporting the coordination and integration of Caltrain ticketing and fare payment systems with state standards and program.

- **Geographic Equity**

  Caltrain's EEP will extend access to Silicon Valley beyond the Bay Area through support of interregional and state projects to extend and integrate future planned rail services. Increasing Caltrain's capacity and providing additional amenities such as Wi-Fi and increased bike access will also provide benefits to a wide-reaching range of riders.

- **Consistency with Sustainable Communities' Strategy**

  MTC has issued a determination that the elements in Caltrain's application are consistent with Plan Bay Area 2040 (PBA 2040), the region's Sustainable Communities Strategy. MTC notes

that the potential expansion of Caltrain diesel service to Salinas, outside of the 9-county Bay Area, is not included in PBA 2040. While this consideration is discussed in Caltrain's application, it is not a direct part of the Caltrain funding request and will be the subject of further discussions, planning and agreements of which MTC will be a part.

Beyond the Bay Area, as detailed extensively in the sections above and throughout this application, expansion of the Caltrain Corridor linking San Francisco, San Jose, and Gilroy is a key component of multiple significant interregional and state projects serving Northern California as well as the entire State of California. As a necessary precursor to High-Speed Rail on the shared corridor between San Francisco and San Jose, the EEP is also consistent with PBA 2040's designation of the Bay Area segment of the California High-Speed Rail Project, including the extension up the shared corridor with Caltrain to San Francisco, as the largest and number 1 ranked project under Key Transportation Strategies, Investments, and Projects. Beyond the Bay Area, and beyond the bounds of PBA 2040, as detailed extensively throughout this application, expansion of capacity on the Caltrain Corridor linking San Francisco, San Jose, and Gilroy is a key component of multiple significant interregional and state projects serving Northern California as well as the entire State of California – notably TAMC's Salinas Rail Extension.

- **Freight Benefits**
  Caltrain is committed to maintaining freight's existing agreed upon usage of the corridor as identified through planning, agreements and processes developed as part of the planning for PCEP. The EEP does not create any additional benefits or impacts to freight operations.

- **Non-State Supplemental Funding Commitments**
  Caltrain's electrification project has numerous non-state supplemental funding commitments, as described further in **Section B, Project Costs and Funding**, and **Section D, Project Benefits**, though those commitments have relatively little to no impact on other planned or underway projects. However, funding of the planning activities requested in this application will have a significant positive impact on coordination with other transit and rail agency's planned or underway projects, which will support positioning Caltrain and its partner's projects in obtaining funding from non-state sources.

- **Multi-Modal Integration**
  As detailed further in **Section D, Project Benefits**, Caltrain directly connects to an airport and multiple bus, transit and intercity rail services, all of which will be positively impacted by the EEP significantly expanding capacity on Caltrain. Caltrain directly connects to the San Francisco International Airport; four rail systems serving the Bay Area and beyond (ACE, Capitol Corridor, Amtrak, and BART); VTA and MUNI light rail in the two biggest cities in the Bay Area; three bus systems serving Santa Clara, San Mateo, and San Francisco Counties as well as longer-distance bus services; and approximately 50 private and public shuttles. Long-range plans also include connecting Caltrain to the Salesforce Transit Center (Transbay Terminal) in downtown San Francisco through the Downtown Extension Project, VTA's extension of BART to Silicon Valley, TAMC's Salinas Rail Extension, and California's High-Speed Rail system, which will share Caltrain's tracks as part of the blended system. Additionally, Caltrain has the most extensive bicycle access program among passenger railroads in the nation, and existing on-board

bicycle accommodations and overall capacity will be enhanced by the implementation of a wayside bike parking and sharing system.

- **Financial Plan for Expansion of Service**
  A financial plan for expansion of Caltrain service as it relates to other planned or underway projects is not yet necessary as the need for partnered projects and their operating funds have not been identified, though should that need arise Caltrain will approach development of any required financial plans through work in developing the Caltrain Business Plan.

F. Disadvantaged Communities, Low-Income Communities, and Low-Income Households

AB 1550 and SB 535 Populations

The Caltrain corridor, and therefore the projects funded through this application, serve AB 1550 communities according to the CARB Funding Guidelines following three criteria which evaluate benefits to those communities:

1A. The project is at least partially located within the boundaries of a disadvantaged community census tract.

1B. The project is at least partially located within the boundaries of a low-income community census tract.

1C. The project is located outside of a disadvantaged community but within ½ mile of a disadvantaged community and within a low-income community census tract.

1A: Disadvantaged Communities

The Caltrain corridor has 4 stations located in disadvantaged communities. Their locations are noted below with their census tract numbers:

- South San Francisco, San Francisco – 6081602300
- San Bruno, San Bruno – 6081604200
- Tamien, San Jose – 6085503113
- Gilroy, Gilroy – 6085512603

1B: Low-Income Communities

Caltrain has 10 stations located in low-income communities. Their locations are noted below with their census tract numbers:

- South San Francisco, San Francisco – 6081602300
- San Bruno, San Bruno – 6081604200
- Millbrae, Millbrae – 6081604400
- Burlingame, Burlingame – 6081605500
- San Mateo, San Mateo – 6081606300
- Redwood City, Redwood City – 6081610202
- Tamien, San Jose – 6085503113
- Capitol, San Jose – 6085503204
- Morgan Hill, Morgan Hill – 6085512314
- Gilroy, Gilroy – 6085512603

1C: Low-Income Communities Adjacent to Disadvantaged Communities

Additionally, Caltrain has 2 stations located within low-income communities and within half a mile of disadvantaged communities. Their locations are noted below with their census tract numbers:

- Redwood City, Redwood City – 6081610202
- Morgan Hill, Morgan Hill – 6085512314

Table 5 details Caltrain stations that are located within or adjacent to disadvantaged and/or low-income communities, along with those disadvantaged and/or low-income communities that are served by connecting shuttle service or other public transportation options to the Caltrain corridor.

Table 5: Caltrain Stations Serving Disadvantaged & Low-Income Communities

Station	Criteria 1A	Criteria 1B	Criteria 1C	Served by Caltrain/SamTrans/ CCAG/SMCTA	Census Tract
San Francisco to San Jose (Tamien)					
Bayshore	-	-	-	✓	6075061000
South San Francisco	✓	✓	-	✓	6081602300
San Bruno	✓	✓	-	✓	6081604200
Millbrae	-	✓	-	-	6081604400
Broadway *(Weekend Only)*	-	-	-	✓	6081605100
Burlingame	-	✓	-	-	6081605500
San Mateo	-	✓	-	✓	6081606300
Redwood City	-	✓	✓	✓	6081610202
Palo Alto	-	-	-	✓	6085511609
California Avenue	-	-	-	✓	6081605100
Lawrence	-	-	-	✓	6085508704
Santa Clara	-	-	-	✓	6085511302
San Jose Diridon	-	-	-	✓	6085500300
Tamien	✓	✓	-	✓	6085503113
San Jose (Tamien) to Gilroy					
Capitol	-	✓	-	-	6085503204
Morgan Hill	-	✓	✓	-	6085512314
Gilroy	✓	✓	-	-	6085512603

Addresses Important Need for a Community or Household

The EEP will result in scaling down the levels of pollution that communities disproportionately suffer and provide a benefit that reduces vulnerability to affected communities. Currently, 12 stations are heavily impacted by diesel emissions, falling at or above the 75th percentile in the State (according to CalEnviroScreen 3.0). Of those 12 stations 11 of them will experience lower diesel pollution impacts due to the replacement of diesel trains with electrical trains along the San Francisco to San Jose corridor. Consequently, this is equivalent to more than 42 percent of the stations along the expansion of the project and 38 percent of the stations within the entire corridor experiencing heavy impacts by diesel emissions. On average, the Caltrain corridor from San Francisco to San Jose falls into the 68th percentile of diesel emissions in the state.

The EEP will also reduce pollution as a result of increasing ridership and reducing traffic congestion. The San Francisco Peninsula and Silicon Valley currently have the highest levels of diesel pollution in the entire Caltrain corridor. This contributes to significant levels of traffic congestion in San Francisco and South of San Jose. Of the 31 existing Caltrain stations, 11 stations are located in areas where traffic

pollution impacts are in the 75th percentile for the state and of those 11 stations, 10 of them will achieve improved levels of traffic congestion. Finally, 2 of the 3 stations along this corridor that have communities that significantly suffer from asthma, which is often triggered by environmental factors such as outdoor air pollution from significant automobile traffic, will see a benefit in the reduction of emissions.

Project Benefits

The EEP provides substantial project benefits to disadvantaged and low-income communities. The Project provides improved passenger rail service in the form of greater capacity and improved accessibility for 10 stations within AB 1550 communities, with 7 of those stations along the San Francisco to San Jose service corridor experiencing a major increase in service capacity with the increase of additional train cars serving their stops. The EEP also improves connectivity between travel modes, notably bicycles, and provides increased access to shared-mobility transportation options along the entire corridor and to the 10 AB 1550 communities served, by implementing a wayside bike share system, in addition to the significant bicycle accommodations currently made on-board Caltrain's trains. Finally, the EEP improves existing service and infrastructure between San Francisco and San Jose by replacing diesel vehicles, which result in higher emissions of pollutants, with electric vehicles, resulting in a significant reduction of air pollution for the 10 stations that have the highest diesel pollution level in the project segment.

G. Project Implementation

The projects included in Caltrain's EEP application can be incorporated into existing electrification contracts, and will be overseen as a part of the overall PCEP. Element details include:

Capacity Expansion:
The project elements included within the "Capacity Expansion" section of Caltrain's application are ready to move forward as soon as funding is received.

- Procurement of 40 EMUs: The PCEP project delivery team will begin work to exercise additional EMU options from JPB's contract with Stadler.
- Platform Lengthening: Caltrain's engineering department will proceed with design and necessary approvals and/or environmental activities related to platform extensions.
- Bike Parking: Caltrain is in the process of hiring a bike access manager, who will be tasked with implementing Caltrain's wayside bike facilities and programs.
- Plans and agreements: Caltrain planning will immediately use available funding to support the Business Plan and other near-term planning activities.

System Enhancement
The project elements included within the "System Enhancement" section of Caltrain's application are also ready to move forward as soon as funding is received.

- Installation of Broadband Communications System: With receipt of funding, Caltrain will amend the installation of wayside broadband communications equipment into the existing, ongoing electrification contract.

Mainline Fleet Conversion:
Mainline fleet conversion can be accomplished by Caltrain executing its remaining contract capacity with Stadler for the final 56 EMUs.

Change orders and risk management will be covered by existing policies and procedures implemented in support of PCEP.

H. Project Readiness

The projects included in Caltrain's EEP application are ready to move forward on the following timeline pending funding:

Capacity Expansion:
With assumed receipt of funding in mid-2018, project activities are anticipated to proceed as follows:

- Procurement of 40 EMUs: The PCEP project delivery team will issue Notice to Proceed (NTP) prior to February of 2019.
- Platform Lengthening: Caltrain's engineering department will conduct design and necessary approvals and/or environmental activities in 2018 and 2019 and would proceed to bid award and construction prior to 2020.
- Bike Parking: Caltrain is in the process of hiring a bike access manager, and in 2018 this individual will be tasked with implementing Caltrain's wayside bike facilities and programs with a target to have all improved facilities operational by 2022.
- Plans and agreements: Caltrain planning will immediately use available funding to support the Business Plan and other near-term planning activities, which will continue through 2022.

System Enhancement
With assumed receipt of funding in mid-2018, project activities are anticipated to proceed as follows:

- Installation of Broadband Communications System: The goal is to amend an existing contract in late 2018 and 2019. This will allow for equipment to be installed in an efficient and cost-effective manner as part of the construction of the electrified system. Following the installation of equipment Caltrain will begin testing and demonstration and will be ready for revenue service in 2022.

Mainline Fleet Conversion:
Mainline fleet conversion will require additional planning work prior to implementation. Specifically, Caltrain intends to address the following issues prior to executing additional EMU options with Stadler;

- Completion of the Caltrain Business Plan including definition of future fleet requirements, use and configuration
- Development of a defined plan and commitment to develop an incremental storage and maintenance facility sufficient to support the expanded electrified fleet as well as the potential to support shared use by other state or interregional rail operators.
- Agreement around the redeployment of diesel fleet to support the expansion of service between San Jose and Gilroy as well as the development of connecting service to Salinas in coordination with TAMC.

Following the completion of these activities Caltrain anticipates executing its remaining contract capacity with Stadler for the final 56 EMUs and issuing notices to proceed by 2021.

Environmental Clearance
The PCEP, including acquisition of vehicles, received State CEQA environmental certification on January 8, 2015. TAMC's Salinas Rail Extension State CEQA Environmental Impact Report was certified in 2006. Caltrain will address additional minor environmental clearance issues related to platform extensions as part of its capital project implementation process.

Partner Agreements

Much of the funding for the PCEP is committed from Federal funds as well as local, regional, and State funds committed through an existing regional nine-party agreement (MOU) between the following funding partners:

- California High-Speed Rail Authority (CHSRA)
- Metropolitan Transpiration Commission (MTC)
- Peninsula Corridor Joint Power Board (PCJPB)
- San Francisco County Transportation Authority (SFCTA)
- San Mateo County Transportation Authority (SMCTA)
- Santa Clara County Transportation Authority (VTA)
- City of San Jose
- City and County of San Francisco
- Transbay Joint Powers Authority (TJPA)

JPB will continue to coordinate with CAHSR to enter into future agreements to allow for the orderly and timely deployment of blended service on the Peninsula Corridor.

JPB will coordinate with relevant cities for wayside bike parking and bike share system, and enter into agreements as applicable for specific improvements for specific stations.

JPB will coordinate with TAMC on any agreements/MOU needed for a potential extension of rail service to Salinas. As this service would be outside of JPB's current service area, it is likely that the planning would be significant and could involve policy discussions surrounding whether to expand Caltrain's service area or become a "contract" operator as well as the resolution of other outstanding operations and labor issues.

Planning funds will support development of the above described MOUs.

STATEMENT OF WORK

i. Project Scope: Peninsula Corridor Electrification Expansion Project (EEP)

Project Tasks

Caltrain is primarily applying for funding to exercise its remaining options under the agency's contract with Stadler and purchase an additional 96 Electric Multiple Unit (EMU) train cars. When fully deployed, these cars, along with the base EMU order under PCEP, will allow Caltrain to operate a completely electrified mainline fleet of 192 EMU vehicles configured in consists of up to 8-cars in length. Full electrification of Caltrain's mainline fleet yields multiple significant benefits including:

- Reduced GHG emissions resulting from the cessation of mainline diesel operations
- Increased flexibility to operate more attractive service and increase ridership to address increasing capacity demands
- The ability to support the development of state and interregional services including;
    - Fulfilling a necessary precursor to allow for blended Caltrain/California High-Speed Rail operations on the San Jose to San Francisco corridor
    - Allowing for the possible redeployment of Caltrain's diesel fleet to potentially expand service to Gilroy and potentially operate an inter-regional San Jose to Salinas service in coordination with TAMC

Caltrain has organized its request for EEP funding into a series of elements that each deliver independent benefit. These include:

1. **EEP Elements to Increase Capacity:** Work on these project elements can begin immediately and benefits will be tied to the 2022 timeframe along with the start of PCEP revenue service, slated for 2022. These project elements are necessary to support the expanded ridership demand that the electrified system is anticipated to generate. They include:
    a. Exercising options on the JPB's existing contract with Stadler for the procurement of 40 additional EMUs to increase capacity of the electrified system by expanding 6-car EMU sets already under procurement to 8-car sets. Exercising these options by early 2019 will allow the PCEP to begin service with 17, 8-car EMU trainsets.
    b. Funding for limited platform modifications (lengthening) to support the operation of 8-car trains. More complex platform modifications, including pursuit of level boarding, will be analyzed as part of the planning work described below. These improvements require significant additional analysis and are not part of this application for funding. During the interim period, 8-car consists can be addressed through operational practices at platform locations where modifications are challenging.
    c. Implementation of improved wayside bicycle facilities throughout the system to complement Caltrain's program of on-board bike carriage and reduce further degradation of Caltrain's onboard seated capacity. Caltrain will seek to enhance ridership and safeguard capacity on the electrified system by implementing a robust wayside bike parking program as defined through its recently adopted "Bicycle Parking Management Plan."[14] Nearly 7,000 passengers a day access the Caltrain system by bicycle, with most of these riders choosing to bring their

[14] http://www.caltrain.com/Assets/_Planning/Bicycle+Access+and+Parking+Plan/Bicycle+Parking+Management+Plan+-+Final.pdf

bike on board the train. In order for Caltrain to maintain this high rate of cycle usage while also preserving overall system capacity, it is essential that the agency provide a viable system of bike parking amenities at its stations as an attractive supplement and alternative to having passengers bring their bike on board the train with them.

d. Planning funds equivalent to 1 percent of the total EMU cost estimate to support the critical development of plans and policy agreements that ensure that the Caltrain corridor and additional EMUs are used in a way that maximizes their utility and meets the goals and service levels identified in the draft 2018 State Rail Plan. This planning would support work related to:
    - The Caltrain Business Plan and the long-term development of the Peninsula Corridor
    - Planning for storage and maintenance needs related to the expansion of the electrified fleet
    - Detailed planning for the long-term evolution of passenger rail services between San Jose, Gilroy and connecting to Salinas, in coordination with TAMC
    - Ongoing planning related to service blending and capacity expansion with California High-Speed Rail on the Caltrain corridor, including planning and design work related to additional infrastructure requirements, a potential new signal system and additional platform modifications and level boarding
    - Significant terminal planning activities in San Francisco and at San Jose Diridon
    - Planning associated with a potential Dumbarton rail connection at Redwood City
    - Planning activities supporting the coordination and integration of Caltrain ticketing and fare payment systems with state standards and programs

2. **EEP Elements to Improve the System:** Caltrain is also seeking to enhance ridership and support the experience of its customers. Work on this element will begin immediately and will deliver benefits starting in 2022. This EEP element includes implementation of a broadband communications program that will include both customer facing Wi-Fi as well as communications systems that support over-the-rail diagnostics and improved fleet maintenance outcomes. This system will be installed in conjunction with the PCEP program and will become operational in 2022 when the electrified system begins revenue service.

3. **EEP Elements to Fully Convert the Mainline Diesel Fleet:** This group of EEP components is required to fully convert the Caltrain mainline fleet to an all-EMU service. These project elements can begin procurement later (in 2021 or 2022) and will deliver benefits by 2027 (at the latest). Minimally, the full conversion of the mainline diesel fleet will deliver GHG and secondary air quality benefits related to the cessation of diesel operations on the main line. These benefits are quantified in Caltrain's application through CARB's Calculator Tool for TIRCP. The full conversion of the mainline fleet also provides a range of secondary benefits and opportunities as described throughout the application. Project elements include;
    a. Exercising of remaining options on the JPB's contract with Stadler for the procurement of 56 additional EMUs to fully convert the mainline diesel fleet and complete the fleet of 192 EMUs. When complete, this procurement will yield a total EMU fleet size equivalent to 24, 8-car EMU sets.
    b. As noted elsewhere in the application, Caltrain will need to modify its existing storage and maintenance facilities to accommodate a 192 vehicle EMU fleet. Caltrain acknowledges this issue and is applying for planning funds that will support the complex analysis and

agreements that will be required to achieve a resolution on the long-term configuration of storage and maintenance facilities for the corridor. Key issues that impact storage and maintenance requirements and must still be decided include:

- The ultimate configuration of the Caltrain 192 EMU fleet and the timing of deployment activities
- Decisions and timing related to the decommissioning and/or redeployment of the diesel fleet
- Decisions related to the potential for sharing future maintenance facilities with California High-Speed Rail or other rail operators
- Ongoing terminal planning at both Salesforce Transit Center/4th & King in San Francisco and San Jose Diridon as these plans relate to current Caltrain storage and maintenance facilities at 4th & King and the Central Equipment Maintenance & Operations Facility (CEMOF)

Project Deliverables

The deliverables for this grant request include:

- An additional 96 EMUs, broken into procurements of 40 and then 56
- Design and implementation of platform modifications
- Improved wayside bicycle facilities
- Planning and Agreement support
- Implementation of a broadband communications program, including customer facing Wi-Fi

Project Milestones

Table 1: Electrification Expansion Project Milestones & Schedule

Milestone Number	Milestone Description	Start Work Date	Completion
Capacity Improvements			
1.1	Procure initial 40 EMUs to achieve conversion of 17, 6-car EMU consists to 17, 8-car consists	FY19	FY2022
1.2	Minor modification of platforms	FY19	FY2022
1.3	Implementation of wayside Bike Parking Program	FY19	FY19-FY22
1.4	Planning and policy support	FY19-FY22	FY19-FY22
System Enhancements			
2.2	Implementation of Broadband communication system	FY19	FY2022
Full Fleet Conversion			
3.1	Additional 56 EMUs to achieve conversion of remaining mainline diesel fleet to 8-car diesel consists	FY2021	FY2027*

Project Location

A project location map noting the project limits can be found at the right, and KML file maps are included as **Attachment G**. Close-up maps of the stations serving disadvantaged and low-income communities can be found in **Attachment E**. Below is a list of the disadvantaged and low-income stations benefitted by the project, listing their specific zip codes organized by county.

- San Mateo County
  - South San Francisco – 94080
  - San Bruno, San Bruno – 94066
  - Millbrae, Millbrae – 94010
  - Burlingame, Burlingame – 94010
  - San Mateo, San Mateo – 94401
  - Redwood City, Redwood City – 94063
- Santa Clara County
  - Tamien, San Jose – 95110
  - Capitol, San Jose – 95111
  - Morgan Hill, Morgan Hill – 95037
  - Gilroy, Gilroy – 95020

The Caltrain corridor's 4 stations located in disadvantaged communities and their census tract numbers are:

- South San Francisco, San Francisco – 6081602300
- San Bruno, San Bruno – 6081604200
- Tamien, San Jose – 6085503113
- Gilroy, Gilroy – 6085512603

Caltrain's 10 stations located in low-income communities and their census tract numbers are:

- South San Francisco, San Francisco – 6081602300
- San Bruno, San Bruno – 6081604200
- Millbrae, Millbrae – 6081604400
- Burlingame, Burlingame – 6081605500
- San Mateo, San Mateo – 6081606300
- Redwood City, Redwood City – 6081610202
- Tamien, San Jose – 6085503113
- Capitol, San Jose – 6085503204
- Morgan Hill, Morgan Hill – 6085512314
- Gilroy, Gilroy – 6085512603

Caltrain's 2 stations located within low-income communities and within half a mile of disadvantaged communities and their census tract numbers are:

- Redwood City, Redwood City – 6081610202
- Morgan Hill, Morgan Hill – 6085512314

ii. Project Costs

The total capital cost of the PCEP, which is underway, is $2 billion. This includes the procurement of 96 initial EMUs, the infrastructure (poles/wires) design build contract, contingency, and owner's costs such as program management, project management, and engineering oversight. The EEP for the expansion of the fleet and associated improvements is $631.5 million. The total combined costs for these foundational elements in a larger program of corridor modernization and development is $2.61 billion. Leveraged funding from other Federal, State, and Regional/Local sources can be found in **Table 3**. The JPB is requesting $631.5 million in TIRCP funds to support the EEP as described in **Table 2** below.

Table 2: EEP TIRCP Elements Project Costs (in Thousands)

Project Element	Cost
Capacity Improvements	
Procurement of 40 Electric Multiple Units (EMUs)	$224,700
Minor Platform Modifications	$8,000
Wayside Bike Parking Improvements	$3,500
Planning and Agreement Support	$6,000
Subtotal	**$242,200**
System Enhancements	
Broadband Communications	$14,000
Subtotal	**$14,000**
Full Fleet Conversion	
Procurement of 56 Electric Multiple Units (EMUs)	$375,300
Subtotal	**$375,300**
TOTAL	**$631,500**

Table 3: PCEP & Electrification Expansion Leveraging Funding (in Thousands)

Funding Sources	Initial PCEP	Current EEP	Total
FEDERAL			
FTA Formula Funding	$330,677		$330,677
Section 5309 Core Capacity	$647,000		$647,000
STATE: Greenhouse Gas Reduction Funds			
Transit and Intercity Rail Capital Program (TIRCP)	$20,000	$631,500	$651,500
Low Carbon Transit Operations Program (LCTOP)	$9,000		$9,000
STATE: Non-Greenhouse Gas Reduction Funds			
Proposition 1B PTMISEA	$8,000		$8000
Proposition 1A and High-Speed Rail Non-Prop 1A	$713,000		$713,000
REGIONAL/LOCAL			
Carl Moyer Program	$20,000		$20,000
MTC Bridge Tolls	$39,430		$39,430
JPB Members	$193,145		$193,145
Total by Project	**$1,980,252**	**$631,500**	**$2,611,752**

Benefits

The direct benefits of the EEP and supporting activities in this application include:

- **Increased Ridership –** Capacity improvements related to the expanded EMU fleet and wayside bicycle program will allow Caltrain to support increases in projected future ridership levels and further reduce greenhouse gas emissions. Similarly, overall ridership growth will be supported by implementation on-board Wi-Fi.
- **Improved Regional Air Quality and Reduced Greenhouse Gas Emissions –** Electrified trains produce substantially less air pollution compared with diesel trains, even when the indirect emissions from electrical power generation are included. The reduction of greenhouse gas emissions is not only good for regional air quality, but will also help meet the State's emission reduction goals. It is projected that there will a reduction of 1.2 million metric tons of greenhouse gas due to this project.
- **Benefits Disadvantaged and Low-Income Communities** – The Project provides improved passenger rail service in the form of greater capacity and improved accessibility for 10 stations within AB 1550 communities along the Caltrain corridor, who will also benefit from improved connectivity between travel modes, notably bicycles, with implementation of a wayside bike share system, complementing the significant bicycle accommodations currently made on-board Caltrain's trains. In addition to a major increase in service capacity with the increase of additional train cars serving the corridor, 7 stations within AB 1550 communities and 10 stations scoring at or above the 75th percentile level in the state in pollutants between San Francisco and San Jose Diridon will benefit from a significant reduction in the levels of diesel exhaust emissions with full electrification of Caltrain's fleet.
- **Safety –** While this benefit is not quantified through the CARB Calculator Tool for TIRCP, the implementation of broadband service and associated systems will do more than just provide customer facing Wi-Fi. Broadband communications will also increase safety and decrease maintenance costs for the railroad.

Cumulative Benefits

Realization of these benefits is contingent on the outcome of additional planning and policy work as well as potential supplemental investments in the corridor and as such they have not been explicitly quantified as part of this application. Cumulative benefits include:

- **Increased Service and Increased Ridership –** Electrified trains can accelerate and decelerate more quickly than diesel-powered trains, allowing Caltrain to run more efficiently. In addition, because of their performance advantages, electrified trains will enable more frequent and/or faster train service to more riders.
- **Coordinated Interregional and State Rail Service –** A fully electrified Caltrain system fulfills a necessary prerequisite allowing for the development of key portions of the interregional and state rail network. Fully electrifying the Caltrain fleet is a key step in preparing the Peninsula Corridor for blended Caltrain/California High-Speed Rail operations. Similarly, the timely expansion of the full Caltrain fleet will allow for the potential redeployment of the remaining diesel fleet to support improved Gilroy service and/or interregional connections in coordination with TAMC to extend rail service to Salinas.

iii. Project Schedule

Table 4: EEP Milestones & Schedule

Milestone Number	Milestone Description	Start Work Date	Completion
Capacity Improvements			
1.1	Procure initial 40 EMUs to achieve conversion of 17, 6-car EMU consists to 17, 8-car consists	FY19	FY2022
1.2	Minor modification of platforms	FY19	FY2022
1.3	Implementation of wayside Bike Parking Program	FY19	FY19-FY22
1.4	Planning and policy support	FY19-FY22	FY19-FY22
System Enhancements			
2.2	Implementation of Broadband communication system	FY19	FY2022
Full Fleet Conversion			
3.1	Additional 56 EMUs to achieve conversion of remaining mainline diesel fleet to 8-car diesel consists	FY2021	FY2027*

iv. Funding Sources

Caltrain received an executed Full Funding Grant Agreement for a Core Capacity Grant from the Federal Transit Administration (FTA) committing $647 million to PCEP in May 2017. The PCEP received a project rating of Medium High. Of the $647 million, an appropriation of $72.9 million from prior year budgets (FY14-FY16) and another $100 million in FY17 are currently available to the project.

In addition to the Core Capacity funding, over $1 billion in local, regional, and state funding for the PCEP is committed through a regional nine-party agreement (MOU) signed in late 2012 between the following funding partners:

- California High-Speed Rail Authority (CHSRA)
- Metropolitan Transpiration Commission (MTC)

- Peninsula Corridor Joint Power Board (PCJPB)
- San Francisco County Transportation Authority (SFCTA)
- San Mateo County Transportation Authority (SMCTA)
- Santa Clara County Transportation Authority (VTA)
- City of San Jose
- City and County of San Francisco
- Transbay Joint Powers Authority (TJPA)

The MOU is the result of a collaborative effort between the CHSRA, MTC, and San Francisco Bay Area local agencies to identify early investment projects along existing rail corridors that improve service, safety, and efficiency, and create linkages between the state high-speed rail system and local passenger rail service. A copy of the MOU is available upon request.

To supplement the original funds committed in the 9-Party Regional Funding MOU, additional fund sources were committed by seven of the funding partners to help fully fund the PCEP. The JPB received $113 million from CHSRA, and a total of $98 million from the JPB member agencies and MTC. These additional fund sources were committed in August 2016 through a supplemental agreement to the MOU (seven party supplemental MOU). Part of the additional funding included leveraging $9 million Low Carbon Transportation Operations (LCTOP) formula funds allocated to the JPB.

A Project Programming Request (PPR) form listing Federal, State, local and regional funding sources by fiscal year can be found in **Attachment H**.

v. Scalable Project Elements

The EEP has discrete elements that could be undertaken as standalone projects. Separating them is not without consequences, of course. The sequencing is listed below with a brief discussion of the benefits and challenges of separating components:

1. Capacity Improvements
   - **a. 40 EMUs with minor platform modifications**
     Benefits: Allows Caltrain to leverage the near-term opportunity to purchase additional trains under the existing EMU contract.
     Challenges: Implementation of component 1 without 2 means Caltrain will run mixed electric and diesel fleet, continuing to result in greenhouse gas (GHG) emissions; neglects to support realization of full potential of long-term planning efforts to support viability of Caltrain and regional, interregional, and State rail network addressed by project component 3; risks not meeting capacity demands and ridership benefits addressed by project components 4-5.
   - **b. Wayside Bike Improvements**
     Benefits: In addition to benefits described under components 1-4 above to significantly reduce GHGs, supports full capitalization of ridership benefits and addresses capacity demands.
     Challenges: None.

c. Planning and Agreement Support
Benefits: In addition to benefits described under components 1 and 2 above to significantly reduce GHGs, supports realization of full potential of long-term planning efforts to support viability of Caltrain and regional, interregional, and State rail network.
Challenges: Implementing components 1-3 only risks not capitalizing on full ridership benefits and addressing capacity demands achieved by project components 4-5.

2. System Enhancements

a. Broadband communications
Benefits: In addition to benefits described under components 1-3 above to significantly reduce GHGs, supports capitalization of ridership benefits and addresses capacity demands.
Challenges: None.

3. Full Fleet Conversion

a. **56 EMUs (assumes platform modifications occur during first sequence)**
Benefits: Allows Caltrain to leverage the near-term opportunity to purchase additional trains under the existing EMU contract; fully electrifies Caltrain fleet resulting in significant GHG reduction.
Challenges: Implementing components 1 and 2 only neglects to support realization of full potential of long-term planning efforts to support viability of Caltrain and regional, interregional, and State rail network addressed by project component 3; risks not meeting capacity demands and full ridership benefits achieved by project components 4-5.

ATTACHED SUPPORT DOCUMENTATION

A. Cost Estimate Certification
Copy of Cover Letter certifying cost estimates

B. Letters of Support

- Project Partners
  - ✓ California High-Speed Rail Authority (CHSRA)
  - ✓ San Francisco County Transportation Authority (SFCTA)
- Metropolitan Planning Organization (MPO) Letter of Concurrence
  - ✓ Metropolitan Transportation Commission (MTC)
- Regional Agencies
  - ✓ Capitol Corridor Joint Powers Authority (CCJPA)
  - ✓ Transbay Joint Powers Authority (TJPA)
  - ✓ Transportation Agency for Monterey County (TAMC)

C. CARB Calculator Tool for CalSTA's TIRCP Greenhouse Gas (GHG) Reduction Fund FY18-19

D. Caltrain Business Plan Materials

E. Disadvantaged and Low-Income Community Maps

F. Ridership Documentation

G. Project Maps (KML Files)

H. Project Programming Request (PPR) Form

Attachment A.

Cost Estimate Certification

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JIM HARTNETT
EXECUTIVE DIRECTOR

January 12, 2018

Ezequiel Castro, Acting Chief
Division of Rail and Mass Transportation
Office of State Transit Programs and Plans (MS 39)
P.O. Box 942874
Sacramento, CA 94274-0001

Subject: 2018 Transit and Intercity Rail Capital Program Application for Peninsula Corridor Electrification Expansion

Dear Mr. Castro,

The Peninsula Corridor Joint Powers Board (JPB/Caltrain) is pleased to submit the enclosed application for the 2018 Transit and Intercity Rail Capital Program (TIRCP). The JPB requests $631.5 million for the Peninsula Corridor Electrification Expansion Project (EEP).

The TIRCP grant funds will contribute to maximizing the benefits of Caltrain's current electrification project, the Peninsula Corridor Electrification Project (PCEP), which is a fully funded and under construction. PCEP provides a transformational foundation on which the future evolution of the Peninsula Corridor will be built. PCEP will replace 75 percent of the existing diesel fleet with electric trains (EMUs) and will install the electrification infrastructure necessary to support their operation. The EEP, as outlined within this grant application, includes procurement of an additional 96 EMUs, supporting the TIRCP program's goals by completely eliminating diesel powered passenger service from Caltrain's mainline and increasing capacity of the system to accommodate regional growth. EEP also achieves a key goal of the draft 2018 State Rail Plan: full electrification of Caltrain. This grant request leverages Caltrain's ability to take advantage of the near-term opportunity to grow service by purchasing additional EMUs under the existing PCEP EMU contract and, provides strong links to ongoing planning work on regional, interregional, and statewide rail planning. This is a unique and important opportunity for Caltrain to leverage ongoing investments in a way that maximizes near-term benefits and creates the potential for Caltrain to be a key part of a future, fully integrated statewide rail network.

Specifically, this grant request supports full electrification and expansion of the Caltrain fleet, modification of platforms, creation of critical new ridership enhancements, and advancement of planning efforts key to development of the Caltrain Business Plan, which supports the future vitality of the Peninsula Corridor. Full conversion and expansion of Caltrain's mainline fleet from diesel to electric trains will increase system-wide ridership in order to further reduce greenhouse gas emissions and aid in improving regional air quality. The planning efforts included in this application emphasize the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's long term growth in a way that supports regional needs and the service and connectivity goals of the draft 2018 State Rail Plan.

The Project will also fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor: extension of High-Speed Rail Service to the Salesforce Transit Center in San Francisco. Finally, conversion of mainline operations to all-electric service will free up Caltrain's limited remaining diesel fleet for deployment to support increased service to Gilroy and support extending passenger rail service south to Salinas.

Please consider this letter a certification that I have approved the cost estimates used in the JPB's application.

Sincerely,

Jim Hartnett
Executive Director

Attachment B.

Letters of Support and Concurrence

Caltrain has included the following letters of concurrence and support as part of its application:

- The Metropolitan Transportation Commission (letter of SCS concurrence)
- Congresswoman Jackie Speier
- Representative Anna Eshoo
- Caltrain's State Legislative Delegation
    - Senator Jerry Hill, 13th District
    - Senator Jim Beall, 15th District
    - Senator Scott Wiener, 11th District
    - Senator Bob Wieckowski, 10th District
    - Assemblymember Phil Ting, 19th District
    - Assemblymember Marc Berman, 24th District
    - Assemblymember Evan Low, 28th District
    - Assemblymember David Chiu, 17th District
    - Assemblymember Kansen Chu, 25th District
    - Assemblymember Kevin Mullin, 22nd District
    - Assemblymember Ash Karla, 27th District
- California High Speed Rail Authority
- Santa Clara Valley Transportation Authority
- City and County of San Francisco
- San Francisco County Transportation Agency

- Transportation Agency for Monterey County
- San Mateo County Transportation Authority
- Bay Area Council
- City of San Jose
- Capitol Corridor Joint Powers Authority
- Transbay Joint Powers Authority
- Commute.org
- San Mateo County Economic Development Association
- SPUR
- Silicon Valley Leadership Group
- Silicon Valley & San Francisco Bicycle Coalitions

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TRANSPORTATION
COMMISSION

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Cities of San Mateo County

Tom Azumbrado
U.S. Department of Housing and Urban Development

Jeannie Bruins
Cities of Santa Clara County

Damon Connolly
Marin County and Cities

Dave Cortese
Santa Clara County

Carol Dutra-Vernaci
Cities of Alameda County

Dorene M. Giacopini
U.S. Department of Transportation

Federal D. Glover
Contra Costa County

Anne W. Halsted
San Francisco Bay Conservation and Development Commission

Nick Josefowitz
San Francisco Mayor's Appointee

Jane Kim
City and County of San Francisco

Sam Liccardo
San Jose Mayor's Appointee

Alfredo Pedroza
Napa County and Cities

Julie Pierce
Association of Bay Area Governments

Bijan Sartipi
California State Transportation Agency

Libby Schaaf
Oakland Mayor's Appointee

Warren Slocum
San Mateo County

James P. Spering
Solano County and Cities

Amy R. Worth
Cities of Contra Costa County

Steve Heminger
Executive Director

Alix Bockelman
Deputy Executive Director, Policy

Andrew B. Fremier
Deputy Executive Director, Operations

Brad Paul
Deputy Executive Director, Local Government Services

January 5, 2018

Mr. Ezequiel Castro, Acting Chief
Division of Rail and Mass Transportation
Office of State Transit Programs and Plans (MS 39)
P.O. Box 942874
Sacramento, CA 94274-0001

RE: 2018 Transit and Intercity Rail Capital Program Application from Caltrain – Consistency with Regional Sustainable Communities Strategy

Dear Mr. Castro:

The Metropolitan Transportation Commission (MTC) is the Metropolitan Planning Organization (MPO) for the nine-county Bay Area. Our current regional Sustainable Communities Strategy, *Plan Bay Area 2040*, was adopted in July 2017.

We have reviewed Caltrain's planned application for the 2018 Transit and Intercity Rail Capital Program, *Caltrain Electrification – Full Fleet Conversion and Expansion*, and confirm that the elements for which funding is requested (expanded EMU fleet and system enhancements) are consistent with Plan Bay Area 2040. We do note, however, that Plan Bay Area 2040 does not include Caltrain expansion south of Gilroy.

Please feel free to contact me with any questions.

Sincerely,

Anne Richman

Anne Richman
Director, Programming and Allocations

AR: CB
J:\PROJECT\Funding\Cap and Trade\TIRCP\TIRCP 2018\SCS Consistency Letters\Caltrain.docx

JACKIE SPEIER
14TH DISTRICT, CALIFORNIA

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Congress of the United States
House of Representatives
Washington, DC 20515-0514

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Senior Whip

January 11, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

I am writing to express my support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). This funding request will be used to expand and fully electrify the fleet, modify platforms, add bike storage capacity to the system, and provide important ridership enhancements.

As you know, Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. I want to thank you and Governor Brown for your tremendous support in the effort to transform Caltrain into a modern rail system. Thankfully, Caltrain also took the prudent step of negotiating an option to purchase more electric rail cars if funding became available.

This particular project is transformational because it will avoid years of service in which diesel and electric trains would otherwise operate on the line. With a fully electric fleet, more passenger cars may be added for every train, thereby expanding access to the service and offering uncrowded trips to tens of thousands more. In addition, these trains will be equipped with WiFi. The combination of additional seats and WiFi for use during the ride will produce a ridership experience that will exceed in comfort and convenience anything that can be provided by buses currently stuck in Highway 101's traffic.

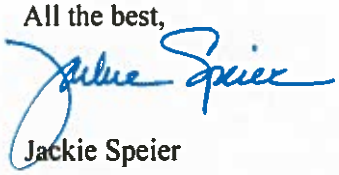
Most importantly, a fully electric fleet will allow Caltrain to create a much more efficient and convenient schedule than would be possible with a mixed fleet. Operating with both diesel and electric vehicles is a bit like operating modern automobiles on highways as they follow donkey carts. Such an outcome is a choice created by a lack of funding, not because it's the best choice for the public. Electrifying all trains on the line would permit Caltrain to fully deploy the capacity being created through $2 + billion in electrification and signalization improvements. California deserves this opportunity.

It is my belief that an all-electric fleet will also prompt Caltrain's ridership to vastly exceed the numbers currently contemplated. The corridor is congested almost beyond description. The Highway 101 corridor is even more congested now than when Governor Davis made his decision about Baby Bullet in 2001. We know that advancements in convenience and comfort prompted unexpected ridership gains in that era. I think that we can expect the same in our own time.

PRINTED ON RECYCLED PAPER

Since the early 2000's, Caltrain has been an uninterrupted success story that earned the loyalty of the public. I respectfully urge you to back this next increment of investment. We need success stories so that the public will support more projects. This grant request isn't a $629 million investment in one train system or corridor. This is an investment in the success of a statewide strategy. Thank you for your time and consideration of this historic opportunity.

All the best,



Jackie Speier

Congress of the United States
House of Representatives
Washington, D.C. 20515

Anna G. Eshoo
Eighteenth District
California

January 12, 2018

The Honorable Brian P. Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, California 95814

Dear Secretary Kelly,

I write in support of Caltrain's application for grant funding under the Transit and Intercity Rail Capital Program (TIRCP) which will support the purchase of 96 new electric trains to serve my constituents on the San Francisco Peninsula.

Caltrain is seeking a $629 million grant to purchase 96 additional Electric Multiple Unit (EMU) trains in support of Caltrain's existing electrification project. This project will replace 75 percent of its existing diesel engines with EMUs and install electric infrastructure. Grant funding from the TIRCP will allow Caltrain to purchase additional EMUs to deploy a fully electric fleet with eight-car trains along the Peninsula Corridor. The funding will also be used to increase platform lengths to accommodate eight-car trains, install a broadband system to provide wi-fi to riders, and improve bicycle storage facilities at stations.

Caltrain is the spine of the transportation system on the San Francisco Peninsula, and this grant will support ongoing efforts to provide cleaner, faster, and quieter service along the San Jose to San Francisco corridor through Silicon Valley. The full conversion and expansion of Caltrain's mainline fleet will reducing diesel pollution and greenhouse gas emissions while increasing the capacity and flexibility of services along the corridor.

Thank you for your consideration of my important request.

Most gratefully,

Anna G. Eshoo

Anna G. Eshoo
Member of Congress

CALIFORNIA LEGISLATURE

STATE CAPITOL
SACRAMENTO, CALIFORNIA
95814

January 3, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

We are writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

We appreciate your consideration of this request to fully fund Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP).

Thank you for your consideration of this request.

Sincerely,

Jerry Hill
Senator, 13th District

Scott Wiener
Senator, 11th District

Jim Beall
Senator, 15th District

Bob Wieckowski
Senator, 10th District

Phil Ting
Assemblymember, 19th District

Marc Berman
Assemblymember, 24th District

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Assemblymember, 28th District

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Assemblymember, 25th District

Kevin Mullin
Assemblymember, 22nd District

Ash Kalra
Assemblymember, 27th District

CALIFORNIA
High-Speed Rail Authority

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Honorable Jim Beall

EDMUND G. BROWN JR.
GOVERNOR

December 20, 2017

Brian P. Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814
tircpcomments@dot.ca.gov

RE: Caltrain TIRCP 2018 Grant Application – Support for Improved Passenger Rail Service

Dear Secretary Kelly:

We are writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). As you know, the California High-Speed Rail Authority (Authority) has been working closely with Caltrain on a strategic plan for optimizing the corridor for high-speed and commuter services as well as advancing sustainable development opportunities around stations. Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements that are consistent with our strategic planning efforts for blended operations.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying 96 additional EMUs supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance EMUs will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional EMUs while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan. We are strongly supportive of the important work done within this framework as we continue to collaborate with Caltrain regarding the components of the blended system for commuter and high speed rail services.

We offer our support for this application because it would advance elements of blended service on the Peninsula Corridor- a key geography in our Silicon Valley to Central Valley Line. We appreciate the partnership with Caltrain and their efforts to advance passenger rail service options in cooperation with the Authority.

Thank you for considering the Caltrain grant application.

Sincerely,

TOM FELLENZ
Interim Chief Executive Officer

cc: Jim Hartnett, General Manager and CEO Caltrain
Ben Tripousis, Northern California Regional Director

Santa Clara Valley Transportation Authority

January 10, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

On behalf of the Santa Clara Valley Transportation Authority (VTA) I am writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP) for additional Electric Multiple Units (EMUs). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

As a partner of Caltrain VTA has long supported the electrification of the system for the environmental and service benefits that it will bring to the service and the service area. The full conversion and expansion of Caltrain's mainline fleet will reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan.

Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San José, Gilroy and Salinas. Similarly, conversion of the mainline fleet to high

Santa Clara Valley Transportation Authority

performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application is structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

Yours truly,

Sam Liccardo
Chair

OFFICE OF THE MAYOR
SAN FRANCISCO

January 5, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

I am writing to express my strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance

1 DR. CARLTON B. GOODLETT PLACE, ROOM 200
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TELEPHONE: (415) 554-6141

OFFICE OF THE MAYOR
SAN FRANCISCO

electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

Sincerely,

London Breed

London Breed
Acting Mayor
City and County of San Francisco

1 DR. CARLTON B. GOODLETT PLACE, ROOM 200
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TELEPHONE: (415) 554-6141

San Francisco County Transportation Authority

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info@sfcta.org www.sfcta.org

December 29, 2017

Secretary Brian Kelly
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Subject: Letter of Support for 2018 Transit and Intercity Rail Capital Program Grant for Caltrain's Purchase of 96 additional Electric Multiple Unit Trains

Dear Secretary Kelly,

The San Francisco County Transportation Authority is pleased to support the Peninsula Corridor Joint Powers Board's (Caltrain's) 2018 Transit and Intercity Rail Capital Program (TIRCP) grant application for the purchase of **96 additional Electric Multiple Unit Trains (EMUs)** and a series of associated projects. The project will expand Caltrain's electrified fleet while allowing for blended operations with the California High-Speed Rail Authority's future high-speed rail service along the San Jose to San Francisco corridor. The project is featured in the 2018 California State Rail Plan. It will also provide for the possibility of re-deploying Caltrain's diesel fleet on a new inter-regional San Jose to Salinas service.

Once fully deployed, these EMUs will allow Caltrain to operate a completely electrified fleet on its mainline with 8-car trains. The comprehensive project takes advantage of the near-term opportunity to purchase additional EMUs while also providing strong linkages to ongoing planning work along the corridor. In addition to expanding the EMU fleet, the project consists of platform modifications, installation of a Broadband Communications System, improved wayside bicycle facilities, and planning funds. The proposed investment will build on the infrastructure and equipment currently being constructed and procured through Caltrain's electrification project.

A completely electrified Caltrain fleet is projected to reduce greenhouse gas emissions by 189,000 metric tons annually and significantly reduce the criteria pollutant emissions and toxic air contaminant health risks along the corridor. Procurement of the 96 additional EMUs is a key step towards full electrification and would allow Caltrain to provide the additional capacity needed to attract and serve riders, further reducing congestion and vehicle miles traveled.

On behalf of the Transportation Authority, I respectfully urge Caltrans to provide funding support for this project to help minimize greenhouse gases and improve mobility for current and future transit riders across California.

Sincerely,

Tilly Chang
Executive Director

cc: S. Heminger, A. Richman - MTC
A.Chan, S. Petty, P. Skinner - Caltrain
MEL, AC, AL, AS, OQ

C:\Users\tilly\Downloads\2017 Caltrain TIRCP Support Letter FINAL.docx

Plan, Fund, Deliver

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TRANSPORTATION AGENCY
FOR MONTEREY COUNTY

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December 21, 2017

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

RE: Support of Caltrain Electrification Grant Application

Dear Secretary Kelly:

On behalf of the Transportation Agency for Monterey County (TAMC), the Regional Transportation Planning Agency for Monterey County, I am writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75% of the diesel service with electric trains and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional, megaregional, and State rail network as well.

Buying 96 additional Electric Multiple Units (EMUs) supports the goals of the TIRCP program by eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important, since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to support interregional, megaregional, and statewide rail projects as envisioned in the draft 2018 California State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere, including as part of a new passenger train service between San Jose and Salinas. TAMC and the City of Salinas are working now to implement the Salinas Rail Extension Project, a project that will make improvements at the Salinas Train Station and in Gilroy. TAMC will submit a TIRCP application for the full buildout of that project, including new stations at Pajaro/Watsonville and Castroville, as is supported in the draft 2018 Rail Plan.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional EMUs, while also providing strong links to ongoing planning work in the corridor. The application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the draft 2018 Rail Plan.

Thank you for your consideration of the Caltrain Transit and Intercity Rail Capital Program grant application.

Sincerely,

Debra L. Hale
Executive Director

cc: Jim Hartnett, Caltrain CEO

SAN MATEO COUNTY
Transportation Authority

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EXECUTIVE DIRECTOR

January 12, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

On behalf of the San Mateo County Transportation Authority, I am writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

SAN MATEO COUNTY TRANSPORTATION AUTHORITY
1250 San Carlos Ave. – P.O. Box 3006
San Carlos, CA 94070-1306 (650)508-6219

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

Sincerely,

April Chan
Chief Officer, Planning, Grants and the Transportation Authority

BAYAREA COUNCIL

January 2, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

RE: Support for Caltrain's Transit and Intercity Rail Capital Program Grant Application to Expand and Fully Electrify the Fleet

Dear Secretary Kelly:

On behalf of the Bay Area Council, a public policy organization representing hundreds of the largest employers in the Bay Area, I'm pleased to express my strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain currently serves over 65,000 daily passengers and links the residents, employees, and visitors with the major economic centers of San Francisco and Silicon Valley. This corridor is home to the nation's fastest growing companies, yet traffic and transit congestion threaten to strangle our future economic success. A fully electrified system will double available capacity and allow the system to deliver a cleaner, quieter, faster, and more frequent service to the region. That is why the Bay Area Council has long advocated for an electrified Caltrain and helped assemble the original package of federal, state and regional funding for the project.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is currently under construction. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service to serve the growing needs in the corridor. Full conversion and expansion of the fleet is also important to support interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion to high performance electric trains will also fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments

P 415.946.8777
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353 Sacramento Street, 10th Floor
San Francisco, California 94111
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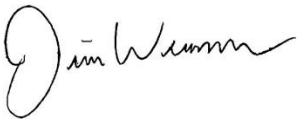
Sacramento, California 95814

in the corridor. For these reasons, the Bay Area Council is pleased to support Caltrain's application for TIRCP funds to fully electrify this critical rail system.

Sincerely,



Jim Wunderman
President & CEO

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353 Sacramento Street, 10th Floor
San Francisco, California 94111

1215 K Street, Suite 220
Sacramento, California 95814

CITY OF SAN JOSE
CAPITAL OF SILICON VALLEY

Sam T. Liccardo
MAYOR

January 9, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly,

I am writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system, and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region, but to the larger inter-regional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting inter-regional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. The conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular, the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth – a framework that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

Sincerely,

Sam Liccardo
Mayor
City of San José

200 East Santa Clara Street, 18th Floor San José, CA 95113 tel (408) 535-4800 fax (408) 292-6422 www.sjmayor.org

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www.capitolcorridor.org

December 21, 2017

The Honorable Brian Kelly
Secretary, California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

The Capitol Corridor Joint Powers Authority (CCJPA) hereby submits our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements. This is an important Northern California Megaregional Rail element that enhances Capitol Corridor service and the development of passenger rail for California.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor, which Capitol Corridor shares for our southern 2.5 miles. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

Sincerely,

David Kutrosky
Managing Director

cc: Jim Hartnett, CEO - Caltrain

TRANSBAY JOINT POWERS AUTHORITY
Mark Zabaneh • Executive Director

January 4, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

The Transbay Joint Powers Authority (TJPA) is pleased to support the award of funding from the Transit and Intercity Rail Capital Program (TIRCP) for Caltrain's request to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the Draft 2018 California State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere, including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular, the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure State funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the Draft 2018 California State Rail Plan.

Sincerely,

Mark Zabaneh, P.E.
Executive Director

Commute.org

January 11, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

On behalf of Commute.org, I am writing to express our support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms, add storage capacity to the system, and provide important ridership enhancements.

Commute.org is dedicated to addressing the challenges involved in getting to and from work, school and home in San Mateo County. Part of our mission is to reduce the number of single occupancy vehicles traveling in, to and through San Mateo County, reducing vehicle emissions resulting in improved air quality.

Caltrain's electrification project is a critical component to the transportation infrastructure that will serve the Peninsula and provide commuters with a viable alternative to driving alone. The Caltrain electrification project will grow service and provide additional benefits, not just to our county, but the Bay Area region and larger interregional rail network as well.

For these reasons, we support the Caltrain's application and their effort to provide safe, reliable, and frequent transit, reduce GHGs, and encourage non-drive alone commuting. Please feel free to contact me for more information on how this project will improve our region.

Sincerely,

John Ford
Executive Director

SAMCEDA
San Mateo County Economic Development Association

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Oracle America, Inc

Ashley Stanley
BKF Engineers

EMERITUS ADVISORS TO THE CHAIR

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Foster Enterprises

Paul Shepherd
Cargill (Retired)

January 3, 2018

Honorable Brian P. Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

The San Mateo County Economic Development Association (SAMCEDA) is an economic development and advocacy organization representing the interest of member businesses and public institutions on important economic, political and social issues throughout the Bay Area. SAMCEDA supports projects and issues which have the potential to positively impact the economic, environmental and social well-being of businesses, communities and residents in the region.

On behalf of the Caltrain Commuter Coalition and the Peninsula Mobility Group, we are writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between

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Genentech

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A Dignity Health Member

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EMERITUS ADVISORS TO THE CHAIR

T. Jack Foster, Jr.
Foster Enterprises

Paul Shepherd
Cargill (Retired)

San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

Sincerely,

Rosanne Foust
President & CEO

SPUR
San Francisco | San Jose | Oakland

January 10, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

RE: Caltrain Grant Application for 2018 TIRCP Funds

Dear Secretary Kelly:

SPUR is a member-supported nonprofit organization that promotes good planning and good government in the San Francisco Bay Area through research, education and advocacy. Improving public transit and increasing transit use in cities are core priorities for our organization.

On behalf of SPUR, I am writing in support of Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, lengthen and modify platforms, add capacity to the system and provide important ridership enhancements.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enable the system to keep up with increased ridership demand, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

SPUR
San Francisco | San Jose | Oakland

The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains while also providing strong links to ongoing planning work in the corridor. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the 2018 draft State Rail Plan.

Sincerely,

Ratna Amin
Transportation Policy Director

SILICON VALLEY LEADERSHIP GROUP

2001 Gateway Place, Suite 101E
San Jose, California 95110
(408)501-7864 svlg.org

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President & CEO

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GE
SHARON RYAN
Bay Area News Group
RON SEGE
Echelon
DARREN SNELLGROVE
Johnson & Johnson
JEFF THOMAS
Nasdaq
JED YORK
San Francisco 49ers

Established in 1978 by David Packard

January 4, 2018

Brian Kelly, Secretary
California State Transportation Agency
915 Capitol Mall, Suite 350B
Sacramento, CA 95814

Dear Secretary Kelly:

On behalf of the Silicon Valley Leadership Group, I am writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms and add storage capacity to the system and provide important ridership enhancements.

By way of background, the Silicon Valley Leadership Group, founded in 1978 by David Packard of Hewlett-Packard, represents more than 375 of Silicon Valley's most respected employers in issues, programs and campaigns that affect the economic quality of life in Silicon Valley. Collectively, Leadership Group members provide nearly one out of every three private sector jobs in Silicon Valley.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. This project is the transformational foundation on which the future of the corridor will be built. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands. Caltrain's application is particularly timely and important since the agency has an open contract with their vehicle manufacturer, Stadler, allowing them to proceed quickly with the purchase of additional electric trains. This is a unique and important opportunity for Caltrain to leverage ongoing investments in the corridor.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. Full conversion and expansion of the fleet is also important to supporting interregional and statewide rail projects as envisioned in the draft 2018 State Rail Plan. Conversion of mainline operations to all-electric service will free up Caltrain's remaining diesel fleet for redeployment elsewhere- including as part of a potential new passenger train service between San Jose and Salinas. Similarly, conversion of the mainline fleet to high performance electric trains will fulfill a necessary prerequisite for the blended operation of Caltrain and California High Speed Rail services on the Peninsula Corridor.

Sincerely,

Carl Guardino
President & CEO
Silicon Valley Leadership Group

January 11, 2018

Brian Kelly, Secretary
California State Transportation Agency

Dear Secretary Kelly:

On behalf of Silicon Valley Bicycle Coalition and the San Francisco Bicycle Coalition, we are writing to express our strong support for Caltrain's application to the Transit and Intercity Rail Capital Program (TIRCP). Their funding request will be used to expand and fully electrify the fleet, modify platforms, and add storage capacity to the system and provide important ridership enhancements.

SVBC and the SF Bicycle Coalition recognize the promise of electrified service and its benefits, including increased capacity per hour. We feel that it is crucial that Caltrain has the opportunity to increase train length for the 2021 launch of electrified service and increase bike space per trainset in order to meet growing ridership numbers.

Caltrain's existing electrification project, which will replace 75 percent of the diesel service with electric trains (EMUs) and install the electrification infrastructure, is under construction. The next wave of improvements, outlined in the TIRCP application, leverage the electrification project to grow service and provide additional benefits, not just to the Bay Area region but to the larger interregional and State rail network as well.

For many years, Caltrain has allowed bikes on board, providing a sustainable first and last mile connection option to roughly 11% of its passengers who bring a bike on board. Demand for Caltrain and for on board bike capacity, both at peak hours and throughout the day, has continued to grow year after year. Buying additional electric trains supports the goals of the TIRCP program by completely eliminating diesel passenger service from Caltrain's mainline operation and by providing additional capacity necessary to serve the corridor's growing demands.

The full conversion and expansion of Caltrain's mainline fleet will further reduce greenhouse gas emissions, enhance capacity, and greatly increase the flexibility of service offered on the Caltrain corridor. The Caltrain application has been structured in a way that will allow the railroad to take advantage of the near-term opportunity to purchase additional electric trains through their open contract with the vehicle manufacturer, Stadler, while also providing strong links to ongoing planning work in the corridor, including High Speed Rail and the draft 2018 State Rail Plan. In particular the application emphasizes the central role of the Caltrain Business Plan in developing a transparent and comprehensive framework for the railroad's growth that will ensure state funding is used to maximum benefit in a way that supports the regional needs and ambitious service and connectivity goals defined in the draft 2018 State Rail Plan.

We urge you to approve Caltrain's support for funding.

Sincerely,

Shiloh Ballard
President and Executive Director
Silicon Valley Bicycle Coalition

Brian Wiedenmeier
Executive Director
San Francisco Bicycle Coalition

Attachment C.

CARB Calculator Tool for CalSTA's TIRCP Greenhouse Gas (GHG) Reduction Fund FY18-19

California Air Resources Board
Calculator Tool for the
California State Transportation Agency
Transit and Intercity Rail Capital Program
Greenhouse Gas Reduction Fund
Fiscal Year 2018-19

The California Air Resources Board (CARB) is responsible for providing the quantification methodology to estimate the greenhouse gas (GHG) emission reductions and other non-GHG outcomes, referred to as co-benefits (e.g., air pollutant emission estimates), from projects receiving monies from the Greenhouse Gas Reduction Fund (GGRF).

CARB released the California State Transportation Agency (CalSTA) Transit and Intercity Rail Capital Program (TIRCP) Draft Quantification Methodology and Draft TIRCP Calculator Tool for Fiscal Year (FY) 2018-19 for public comment in September 2017. The Draft Quantification Methodology and Draft TIRCP Calculator Tool were updated as necessary to reflect stakeholder comments and final TIRCP Guidelines for FY 2018-19. This Final TIRCP Calculator Tool accompanies the Final Quantification Methodology for FY 2018-19, available at:
www.arb.ca.gov/cci-quantification

Instructions: Applicants must use this calculator to estimate the GHG emission reductions and air pollutant emissions associated with the quantification methodology, as applicable. This Excel file must be submitted with other documentation requirements. Please use the following file naming convention: "[Project Name]_calc" not to exceed 20 characters. Project names may be abbreviated. Additional documentation may be necessary to substantiate the inputs to this file. Fields highlighted in yellow indicate input needed by the project applicant.

Step 1 Define the Project: Applicants must define the project by identifying both eligible project types in Table 2 of the Quantification Methodology and the number of quantifiable components.

Step 2 Determine the TIRCP Calculator Tool Inputs Needed: The applicant will use Table 3 in the Quantification Methodology to determine the required data inputs to estimate the GHG emission reductions and air pollutant emission co-benefits for each quantifiable component by project type, as identified in Step 1.

Step 3 Estimate the GHG Emission Reductions and Air Pollutant Emissions for the Proposed Project for Each Component Using the TIRCP Calculator Tool: The applicant will enter the required data inputs identified in Step 2 into this TIRCP Calculator Tool to calculate the GHG emission reductions and air pollutant emission estimates of the proposed project.

Read Me Tab (this page):
Enter the Project Name and the contact information for person who can answer project-specific questions on the quantification calculations.

Project Name:	**Penisula Corridor Electrification Expansion**
Contact Name:	**Peter Skinner**
Contact Phone Number:	**650-622-7818**
Contact Email:	skinnerp@samtrans.com
Date Completed:	**1/5/2018**

Quantifiable Component Tabs:
Cells in yellow with headers in red indicate a direct user input is required. Cells in red indicate a direct user input is optional (note: additional supporting documentation is required if used). Green fields indicate a selection from a drop-down box is required. Gray fields indicate output or calculation fields that are automatically populated based on user entries and the quantification methods.

For each component, applicants must work from top to bottom and enter all relevant data. Some cells may not be applicable to the project type; these cells will turn black and lock. Applicants should use one tab per quantifiable component and may use as many tabs as necessary to characterize all relevant components of the proposed project, including additional GGRF funding requested from other California Climate Investments (CCI) programs. A component is a project type for which GHG emission reductions and air pollutant emissions may be estimated, evaluated and reported separately from other components within the TIRCP project. Inputs must be substantiated in the documentation provided to CalSTA and CARB; see Section C. Documentation of the Quantification Methodology.

Submit documentation: Save file for submittal. See Section C. Documentation of the Quantification Methodology for additional documentation requirements.

For more information on CARB's efforts to support implementation of GGRF investments, see: http://www.arb.ca.gov/caclimateinvestments
Questions pertaining to TIRCP should be sent to: TIRCPcomments@dot.ca.gov
Questions on this calculator should be sent to : GGRFProgram@arb.ca.gov

California Air Resources Board
Calculator Tool for the
California State Transportation Agency
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Greenhouse Gas Reduction Fund
Fiscal Year 2018-19

Project Name:	Penisula Corridor Electrification Expansion

Input	Description	Quantified Component 1	
Identifying Descriptor (ID)	Brief description of the quantifiable component identifying it from other separable components.	Capacity increases- order of 40 new EMUs to expand consist length from 6- to 8-car trains. Development of improved bike parking and bikeshare system	
Funding Inputs			
TIRCP Funds Requested	Total TIRCP funds requested for this separable component.	$242,200,000	
Multi-Year	Will this component request several California Transportation Commission allocations over multiple calendar years?	No	
Additional CCI Program 1			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 1.		
Additional CCI Program 2			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 2.		
Total GGRF Funds Requested	Total GGRF funds requested from all CCI Programs	$242,200,000	
Project Inputs			
Project Type	For the purposes of this quantification, eligible TIRCP projects fall into four project types. Select the project type that best describes this component.	New/Expanded Service	
Service Type	The transit service (e.g., Intercity/Express Bus (Long Distance), Light Rail, Vanpool, etc.) directly associated with the proposed project. For projects that serve multiple services, select Multi-modal.	Heavy Rail	
Vehicle Type	The vehicle type (e.g., Transit Bus, Streetcar, Ferry, etc.) that will operate the new service or will be procured.	Heavy Rail	
Region	The region that best encompasses the geographic location for the proposed project type.	Air Basin	
Sub region	The County or Air Basin where the majority of the service occurs.	San Francisco Bay Area	
Year 1 (Yr1)	The first year of service or the first year the facility or rolling stock will be in use.	2022	
Year F (YrF)	The final year of service or the final year the facility or rolling stock's useful life.	2052	
Useful Life	The number of years the service is funded or the useful life of the facility or rolling stock.	30	
Displaced Autos Inputs		**Input**	**Reference**
Yr1 Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the first year (Yr1).	2,658,680	see ridership discussion
YrF Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, Yr1 and YrF should be the same value.	8,218,184	see ridership discussion
Adjustment Factor (A)	Discount factor applied to annual ridership to account for transit-dependent riders. Use: document project-specific data or system average developed from a recent, statistically valid survey or default.	0.83	default value taken

Length of Average Trip (L)	Annual passenger miles over unlinked trips directly associated with the proposed project.	26.6	2016 NTD figure
New/Expanded Service Vehicle Inputs		**Input**	**Reference**
Hybrid Vehicle	Is the vehicle for the new/expanded service, or vehicle(s) to be procured, a hybrid?	No	
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the vehicle for the new/expanded service, or of the new vehicle(s) to be procured.	Electric	
Model Year	The engine model year of the vehicle that will operate the new/expanded service, or of the new vehicle(s) to be procured.		
Project-Specific Emission Factor	If used, applicant must be able to demonstrate an approved carbon intensity value under the Low Carbon Fuel Standard and submit additional documentation.		
Annual VMT	The estimated annual VMT required to operate the new/expanded service or of the new vehicle(s) to be procured (e.g., 72,000). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.	2,966,700	see VMT and fuel calculation sheets
Annual Fuel	The estimated annual fuel (i.e., gallon of diesel, KWh of electricity) required to operate the new/expanded service, or of the new rail or ferry vehicle(s) to be procured (e.g., 26,000).	27,004,074	see VMT and fuel calculation sheets
Displaced Vehicle/Fuel Reductions Inputs		**Input**	**Reference**
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the displaced vehicle(s) or of fuel reductions as a result of the project.		
Model Year	The average engine model year(s) of the displaced vehicle(s) or of the vehicle(s) to realize fuel reductions as a result of the project.		
Annual VMT	The estimated annual VMT of the displaced vehicle(s). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel reductions expected to be realized as a result of the project or the estimated annual fuel the displaced vehicle(s) would have required to operate the equivalent as the new vehicle to be procured.		

California Air Resources Board
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Greenhouse Gas Reduction Fund
Fiscal Year 2018-19

Project Name:	Penisula Corridor Electrification Expansion

Input	Description	Quantified Component 2	
Identifying Descriptor (ID)	Brief description of the quantifiable component identifying it from other separable components.	Installation of Broadband communications system including customer-facing wi-fi	
Funding Inputs			
TIRCP Funds Requested	Total TIRCP funds requested for this separable component.	$14,000,000	
Multi-Year	Will this component request several California Transportation Commission allocations over multiple calendar years?	No	
Additional CCI Program 1			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 1.		
Additional CCI Program 2			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 2.		
Total GGRF Funds Requested	Total GGRF funds requested from all CCI Programs	$14,000,000	
Project Inputs			
Project Type	For the purposes of this quantification, eligible TIRCP projects fall into four project types. Select the project type that best describes this component.	System and Efficiency Improvements	
Service Type	The transit service (e.g., Intercity/Express Bus (Long Distance), Light Rail, Vanpool, etc.) directly associated with the proposed project. For projects that serve multiple services, select Multi-modal.	Heavy Rail	
Vehicle Type	The vehicle type (e.g., Transit Bus, Streetcar, Ferry, etc.) that will operate the new service or will be procured.	Heavy Rail	
Region	The region that best encompasses the geographic location for the proposed project type.	Air Basin	
Sub region	The County or Air Basin where the majority of the service occurs.	San Francisco Bay Area	
Year 1 (Yr1)	The first year of service or the first year the facility or rolling stock will be in use.	2022	
Year F (YrF)	The final year of service or the final year the facility or rolling stock's useful life.	2037	
Useful Life	The number of years the service is funded or the useful life of the facility or rolling stock.	15	
Displaced Autos Inputs		**Input**	**Reference**
Yr1 Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the first year (Yr1).	701,727.00	See riderhsip and benefit discussion
YrF Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, Yr1 and YrF should be the same value.	930,322.00	See riderhsip and benefit discussion
Adjustment Factor (A)	Discount factor applied to annual ridership to account for transit-dependent riders. Use: document project-specific data or system average developed from a recent, statistically valid survey or default.	0.83	defualt value used

Length of Average Trip (L)	Annual passenger miles over unlinked trips directly associated with the proposed project.	26.6	2016 NTD value
New/Expanded Service Vehicle Inputs		**Input**	**Reference**
Hybrid Vehicle	Is the vehicle for the new/expanded service, or vehicle(s) to be procured, a hybrid?		
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the vehicle for the new/expanded service, or of the new vehicle(s) to be procured.		
Model Year	The engine model year of the vehicle that will operate the new/expanded service, or of the new vehicle(s) to be procured.		
Project-Specific Emission Factor	If used, applicant must be able to demonstrate an approved carbon intensity value under the Low Carbon Fuel Standard and submit additional documentation.		
Annual VMT	The estimated annual VMT required to operate the new/expanded service or of the new vehicle(s) to be procured (e.g., 72,000). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel (i.e., gallon of diesel, KWh of electricity) required to operate the new/expanded service, or of the new rail or ferry vehicle(s) to be procured (e.g., 26,000).		
Displaced Vehicle/Fuel Reductions Inputs		**Input**	**Reference**
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the displaced vehicle(s) or of fuel reductions as a result of the project.		
Model Year	The average engine model year(s) of the displaced vehicle(s) or of the vehicle(s) to realize fuel reductions as a result of the project.		
Annual VMT	The estimated annual VMT of the displaced vehicle(s). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel reductions expected to be realized as a result of the project or the estimated annual fuel the displaced vehicle(s) would have required to operate the equivalent as the new vehicle to be procured.		

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Project Name:	Penisula Corridor Electrification Expansion

Input	Description	Quantified Component 3	
Identifying Descriptor (ID)	Brief description of the quantifiable component identifying it from other separable components.		
Funding Inputs			
TIRCP Funds Requested	Total TIRCP funds requested for this separable component.		
Multi-Year	Will this component request several California Transportation Commission allocations over multiple calendar years?		
Additional CCI Program 1			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 1.		
Additional CCI Program 2			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 2.		
Total GGRF Funds Requested	Total GGRF funds requested from all CCI Programs		
Project Inputs			
Project Type	For the purposes of this quantification, eligible TIRCP projects fall into four project types. Select the project type that best describes this component.		
Service Type	The transit service (e.g., Intercity/Express Bus (Long Distance), Light Rail, Vanpool, etc.) directly associated with the proposed project. For projects that serve multiple services, select Multi-modal.		
Vehicle Type	The vehicle type (e.g., Transit Bus, Streetcar, Ferry, etc.) that will operate the new service or will be procured.		
Region	The region that best encompasses the geographic location for the proposed project type.		
Sub region	The County or Air Basin where the majority of the service occurs.		
Year 1 (Yr1)	The first year of service or the first year the facility or rolling stock will be in use.		
Year F (YrF)	The final year of service or the final year the facility or rolling stock's useful life.		
Useful Life	The number of years the service is funded or the useful life of the facility or rolling stock.		
Displaced Autos Inputs		**Input**	**Reference**
Yr1 Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the first year (Yr1).		
YrF Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, Yr1 and YrF should be the same value.		
Adjustment Factor (A)	Discount factor applied to annual ridership to account for transit-dependent riders. Use: document project-specific data or system average developed from a recent, statistically valid survey or default.		

Length of Average Trip (L)	Annual passenger miles over unlinked trips directly associated with the proposed project.		
New/Expanded Service Vehicle Inputs		**Input**	**Reference**
Hybrid Vehicle	Is the vehicle for the new/expanded service, or vehicle(s) to be procured, a hybrid?		
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the vehicle for the new/expanded service, or of the new vehicle(s) to be procured.		
Model Year	The engine model year of the vehicle that will operate the new/expanded service, or of the new vehicle(s) to be procured.		
Project-Specific Emission Factor	If used, applicant must be able to demonstrate an approved carbon intensity value under the Low Carbon Fuel Standard and submit additional documentation.		
Annual VMT	The estimated annual VMT required to operate the new/expanded service or of the new vehicle(s) to be procured (e.g., 72,000). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel (i.e., gallon of diesel, KWh of electricity) required to operate the new/expanded service, or of the new rail or ferry vehicle(s) to be procured (e.g., 26,000).		
Displaced Vehicle/Fuel Reductions Inputs		**Input**	**Reference**
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the displaced vehicle(s) or of fuel reductions as a result of the project.		
Model Year	The average engine model year(s) of the displaced vehicle(s) or of the vehicle(s) to realize fuel reductions as a result of the project.		
Annual VMT	The estimated annual VMT of the displaced vehicle(s). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel reductions expected to be realized as a result of the project or the estimated annual fuel the displaced vehicle(s) would have required to operate the equivalent as the new vehicle to be procured.		

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Project Name:	Penisula Corridor Electrification Expansion

Input	Description	Quantified Component 4	
Identifying Descriptor (ID)	Brief description of the quantifiable component identifying it from other separable components.	Conversion of remaining mainline diesel fleet through purchase of an additional 56 EMUs	
Funding Inputs			
TIRCP Funds Requested	Total TIRCP funds requested for this separable component.	$375,300,000	
Multi-Year	Will this component request several California Transportation Commission allocations over multiple calendar years?	Yes	
Additional CCI Program 1			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 1.		
Additional CCI Program 2			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 2.		
Total GGRF Funds Requested	Total GGRF funds requested from all CCI Programs	$375,300,000	
Project Inputs			
Project Type	For the purposes of this quantification, eligible TIRCP projects fall into four project types. Select the project type that best describes this component.	Cleaner Vehicles/Technology/Fuels	
Service Type	The transit service (e.g., Intercity/Express Bus (Long Distance), Light Rail, Vanpool, etc.) directly associated with the proposed project. For projects that serve multiple services, select Multi-modal.	Heavy Rail	
Vehicle Type	The vehicle type (e.g., Transit Bus, Streetcar, Ferry, etc.) that will operate the new service or will be procured.	Heavy Rail	
Region	The region that best encompasses the geographic location for the proposed project type.	Air Basin	
Sub region	The County or Air Basin where the majority of the service occurs.	San Francisco Bay Area	
Year 1 (Yr1)	The first year of service or the first year the facility or rolling stock will be in use.	2027	
Year F (YrF)	The final year of service or the final year the facility or rolling stock's useful life.	2057	
Useful Life	The number of years the service is funded or the useful life of the facility or rolling stock.	30	
Displaced Autos Inputs		**Input**	**Reference**
Yr1 Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the first year (Yr1).		
YrF Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, Yr1 and YrF should be the same value.		
Adjustment Factor (A)	Discount factor applied to annual ridership to account for transit-dependent riders. Use: document project-specific data or system average developed from a recent, statistically valid survey or default.		

Length of Average Trip (L)	Annual passenger miles over unlinked trips directly associated with the proposed project.		
New/Expanded Service Vehicle Inputs		**Input**	**Reference**
Hybrid Vehicle	Is the vehicle for the new/expanded service, or vehicle(s) to be procured, a hybrid?	No	
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the vehicle for the new/expanded service, or of the new vehicle(s) to be procured.	Electric	
Model Year	The engine model year of the vehicle that will operate the new/expanded service, or of the new vehicle(s) to be procured.		
Project-Specific Emission Factor	If used, applicant must be able to demonstrate an approved carbon intensity value under the Low Carbon Fuel Standard and submit additional documentation.		
Annual VMT	The estimated annual VMT required to operate the new/expanded service or of the new vehicle(s) to be procured (e.g., 72,000). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.	2,745,600	see VMT and fuel calculations
Annual Fuel	The estimated annual fuel (i.e., gallon of diesel, KWh of electricity) required to operate the new/expanded service, or of the new rail or ferry vehicle(s) to be procured (e.g., 26,000).	23,341,535	see VMT and fuel calculations
Displaced Vehicle/Fuel Reductions Inputs		**Input**	**Reference**
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the displaced vehicle(s) or of fuel reductions as a result of the project.	Diesel	
Model Year	The average engine model year(s) of the displaced vehicle(s) or of the vehicle(s) to realize fuel reductions as a result of the project.		
Annual VMT	The estimated annual VMT of the displaced vehicle(s). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.	2,005,900.00	see VMT and fuel calculations
Annual Fuel	The estimated annual fuel reductions expected to be realized as a result of the project or the estimated annual fuel the displaced vehicle(s) would have required to operate the equivalent as the new vehicle to be procured.	1,125,009.60	see VMT and fuel calculations

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Project Name:	Penisula Corridor Electrification Expansion

Input	Description	Quantified Component 5	
Identifying Descriptor (ID)	Brief description of the quantifiable component identifying it from other separable components.		
Funding Inputs			
TIRCP Funds Requested	Total TIRCP funds requested for this separable component.		
Multi-Year	Will this component request several California Transportation Commission allocations over multiple calendar years?		
Additional CCI Program 1			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 1.		
Additional CCI Program 2			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 2.		
Total GGRF Funds Requested	Total GGRF funds requested from all CCI Programs		
Project Inputs			
Project Type	For the purposes of this quantification, eligible TIRCP projects fall into four project types. Select the project type that best describes this component.		
Service Type	The transit service (e.g., Intercity/Express Bus (Long Distance), Light Rail, Vanpool, etc.) directly associated with the proposed project. For projects that serve multiple services, select Multi-modal.		
Vehicle Type	The vehicle type (e.g., Transit Bus, Streetcar, Ferry, etc.) that will operate the new service or will be procured.		
Region	The region that best encompasses the geographic location for the proposed project type.		
Sub region	The County or Air Basin where the majority of the service occurs.		
Year 1 (Yr1)	The first year of service or the first year the facility or rolling stock will be in use.		
Year F (YrF)	The final year of service or the final year the facility or rolling stock's useful life.		
Useful Life	The number of years the service is funded or the useful life of the facility or rolling stock.		
Displaced Autos Inputs		**Input**	**Reference**
Yr1 Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the first year (Yr1).	3,249,077	see ridership discussion
YrF Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, Yr1 and YrF should be the same value.	3,784,174	see ridership discussion
Adjustment Factor (A)	Discount factor applied to annual ridership to account for transit-dependent riders. Use: document project-specific data or system average developed from a recent, statistically valid survey or default.	0.83	default value used

Length of Average Trip (L)	Annual passenger miles over unlinked trips directly associated with the proposed project.	23.3	2017 annual passanger count report
New/Expanded Service Vehicle Inputs		**Input**	**Reference**
Hybrid Vehicle	Is the vehicle for the new/expanded service, or vehicle(s) to be procured, a hybrid?	No	
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the vehicle for the new/expanded service, or of the new vehicle(s) to be procured.	Electric	
Model Year	The engine model year of the vehicle that will operate the new/expanded service, or of the new vehicle(s) to be procured.		
Project-Specific Emission Factor	If used, applicant must be able to demonstrate an approved carbon intensity value under the Low Carbon Fuel Standard and submit additional documentation.		
Annual VMT	The estimated annual VMT required to operate the new/expanded service or of the new vehicle(s) to be procured (e.g., 72,000). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.	9,152,000	
Annual Fuel	The estimated annual fuel (i.e., gallon of diesel, KWh of electricity) required to operate the new/expanded service, or of the new rail or ferry vehicle(s) to be procured (e.g., 26,000).	83,305,116	
Displaced Vehicle/Fuel Reductions Inputs		**Input**	**Reference**
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the displaced vehicle(s) or of fuel reductions as a result of the project.		
Model Year	The average engine model year(s) of the displaced vehicle(s) or of the vehicle(s) to realize fuel reductions as a result of the project.		
Annual VMT	The estimated annual VMT of the displaced vehicle(s). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel reductions expected to be realized as a result of the project or the estimated annual fuel the displaced vehicle(s) would have required to operate the equivalent as the new vehicle to be procured.		

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Project Name:	Penisula Corridor Electrification Expansion

Input	Description	Quantified Component 6	
Identifying Descriptor (ID)	Brief description of the quantifiable component identifying it from other separable components.		
Funding Inputs			
TIRCP Funds Requested	Total TIRCP funds requested for this separable component.		
Multi-Year	Will this component request several California Transportation Commission allocations over multiple calendar years?		
Additional CCI Program 1			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 1.		
Additional CCI Program 2			
CCI Program	Other CCI Program from which project has or will be requesting GGRF funds.		
Additional GGRF Funds	Total GGRF funds requested or to be requested from Additional CCI Program 2.		
Total GGRF Funds Requested	Total GGRF funds requested from all CCI Programs		
Project Inputs			
Project Type	For the purposes of this quantification, eligible TIRCP projects fall into four project types. Select the project type that best describes this component.		
Service Type	The transit service (e.g., Intercity/Express Bus (Long Distance), Light Rail, Vanpool, etc.) directly associated with the proposed project. For projects that serve multiple services, select Multi-modal.		
Vehicle Type	The vehicle type (e.g., Transit Bus, Streetcar, Ferry, etc.) that will operate the new service or will be procured.		
Region	The region that best encompasses the geographic location for the proposed project type.		
Sub region	The County or Air Basin where the majority of the service occurs.		
Year 1 (Yr1)	The first year of service or the first year the facility or rolling stock will be in use.		
Year F (YrF)	The final year of service or the final year the facility or rolling stock's useful life.		
Useful Life	The number of years the service is funded or the useful life of the facility or rolling stock.		
Displaced Autos Inputs		**Input**	**Reference**
Yr1 Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the first year (Yr1).		
YrF Ridership	The increase in unlinked passenger trips directly associated with the proposed project in the final year. If the ridership is not expected to change, Yr1 and YrF should be the same value.		
Adjustment Factor (A)	Discount factor applied to annual ridership to account for transit-dependent riders. Use: document project-specific data or system average developed from a recent, statistically valid survey or default.		

Length of Average Trip (L)	Annual passenger miles over unlinked trips directly associated with the proposed project.		
New/Expanded Service Vehicle Inputs		**Input**	**Reference**
Hybrid Vehicle	Is the vehicle for the new/expanded service, or vehicle(s) to be procured, a hybrid?		
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the vehicle for the new/expanded service, or of the new vehicle(s) to be procured.		
Model Year	The engine model year of the vehicle that will operate the new/expanded service, or of the new vehicle(s) to be procured.		
Project-Specific Emission Factor	If used, applicant must be able to demonstrate an approved carbon intensity value under the Low Carbon Fuel Standard and submit additional documentation.		
Annual VMT	The estimated annual VMT required to operate the new/expanded service or of the new vehicle(s) to be procured (e.g., 72,000). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel (i.e., gallon of diesel, KWh of electricity) required to operate the new/expanded service, or of the new rail or ferry vehicle(s) to be procured (e.g., 26,000).		
Displaced Vehicle/Fuel Reductions Inputs		**Input**	**Reference**
Fuel Type	The fuel type (e.g., electric, diesel, etc.) of the displaced vehicle(s) or of fuel reductions as a result of the project.		
Model Year	The average engine model year(s) of the displaced vehicle(s) or of the vehicle(s) to realize fuel reductions as a result of the project.		
Annual VMT	The estimated annual VMT of the displaced vehicle(s). For rail and ferry vehicles, applicants may alternatively use Annual Fuel.		
Annual Fuel	The estimated annual fuel reductions expected to be realized as a result of the project or the estimated annual fuel the displaced vehicle(s) would have required to operate the equivalent as the new vehicle to be procured.		

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Project Name:	Penisula Corridor Electrification Expansion

	Quantified GHG Component 1	Quantified GHG Component 2	Quantified GHG Component 3	Quantified GHG Component 4	Quantified GHG Component 5	Quantified GHG Component 6	Total Project
Identifying Descriptor	Capacity increases- order of 40 new EMUs to expand consist length from 6- to 8-car	Installation of Broadband communications system including		Conversion of remaining mainline diesel fleet through purchase of an			
GHG Emission Reduction Start Date (Year)	2022	2022		2027			
Total CCI							
Total GHG Emission Reductions ($MTCO_2e$)	891,952	98,264		197,917			1,188,133
Total GGRF Funds Requested ($)	242,200,000	14,000,000		375,300,000			631,500,000
Total GHG Emission Reductions/Total GGRF Funds Requested ($MTCO_2e$/$)	0.003683	0.007019		0.000527			0.001881
TIRCP							
TIRCP GHG Emission Reductions ($MTCO_2e$)	891,952	98,264		197,917			1,188,133
TIRCP Funds Requested ($)	242,200,000	14,000,000		375,300,000			631,500,000
TIRCP GHG Emission Reductions/TIRCP Funds Requested ($MTCO_2e$/$)	0.003683	0.007019		0.000527			0.001881
TIRCP Funds Requested/TIRCP GHG Emission Reductions ($/$MTCO_2e$)	272	142		1,896			532
Additional CCI Program 1							
CCI Program							
GHG Emission Reductions Attributable to other GGRF Programs (MTCO2e)							
Total Additional GGRF Funds to Implement Project ($)							
Additional CCI Program 2							
CCI Program							
GHG Emission Reductions Attributable to other GGRF Programs (MTCO2e)							
Total Additional GGRF Funds to Implement Project ($)							

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Project Name:	Penisula Corridor Electrification Expansion

		Quantified Co-Benefit Component 1	Quantified Co-Benefit Component 2	Quantified Co-Benefit Component 3	Quantified Co-Benefit Component 4	Quantified Co-Benefit Component 5	Quantified Co-Benefit Component 6	Total Project
	Identifying Descriptor	Capacity increases- order of 40 new EMUs to expand consist length from 6- to 8-car trains. Development of	Installation of Broadband communications system including customer-facing wi-fi		Conversion of remaining mainline diesel fleet through purchase of an additional 56 EMUs			
	Total CCI							
Key Variables	Passenger VMT Reductions (miles)	120,069,709	18,016,189			68,008,021		206,093,918
Key Variables	Fossil Fuel Use Reductions	N/A	N/A		N/A			
Key Variables	Fossil Fuel Energy Use Reductions (kWh)	N/A	N/A		N/A			
Co-Benefits	ROG Emission Reductions (lbs)	48,739	5,034		421,591			475,364
Co-Benefits	NOx Emission Reductions (lbs)	267,583	26,848		7,622,457			7,916,887
Co-Benefits	PM2.5 Emission Reductions (lbs)	6,911	711		268,865			276,488
Co-Benefits	Diesel PM Emission Reductions (lbs)	23,027	2,750		277,180			302,957
	TIRCP							
Key Variables	Passenger VMT Reductions (miles)	120,069,709	18,016,189			68,008,021		206,093,918
Key Variables	Fossil Fuel Use Reductions	N/A	N/A		N/A			
Key Variables	Fossil Fuel Energy Use Reductions (kWh)	N/A	N/A		N/A			
Co-Benefits	ROG Emission Reductions (lbs)	48,739	5,034		421,591			475,364
Co-Benefits	NOx Emission Reductions (lbs)	267,583	26,848		7,622,457			7,916,887
Co-Benefits	PM2.5 Emission Reductions (lbs)	6,911	711		268,865			276,488
Co-Benefits	Diesel PM Emission Reductions (lbs)	23,027	2,750		277,180			302,957
	Additional CCI Program 1							
Key Variables	Passenger VMT Reductions (miles)							
Key Variables	Fossil Fuel Use Reductions							
Key Variables	Fossil Fuel Energy Use Reductions (kWh)							
Co-Benefits	ROG Emission Reductions (lbs)							
Co-Benefits	NOx Emission Reductions (lbs)							
Co-Benefits	PM2.5 Emission Reductions (lbs)							
Co-Benefits	Diesel PM Emission Reductions (lbs)							
	Additional CCI Program 2							
Key Variables	Passenger VMT Reductions (miles)							
Key Variables	Fossil Fuel Use Reductions							
Key Variables	Fossil Fuel Energy Use Reductions (kWh)							
Co-Benefits	ROG Emission Reductions (lbs)							
Co-Benefits	NOx Emission Reductions (lbs)							
Co-Benefits	PM2.5 Emission Reductions (lbs)							
Co-Benefits	Diesel PM Emission Reductions (lbs)							

Attachment D.

Caltrain Business Plan Materials

AGENDA ITEM # 9
DECEMBER 7, 2017

PENINSULA CORRIDOR JOINT POWERS BOARD
STAFF REPORT

TO: Joint Powers Board

THROUGH: Jim Hartnett
Executive Director

FROM: Michelle Bouchard,
Chief Operating Officer, Caltrain

SUBJECT: **CALTRAIN BUSINESS PLAN - DRAFT BUSINESS STRATEGY AND SCOPE**

ACTION

Staff Coordinating Council recommends the Board receive and review the attached draft Business Strategy Principles and Draft Caltrain Business Plan Scope of Work

SIGNIFICANCE

Caltrain staff has prepared two draft documents (attached) for the Board's initial review along with a presentation describing their contents. The two documents include:

- A set of draft policy principles comprising a "Business Strategy" that will help guide the further development of the Caltrain Business Plan
- A draft Scope of Work that describes the tasks and technical analysis required to complete the Caltrain Business Plan

Pending the Board's review and comments, staff will revise these documents and return to the Board in January to request their formal adoption. This action would launch "phase 2" of the Caltrain Business Plan. Following the Board's adoption of the "Business Strategy" and Business Plan Scope, the Business Plan would take approximately one year to complete. The schedule for proposed Board updates and action is shown below:

- **January 2018:** Proposed Board Action- adopt the "Business Strategy" policy principles and the Scope of Work for the Business Plan (Attachments 1 and 2) along with any corresponding funding agreements or budget amendments.

- **Spring 2018:** Proposed Board informational update on Tasks 1 and 2 from the Scope of Work. The Board will be presented with analysis of potential markets and strategic opportunities for rail service on the Peninsula Corridor out to 2040 (Task 1) Staff will also present the specific Service Vision scenarios that are being evaluated for how the Caltrain service and corridor could grow between 2022 and 2040 (Task 2A). Finally, staff will report on preliminary findings regarding a structural assessment of the Caltrain organization as well as a preliminary analysis of the community benefits, impacts and interface related to the development and evolution of the railroad (Tasks 2B and 2C).

- **Summer 2018:**
    - Proposed Board Action: Adopt a long range "Service Vision" for the Caltrain corridor including number of trains per hour, mix of express and local services, stopping patterns and desired connectivity to the regional, interregional and state rail network. The Service Vision will define:
        - A pathway of incremental, interim steps and timeframes to evolve from current service levels to the 2040 Service Vision, and
        - Preliminary performance targets for Caltrain service including ridership, service characteristics, costs and revenues.

    - Proposed Board Action: The Board will be presented with analyses that show how the Service Vision will drive infrastructure needs in the corridor and how these needs will influence other plans and projects throughout the region. The Board may then choose to direct Caltrain staff to use the Service Vision as the planning basis for engaging with other local, regional and state projects going forward.

    - Proposed Board Action: The Board will be presented with analyses from Task 2B showing how the Caltrain organization currently functions and review comparative examples of organizational structures used by railways elsewhere. The Board may then choose to direct staff to develop an "organizational strategy" that shows options for how the Caltrain organization could evolve (in coordination with input and direction from the JPB partners) to support the 2040 Service Vision.

    - Proposed Board Action: Finally, the Board will be presented with analysis from Task 2C describing how Caltrain's service creates both benefits and impacts in its surrounding communities. The Board may then choose to direct staff to develop a "community interface strategy" that shows how Caltrain can work with partner jurisdictions and agencies to maximize community benefits and minimize impacts as the Service Vision is implemented over time.

- **Fall 2018:** Proposed Board informational update on Tasks 3 and 4 from the Scope of Work. The Board will be presented with additional technical analysis and refinements made to the "Service Vision" and will have the opportunity to provide input on any changed assumptions or new issues that have been identified through subsequent technical analysis.
  The Board will also be presented with analysis showing how first- and last-mile considerations, fare policy and joint development opportunities are being integrated into the Business Plan (Task 3). Additionally the Board will receive updates on the development of an Organizational Strategy and a Community Interface Strategy and will have the opportunity to provide further direction (Task 3). Finally, the Board will receive preliminary information about the funding strategy underlying Business Plan (Task 4).

- **End of 2018:** The Board will be presented with the completed analyses from Tasks 3 and 4 as well as a draft Business Plan document and may then choose to take the following actions:
    - Proposed Board Action: Adopt a detailed, refined and optimized Business Plan that includes a year-to-year description of how service in the corridor will grow and change to achieve the 2040 Vision.
        - The plan will run through 2040 but will include a greater level of detail for the 2022-2032 period.
        - The Business Plan will identify the timing and nature of required infrastructure projects and fleet purchases along with capital and operating cost projections and targets.
        - The Business Plan will include refined revenue and ridership projections and targets.
        - The Business Plan will incorporate planning, policy and business recommendations related to improved customer amenities, fares and ticketing, first- and last-mile connections, and the development of Caltrain owned property. These recommendations will be coordinated with and based on ongoing planning work.
        - The Business Plan will include a full funding strategy and a defined implementation program
    - Proposed Board Action: Review the Organizational Strategy prepared by staff and recommend next steps in conjunction with input from Caltrain's partners
    - Proposed Board Action: Review the Community Interface Strategy prepared by staff and recommend next steps in conjunction with input from Caltrain's partners and local jurisdictions

BUDGET IMPACT

There is no impact on the budget at this time. When staff presents a final scope of work to the Board for adoption it will be accompanied by any associated funding agreements or required budget amendments.

BACKGROUND

In 2017 Caltrain secured full funding for the Peninsula Corridor Electrification Project and issued notices to proceed to its contractors. Now that construction on this long-awaited project has begun, the agency has the opportunity to articulate a long term business strategy for the future of the system. The initial concept for a Caltrain "Business Plan" was brought to the Board in April of 2017 and the Board was provided with a subsequent written update in July of 2017. The Board formed an Ad-Hoc Subcommittee to focus on the Business Plan in August of 2017.

Since that time staff has engaged with corridor stakeholders to discuss the future of the railroad. These interactions culminated in September 2017 with an all-day stakeholder workshop focused on the "future of Caltrain."

The workshop was attended by: general managers and staff from Caltrain's funding partners and peer agencies, state officials, city councilmembers, and members of the business and advocacy communities. The workshop was also attended by the four Caltrain Board members who comprise the Caltrain Business Plan Ad Hoc Committee. Participants were asked to envision the future they wanted for the railroad and to consider the challenges and obstacles that might stall or prevent the realization of that vision.

Following the workshop staff has worked to develop a technical scope of work for the Business Plan that responds to the issues and ideas raised. Staff has also continued conversations with corridor stakeholders to raise awareness of the Business Plan effort. Notable outreach has included discussion with local, state and federal elected officials.

Prepared by: Sebastian Petty, Senior Policy Advisor 650.622.7831

Attachment 1: Proposed Caltrain "Business Strategy" Policy Principles

The following broad principles have been developed based on stakeholder outreach conducted during Phase 1 of the Business Plan. They are proposed for Board adoption as policy principles that will be used to guide the development of the Caltrain Business Plan:

- Caltrain's core business is rail service. The Caltrain organization exists to manage the delivery of rail service, as well as the assets, infrastructure and ancillary activities that are required to support that delivery.
- Today Caltrain provides a commuter rail service that primarily serves weekday commuters and special event attendees. After electrification, Caltrain will face choices about how best to expand and tailor its service to support a much broader range of mobility markets. The primary task of the Business Plan is to aid in the selection of a detailed, achievable Service Vision for Caltrain that provides maximum value to its customers. The development of this Service Vision will require an understanding of the near-, medium and long term market for rail service in the corridor and an analysis of the different service approaches that could satisfy these demands. A "business case" approach to the analysis of service options will allow ridership and other mobility benefits to be weighed against costs and infrastructure requirements.
- The Caltrain corridor has a complex interface with the communities it traverses. The implementation of new services and infrastructure on the corridor will create a range of community benefits, opportunities and impacts. The Business Plan can address this reality by exploring economic, policy and technical approaches that will allow Caltrain to strategically and equitably manage its interface with communities in a way that minimizes impacts, generates value, and supports the Service Vision.
- Finally, the selection of a Service Vision will influence how the Caltrain organization evolves over time. Caltrain's organizational, governance, and commercial and contracting strategies will be evaluated as part of a comprehensive structural assessment of what is needed to deliver value and support the long term success of the Service Vision.

Attachment 2: Draft Business Plan Scope of Work

Background: The following pages present a high level draft scope of work for the Caltrain Business Plan along with a description of outreach plans, project management structure, budget and potential funding sources. The scope and project management portions of this document are presented for review and comment and will ultimately be proposed for Board adoption. The scope has been written at a level of detail that describes the general organization, purpose and proposed outputs of individual project tasks while leaving flexibility to accommodate a range of detailed technical approaches and adaptation based on changing project needs and expert input. Subsequent to adoption, staff will return to the Board if a material deviation from the scope is anticipated or requested.

More detailed technical work scopes for individual tasks and plan components will be developed and provided to the JPB's Caltrain Business Plan Ad Hoc committee for their review and comment throughout the Business Plan process.

Task 1- The "Strategic Case" for Caltrain

Rail infrastructure investments have decades-long lifespans and the Business Plan will have a long range outlook. The Plan will begin by defining the potential markets and strategic opportunities for rail service on the Peninsula Corridor through 2040 (a horizon year that is consistent with the California State Rail Plan and the Regional Transportation Plan).

The "Strategic Case" for Caltrain will present an analysis of current and projected demographic, economic development and travel pattern trends in the corridor, region and mega-region. In doing so it will frame the strategic importance of the Caltrain corridor and its role in supporting the long term growth and mobility of the region. The "Strategic Case" will also consider Caltrain's "competitors" including the ability of the Bay Area's freeway network to accommodate projected growth in travel demand as well as a discussion of how autonomous vehicles and other emerging technologies might shape Caltrain's long term market outlook and business approach.

Finally, in addition to defining the strategic importance of the corridor and reviewing local and regional market opportunities, the Strategic Case will also contextualize the long term development potential of the Caltrain corridor relative to other, comparable national and international rail corridors.

Task 2A - Service Business Case Analysis

Task 2A will involve the development of multiple "scenarios" or "evolutionary paths" showing how the Caltrain service and corridor could grow between 2022 and 2040. The work will start with operational analysis to understand how many trains per hour could run on the corridor in 2040, how local and express services could be balanced, where trains could stop and how they could connect to a larger state and megaregional rail network.

This operational analysis will pay particular attention to the blending of Caltrain service with High Speed Rail service as well as the operations and infrastructure outcomes at the North Terminal (4th and King and DTX/ TTC), a potential Dumbarton rail interface at Redwood City, at the South Terminal (including San Jose Diridon Station) and in the southern portion of the corridor stretching from San Jose to Gilroy.

From there, the project team will analyze the range of ridership and benefits associated with each service scenario, the infrastructure and fleet that would be required to deliver the service, and the kinds of costs and impacts the service would create. Finally, the team will analyze the incremental service steps and infrastructure investments that make up different "evolutionary paths" for how Caltrain could grow over time from its current service, through electrification and into each of the ultimate 2040 scenarios contemplated. This full set of analysis will be used to develop "Business Cases" around each scenario, laying out the cumulative set of costs and benefits associated with each "evolutionary path" that Caltrain could take. **In the summer of 2018 staff will present this analysis to the Board to aid in the selection of a single (or non-exclusive combination of) service scenarios as the basis for a "Service Vision."**

Task 2B – Organizational Assessment

In parallel to Task 2A the technical team will also work on Task 2B; a structural assessment of the "Caltrain Organization." Within the context of the Business Plan the term "Caltrain Organization" is used broadly to encompass the total set of present and future governance structures, organizations, staff and contracted entities responsible for the funding, direction and delivery of the Caltrain service as well as the construction and maintenance of the corridor's facilities.

Within Task 2B, the technical team will map the existing Caltrain organization and identify key performance indicators and measures to help describe and quantify how the Caltrain organization functions and its effectiveness at delivering value for money spent. The plan will then include a comparative analysis of peer railways and organizations both locally, domestically and internationally, reviewing alternative approaches to how a railway can be organized. Finally, Task 2B will include a high level analysis of how organizational needs may change in tandem with the long rang service scenarios under consideration in Task 2A. **This information will be presented to Caltrain's partners and the Board in the summer of 2018 with a request that they provide feedback on the subsequent development of options for an "Organizational Strategy" that could support the delivery of the Service Vision.**

Task 2C – Community Interface Assessment

Along with Tasks 2A and 2B, the technical team will also conduct an analysis of the railroad's community interface and an assessment of equity considerations related to the development and evolution of the railroad.

Much as in the preceding tasks, the focus of Task 2C will be the development of an analytical and policy framework that assists staff and stakeholders in understanding and quantifying issues related to community interface and equity considerations.

This work will include a description and quantified framework for thinking about the major ways in which the railroad and its services add value to individual communities and the region as a whole including improved environmental outcomes and impacts to land values. The project team will also document and quantify the ways in which the railroad creates externalized costs and impacts in its surrounding communities including noise and vibration and safety and traffic impacts at at-grade crossings. In documenting these benefits and impacts the project team will specifically consider equity issues- focusing on the potential for different geographies or demographic groups to be affected unequally as the railroad changes and grows. Finally, the project team will consider and conduct more detailed analysis related to two major known community interface issues; the impacts of increased rail service on at-grade crossings and the potential for development and change at specific Caltrain land holdings and opportunity sites along the corridor. **This information will be presented to Caltrain's partners, local jurisdictions and the Board in the summer of 2018 with a request that they provide feedback on the subsequent development of a "Community Interface Strategy" that could support the delivery of the Service Vision.**

Task 3- Developing the Business Plan

Based on the Board's adoption of a long range Service Vision in the summer of 2018, the project team will work to translate the Vision into a focused, long range business plan that will be presented to the Board for review and proposed adoption at the end of the year. The technical scope for the second half of the business plan is necessarily looser at this early stage in the project but will include the core elements described below.

First, the project team will conduct additional technical work and modeling to optimize, validate and add detail to the adopted Service Vision. Additional operational and infrastructure analysis will be employed to help the Board further consider the incremental options for growing the railroad over time along with the service trade-offs and investments that may be required. Further financial and ridership modeling will also be conducted to validate the costs, revenues and benefits of specific investments in the Caltrain corridor and service. This analysis will place a particular focus on the investments and strategies that can be employed to optimize the first 10-years of the electrified system's operation. In seeking to optimize the overall "business case" for Caltrain service, the project team will also expand the range of issues considered. The team will review ancillary business strategies and options to generate revenue and add customer value and will incorporate ongoing planning work related to first- and last-mile connections and joint development as well fares and retailing strategies into the analysis of service benefits and financial performance.

The technical team will also develop an "organizational strategy" based on the Board's mid-year feedback and ongoing input from Caltrain partner agencies.

This strategy may include analysis and recommendations related to potential options for how the Caltrain organization could change and grow in conjunction with the evolution of Caltrain's service and may also include recommendations related to Caltrain's contracting and commercial approach.
The strategy will be supported by appropriate legal, regulatory and financial analysis and will be framed using the organizational evaluation criteria developed in Task 2 of the Business Plan. The organizational strategy will also be designed to demonstrate how Caltrain can organize to most effectively access and use financial resources. This may include options for optimizing the organization to take full advantage of both existing and contemplated revenue and funding streams including new funding sources, value capture strategies, and private investment. Finally, the organizational strategy will describe a series of next steps, options and issues for discussion that Caltrain may pursue in coordination with its funding partners and other regional and state agencies.

The technical team will also develop a "community interface strategy" as part of the final Business Plan. It is anticipated that this Strategy may include a detailed, quantified assessment of the secondary community impacts and benefits that will be created through the implementation of the Service Vision. It may also include a discussion of options for how Caltrain could work with partner communities to best leverage and maximize the value its service creates including recommendations related to value capture, joint development and use of Caltrain-owned property. The strategy may also include recommendations for how Caltrain can mitigate the impacts of increased rail service on communities and how the timing of these mitigations could relate to the build out and realization of the Service Vision. In the case of impacts at at-grade crossings, recommended mitigations could include analysis of new and innovative policy approaches designed to maximize public benefit and utilize resources equitably and efficiently. Finally, the community interface strategy may include specific options and recommendations for how Caltrain can improve and address equity outcomes, both among its customers as well as within the communities it traverses, as it implements the Service Vision.

Task 4- Funding and Implementation

The Business Plan will conclude with a detailed funding plan that shows how the recommendations and investments identified can be paid for. This funding plan will show how the agency can use self-generated revenues and leverage its assets to deliver maximum customer benefit and public value. Where new sources of outside funding may be needed, the plan will present choices and analysis of specific measures, value capture approaches or public-private partnering strategies that could be used effectively. This funding plan will be paired with a consolidated implementation plan that makes detailed, specific recommendations about actions and next steps required to advance the Service Vision and Business Plan. This implementation plan will be specifically focused on the actions Caltrain may to take in the next five years and will also describe issues where partnering with local communities and Caltrain partner agencies or other government agencies may be required.

Education and Outreach Plan

The Business Plan will be a complex effort that touches on issues that are of wide interest to Caltrain's customers as well as a range of stakeholders and publics within and beyond the Caltrain corridor. A robust program of education and outreach will accompany the technical work of the Business Plan.

The complexity of the Business Plan requires the development of thoughtful educational materials that help explain the connections between abstract technical and policy choices and the real world outcomes that Caltrain's customers and communities care about. The project team will develop an excellent dedicated website and set of written and visual communication tools that help explain the work of the Business Plan in a format that is engaging to a wide audience and helps facilitate meaningful, informed discussion of the policy issues under consideration.

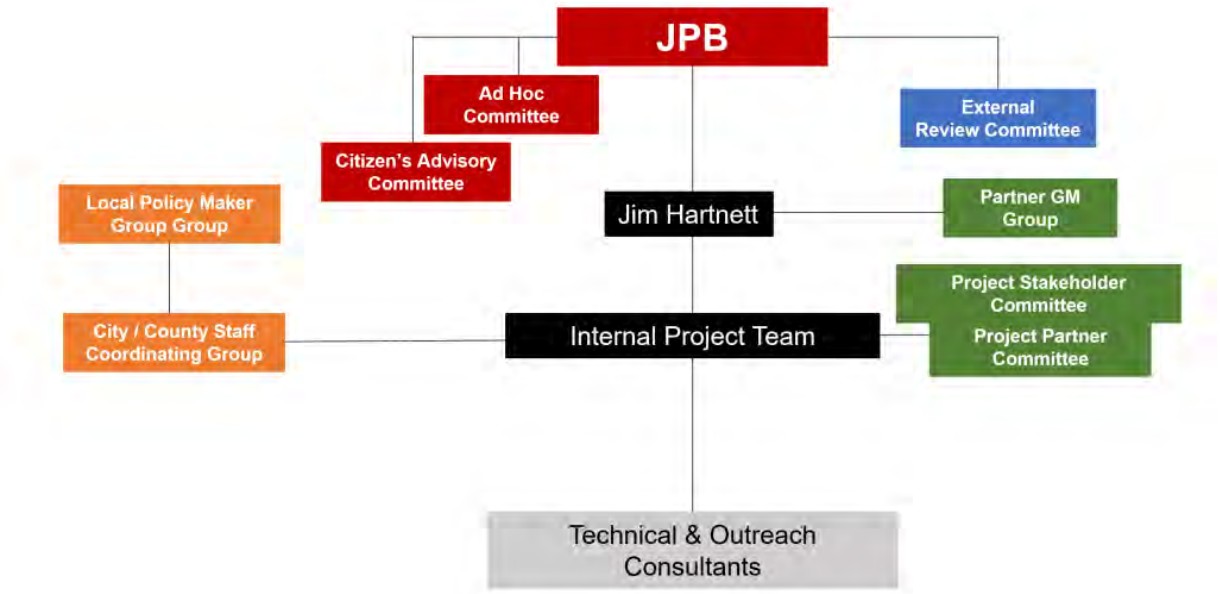
These educational tools will provide the foundation for a deep program of public and stakeholder outreach. During the Business Plan process Caltrain will engage with its customers and the public along the entire corridor through community meetings, station-based outreach, customer and community surveying, and tradional/social media. The project team will also seek to coordinate with partner meetings and community events throughout the corridor to amplify the outreach campaign's penetration to customers and the public.

In addition to customer and broader public outreach, the project team will also engage with stakeholder staff and policy makers at the local, state and federal levels. Caltrain's City and County Staff Coordinating Group and Local Policy makers Group are named within the project structure as subsequently shown. These regular meetings will be supplemented by additional direct outreach to local jurisdiction policy makers and staff as requested or when specific technical considerations will benefit from locally focused discussion. The project team anticipates quarterly outreach to state and federal policy makers to make sure they are informed of the Business Plan's progress and have an opportunity to provide feedback and input.

Caltrain's partner agencies and staff are included within the formal project structure of the Business Plan (as subsequently described). Additionally, however, Caltrain will update its partners on a regular basis and plans to present Business Plan materials to partner agency Boards as well as County Board of Supervisors in Santa Clara, San Mateo and San Francisco at key moments in the project or as requested.

Finally, the project team will engage with corridor business groups and advocacy organizations whose mission and goals intersect with subjects and issues considered in the Business Plan. Some business and advocacy groups will be represented in the formal project structure (as shown) but the project team will also engage in sustained, direct outreach to these and other groups throughout the Business Plan process.

Project Structure
The work of the Business Plan will be developed within the project structure shown and described below.



Internal Structure: Within the Caltrain organization, the Caltrain Business Plan will be managed as an integrated project structure reporting directly to Caltrain's Executive Director Jim Hartnett.

The Internal Project Team will be led by Sebastian Petty, Senior Policy Advisor and full-time project manager. The project manager will be supported by a cross-disciplinary internal team of executives and staff representing key functions and competencies within the Caltrain organization.

Project Partner and Stakeholder Committees: The Project Partner Committee will meet monthly and will include staff representatives from JPA member agencies as we as all of the Business Plan's funding entities or their designees. The Project Partner Committee will provide input on ongoing project technical work and outreach materials and will serve as liaisons to their respective organizations.

The Project Partner Committee will be a subset of a larger project stakeholder committee. This larger stakeholder group will meet approximately four times during the project and will participate in the review of technical and outreach materials. The stakeholder committee will include all Project Partner Committee members as well as representatives from the following:

- Staff from JPA member agencies (Santa Clara Valley Transportation Authority (VTA), City and County of San Francisco (CCSF), SamTrans)
- Staff from funding partners (Metropolitan Transportation Agency (MTC), California High Speed Rail Authority (CHSRA), California State Transportation Agency (CalSTA)
- Local Jurisdiction Representatives
- Business Community Representatives
- Advocacy Group Representatives

Partner General Manager Group: On an approximately quarterly basis or in advance of major project milestones Jim Hartnett will convene a meeting of the General Managers of Caltrain's partner agencies (including JPB member agencies as well as MTC, CHSRA and an appropriate designee from CalSTA) to discuss project findings and review materials.

External Review: The "External Review Committee" will be comprised of an academic panel and/or designated industry group (such as APTA or the International Union of Railways). This committee will be charged with developing an independent, written review of Business Plan materials at least two times during the Plan process. These reviews will be provided directly to the JPB as well as to Caltrain's partner agencies and the project stakeholder group.

Local Policy Makers Group and City/County Staff Coordinating Group: The project team anticipates utilizing Caltrain's Local Policy Maker's Group and City / County Staff Coordinating Group as a venue for important feedback from local jurisdictions with updates to these groups occurring on a bi-monthly basis. It is proposed that each of these groups be expanded beyond their current composition of jurisdictions from San Francisco to San Jose to also include policy makers and staff from the cities of Morgan Hill and Gilroy.

Board Involvement: The JPB has established an Ad Hoc Committee to guide the development of the Business Plan. This Committee will meet on an approximately monthly basis for the duration of the Business Plan process and will review all major project materials and deliverables before their release to the public or introduction to the full Board.

The Board will also receive reports from Caltrain's Citizen Advisory Committee (the CAC). The CAC will receive regular project updates throughout the Business Plan process paralleling the project updates that go to the JPB.

It is proposed that the full JPB will take action on the Business Strategy, Service Vision and Business Plan as described previously.

It is anticipated that the Board will receive major informational updates during the spring and fall 2018 and will also hold at least one informational half-day workshop (likely timed for early summer 2018, prior to the proposed adoption of the Service Vision).

Budget Estimate and Funding Proposal:
The Business Plan has been scoped as a large-scale, rigorous effort that must simultaneously address multiple lines of specialized technical inquiry while supporting detailed engagement with multiple stakeholder communities and the public. It will be resource intensive.

Staff estimates that the total cost for consultant services on the Business Plan (including technical work, outreach, independent review, project management and contingency) will be approximately $5,000,000. The estimated cost to complete the first half of the Business Plan (including Tasks 1 and 2) is $2,175,000.
Staff anticipates that funding for the business plan will come from a variety of potential sources including already budgeted Caltrain project development funds, JPB partner contributions, regional contributions, state funding and private contributions. It is anticipated that some contributions may come as in-kind consultant support rather than direct financial contributions. It is also anticipated that the project will be cash-flowed and that not all funding will be secured before work commences. Staff is engaged in various conversations related to funding opportunities and timing and anticipates returning to the Board with a defined funding plan in January.

Caltrain Business Plan

Draft Busines Strategy and Scope

Board of Directors
December 7, 2017
Agenda Item 9

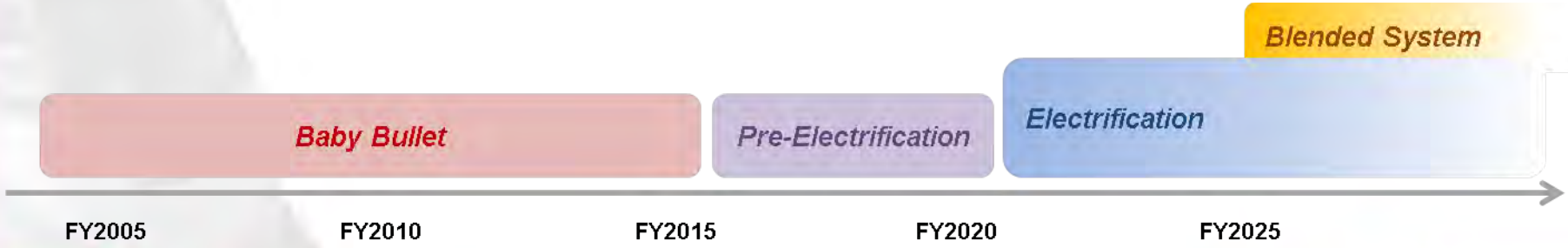
Overview

- Background and Process
- Draft “Business Strategy”
- Draft Phase 2 Scope
  - Technical Tasks
  - Outreach
  - Project Organization
  - Funding
- Next Steps

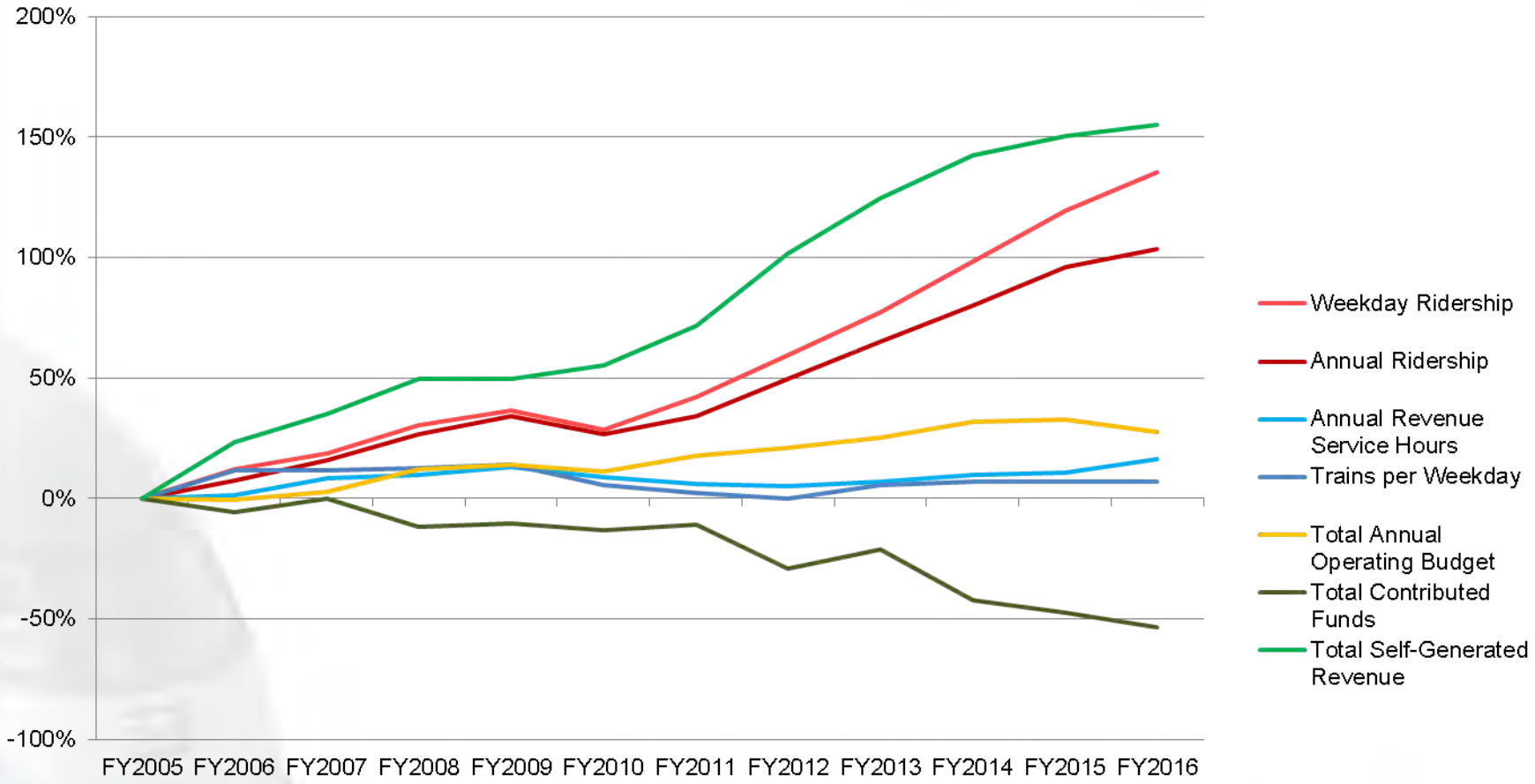
Background and Process

Background - Caltrain's Changing Business Context

- Since 2005:
  - Ridership increasing while service held constant
  - Declining operating subsidies and increased reliance on fare revenue
  - Constrained capital funding
  - Signature investment in modernization and commitment to blended system



Background- Business Metrics



Percentage Change in Key Operating Metrics - CPI Adjusted

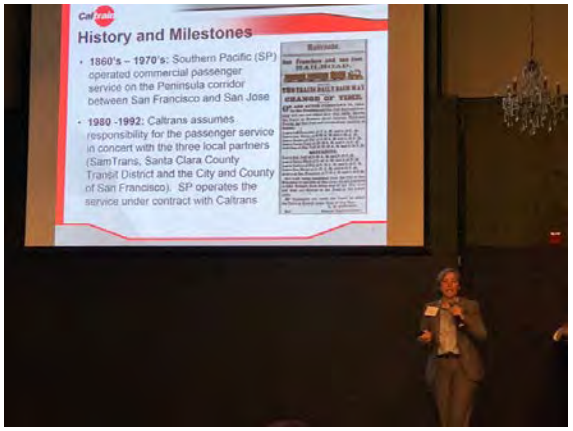
Process

- April 2017 - Business Plan concept introduced to JPB
  - Background context
  - Discussion of need an conceptual elements
- July 2017 – Update to JPB
  - Refinement of conceptual elements
  - Phasing of plan
- August 2017 – Formation of Ad Hoc Committee

Process Continued…

- August 2017
  - Citizen Advisory Committee and Local Policy Maker Group briefings
- September 2017
  - Meetings of JPB Ad Hoc Sub-Committee
  - Corridor Stakeholder Workshop (9/20)
- October – November 2017
  - Ongoing stakeholder outreach
  - Draft Business Strategy and Scope Development

Stakeholder Workshop



Stakeholder Workshop - Participants

- Board Ad Hoc Committee
- Partner agency General Managers and staff
- State and regional agencies
- Peer railroads (ACE, Capitol Corridor, BART)
- LPMG delegation
- Advocacy groups (SPUR, Friends of Caltrain)
- Private sector groups and companies

Stakeholder Workshop – Topics

- Caltrain history and background
- Local, regional and state context
- Brainstorming
  - "Vision" for Caltrain's future
  - Challenges and obstacles
- Expert Presentations
  - Business context of European passenger rail
  - Business planning and business case analysis

Draft Business Strategy

Key Questions

- Stakeholder outreach helped identify three “big picture” interrelated questions

Draft Business Strategy

- **Caltrain's core business is rail service.**
  The Caltrain organization exists to manage the delivery of rail service, as well as the assets, infrastructure and ancillary activities that are required to support that delivery.

What is the Service Vision for Caltrain?

- Today Caltrain provides a commuter rail service that primarily serves weekday commuters and special event attendees. After electrification, Caltrain will face choices about how best to expand and tailor its service to support a much broader range of mobility markets. **The primary task of the Business Plan is to aid in the selection of a detailed, achievable Service Vision for Caltrain that provides maximum value to its customers.** The development of this Service Vision will require an understanding of the near-, medium and long term market for rail service in the corridor and an analysis of the different service approaches that could satisfy these demands. A "business case" approach to the analysis of service options will allow ridership and other mobility benefits to be weighed against costs and infrastructure requirements.

Draft Business Strategy

- The selection of a Service Vision will influence how the Caltrain organization evolves over time. **Caltrain's organizational, governance, and commercial and contracting strategies will be evaluated as part of a comprehensive structural assessment of what is needed to deliver value and support the long term success of the Service Vision.**
- The Caltrain corridor has a complex interface with the communities it traverses. The implementation of new services and infrastructure on the corridor will create a range of community benefits, opportunities and impacts. **The Business Plan can address this reality by exploring economic, policy and technical approaches that will allow Caltrain to strategically and equitably manage its interface with communities in a way that minimizes impacts, generates value, and supports the Service Vision.**

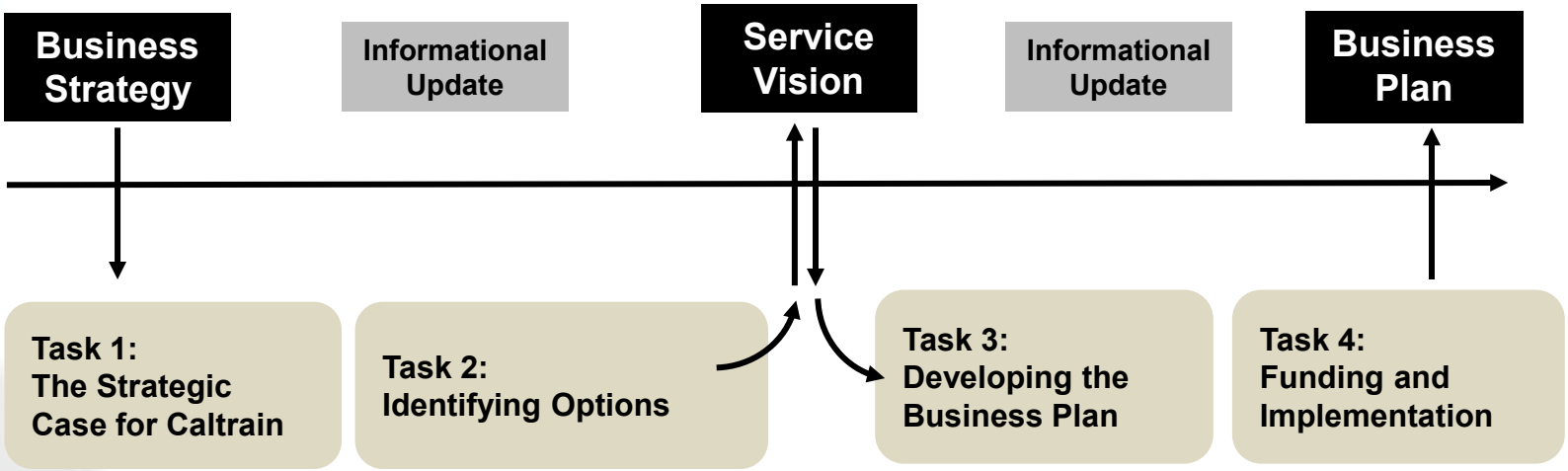
How Can the service be delivered as effectively as possible?

How does Caltrain interact and connect with the communities it touches?

Draft “Phase 2” Scope of Work

Overview

Board Process



Technical Work

- Task 2A: Service Business Case Analysis
- Task 2B: Organizational Assessment
- Task 2C: Community Interface Assessment

Task 1- the "Strategic Case" for Caltrain

- Define the long range markets and opportunities for rail service on the Peninsula
- Consider opportunities for connection and integration with other systems
- Understand local, regional and mega-regional demographic trends, development patterns and environmental context as they relate to rail
- Consider the long range outlook of the overall future Bay Area Transportation Network

Task 2A- Service Business Case Analysis

- Consider options for the evolution of rail service on the Peninsula corridor (trains/hour, local vs. express, stopping patterns and connectivity)
- Understand infrastructure, fleet, ridership, cost and revenue implications of different service options
- **Present analysis to the Board to aid in the selection of a "Service Vision" to guide long range planning and business development**

Task 2B- Organizational Assessment

- Describe and outline the current “Caltrain Organization” including governance structures, partnerships, managing agency and contracted entities
- Identify metrics and measures to describe, quantify and assess organizational characteristics and functions
- Compare organizational approaches utilized by peer railways including local, domestic and international examples
- **Present analysis to the Board to for feedback so that staff can develop options for an organizational strategy to support the Service Vision**

Task 2C- Community Interface Assessment

- Identify and quantify the full range of community impacts, benefits and opportunities the railroad creates
- Focused analysis to better understand and describe the extent of Caltrain's impacts at at-grade crossings
- Focused analysis to better define and understand options for joint development and value capture along corridor
- **Present analysis to the Board to for feedback so that staff can develop options for a community interface strategy to support the Service Vision**

Proposed Board Action – Adopt a "Service Vision"

- Adopt a long range "Service Vision" for the Caltrain corridor including number of trains per hour, mix of express and local services, stopping patterns and desired connectivity to the regional, interregional and state rail network. Vision would include;
  - Incremental, interim steps and timeframes to evolve from current service levels to the 2040 Service Vision
  - Preliminary performance targets for Caltrain service including ridership, service characteristics, costs and revenues.
- Serves as the basis for developing a full Business Plan as well as an Organizational Strategy and Community Interface Strategy in Tasks 3 and 4

Task 3- Develop the Business Plan

- Validate, optimize and refine the service assumptions included in the “Service Vision”. Detailed focus on the first 10-years of electrified service
- Incorporate additional issues and strategies including customer experience, first- and last-mile connections, TOD, fares and retailing strategies
- Work with Caltrain’s partners to develop an organizational strategy that shows options for how all aspects of the organization could grow and change in support of the Service Vision
- Work with Caltrain’s partners and local jurisdictions to develop a community interface strategy that shows options for maximizing the community benefits the Service Vision creates while minimizing and mitigating impacts

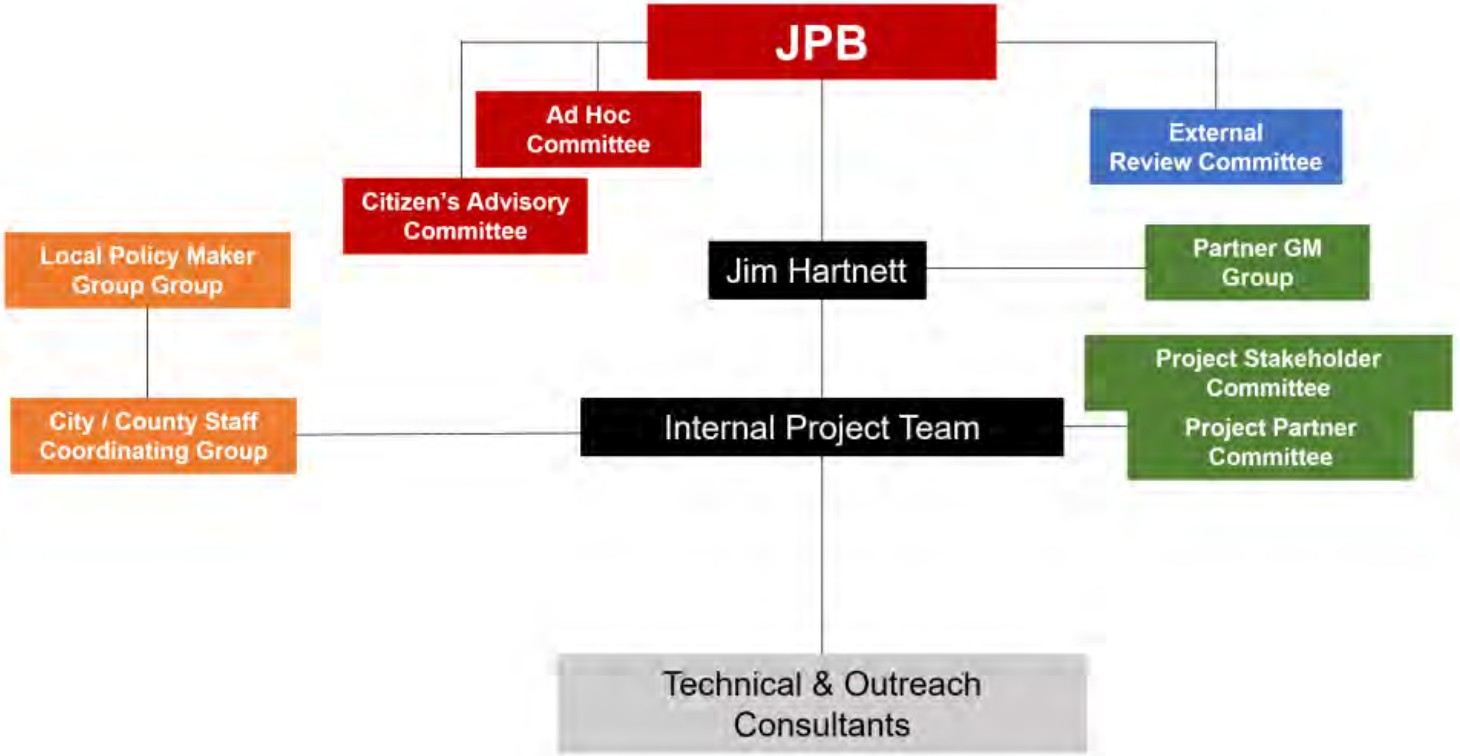
Task 4- Funding and Implementation

- Develop a funding plan or funding scenarios for implementation of recommend services and investments
- Understand what can be funded through self-generated revenues and monetization of assets
- Identify where new funding sources may be needed and analyze potential options including measures, value-capture strategies and public private partnerships
- Develop a focused implementation plan that identifies steps that the organization and its partners must take within the next 5-years

Outreach and Engagement

- Major outreach and engagement campaign planned
- Customer and public engagement through dedicated website and visual communications tools, meetings, station-based outreach, social media engagement and surveying
- Coordination with local jurisdiction staff and policy makers through the City and County Staff Coordinating Group / LPMG as well as direct meetings
- Outreach to state and federal policymakers
- Presentations to partner agency boards and committees
- Coordination and outreach to community groups, advocacy organizations and business groups

Project Structure



Budget and Funding

- Substantial technical effort requiring specialized expertise in multiple fields
- Initial consultant cost estimate of $5,000,000 for all technical and outreach activities
- Cashflowing of work possible
- Seeking funding from various potential sources including already budgeted Caltrain project development funds, JPB partner contributions, regional contributions, state funding and private contributions
- Initial funding plan will be presented in January

Next Steps

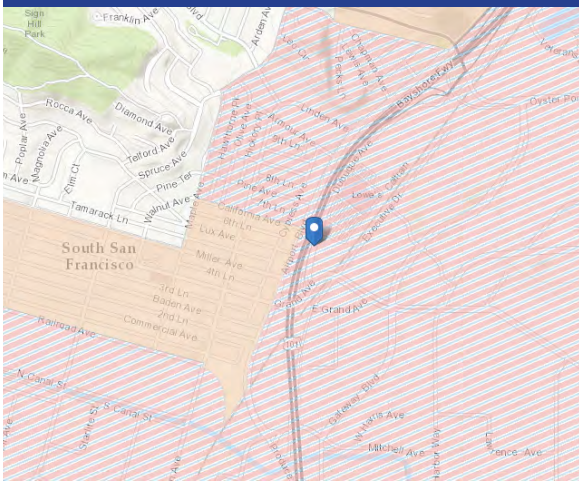
- Continue outreach and take feedback on materials
- Revise Business Strategy and Scope
- Identify funding and begin consultant procurement activities
- Present refined Business Strategy and Scope to Board for proposed adoption in January 2018

Attachment E.

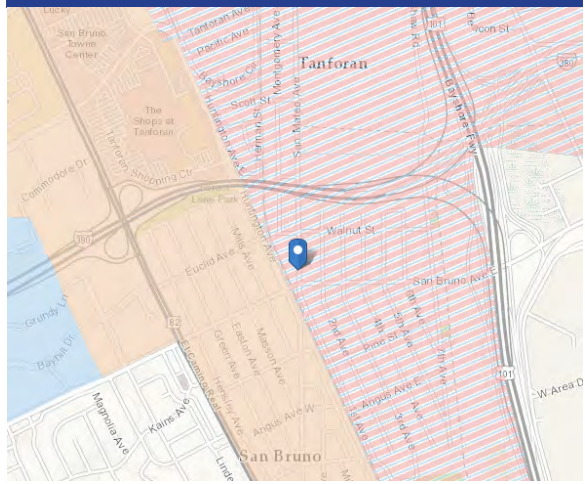
Disadvantaged and Low-Income Community Map

Caltrain Stations located within the boundaries of a disadvantaged or low-income community census tract are shown below.

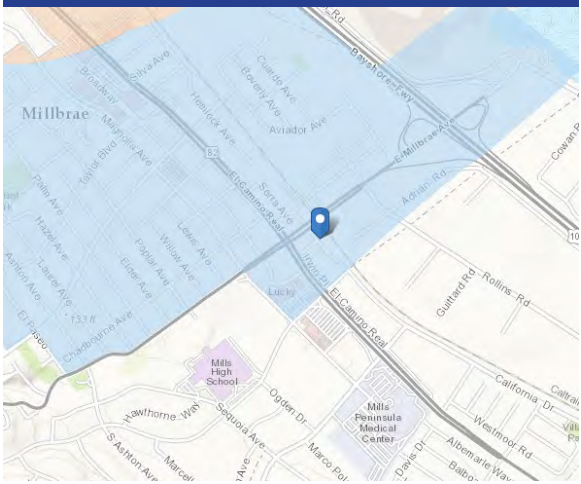
South San Francisco Station



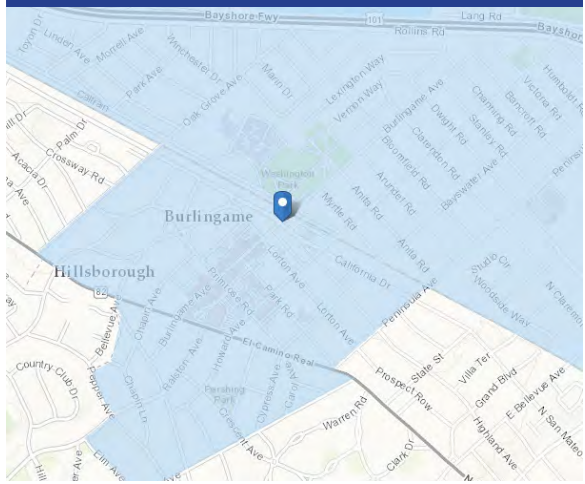
San Bruno Station



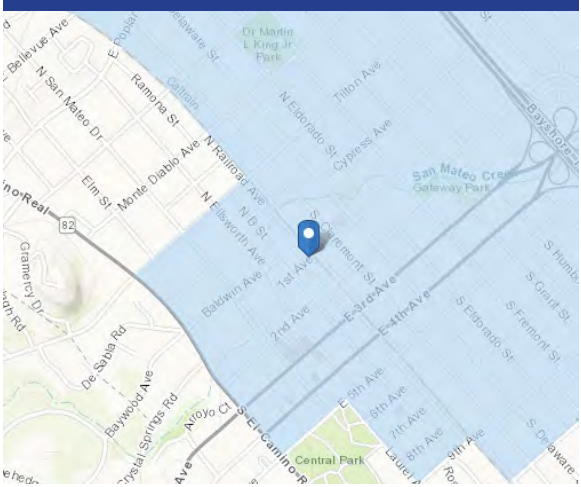
Millbrae Station



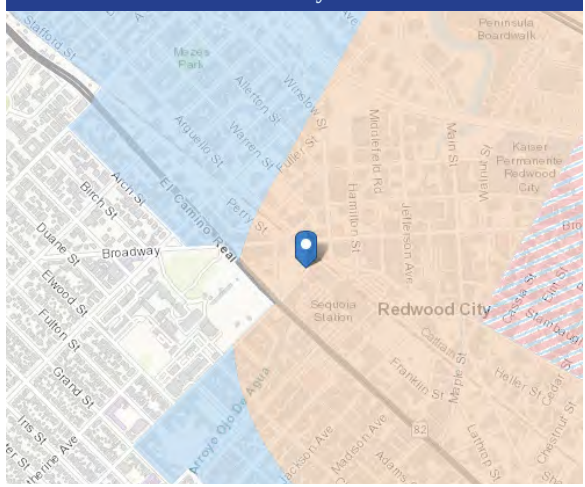
Burlingame Station



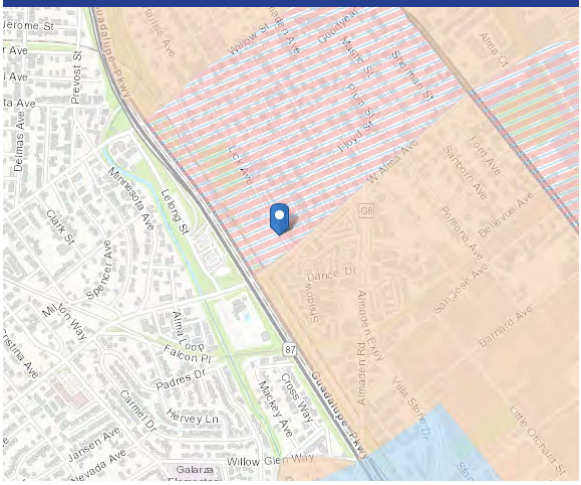
San Mateo Station



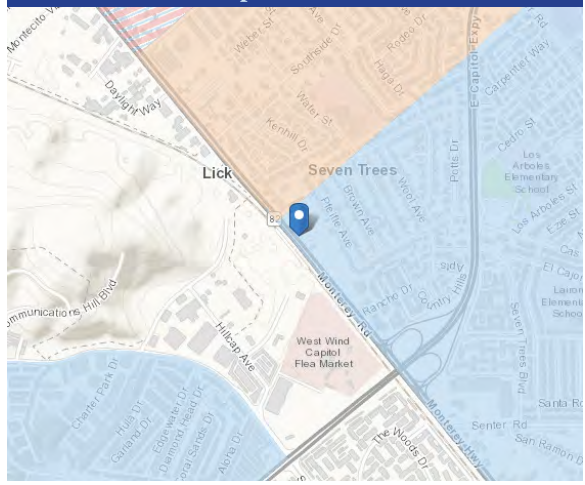
Redwood City Station



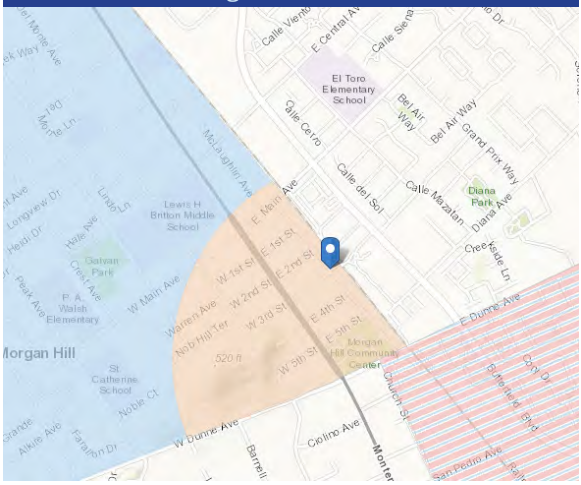
Tamien Station



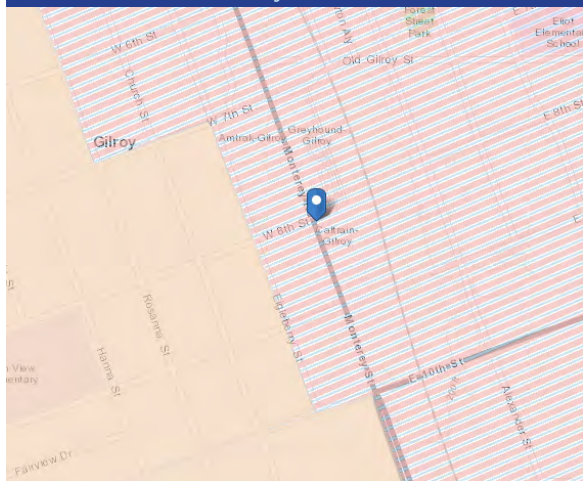
Capitol Station



Morgan Hill Station



Gilroy Station



Attachment F.

Ridership Documentation

Calculations and backup for Caltrain data entered into CARB Model

Quantifiable Component 1 - Capacity Increases

Ridership Increase

Quantitative basis for ridership calculation is the delta of projected ridership (and benefits) between old (2013) projections and revised (2017) projections
Increase in a projected ridership is a result of increased actual demand (above baseline growth) as well as a long term increase in assumed service to the Transbay Terminal
Accomodating this increased ridership demand will require additonal capacity.

2013-based prototypical weekday projection vs 2017-based prototypical weekday projections

	FY2022		FY2052	
	Weekday	Annualized	Weekday	Annualized
2013-based	73379	23,331,224	136795	43,494,661
2017-based	81741	25,989,904	162642	51,712,845
Delta	8,362	2,658,680	25,847	8,218,184

ANNUALIZATION	2015	2016
Income-based annual ridership	19,002,969	18,743,189
Income-based Weekday ridership	59,582	59,132
Annualization factor	318.94	316.97
Average	317.96	

VMT and KWH Calculations

VMT calculations are based on a comparision of prototypical schedules running 6-car EMU consists vs 8-car consists.

	Prototypical Schedule w 6-car EMUs (VMT-Scenario 1A6)	Prototypical Schedule w 8-car EMUs (VMT-Scenario 1A8)	Delta
Diesel Vehicle VMT (per car)	2,368,080	2,368,080	-
Diesel Fuel Used	1,293,761	1,293,761	-
EMU Vehicle VMT (per EMU car)	8,900,100	11,866,800	2,966,700
Killowat Hours Consumed	83,212,223	110,216,297	27,004,074

Quantifiable Component 2 - Broadband Communictions

Ridership Increase

Quantitative basis for ridership calculation 3% increase in ridership capital corridor observed for "continuing, high frequency riders" when the impacts of adding wi-fi to their service were studied. This increase in expected ridership has been applied to ridership projections as shown

	FY2022		FY2032	
	Weekday	Annualized	Weekday	Annualized
2017-based Ridership Projections	81741	25,989,904	108369	34,456,365
3%		701,727.41		930,321.85

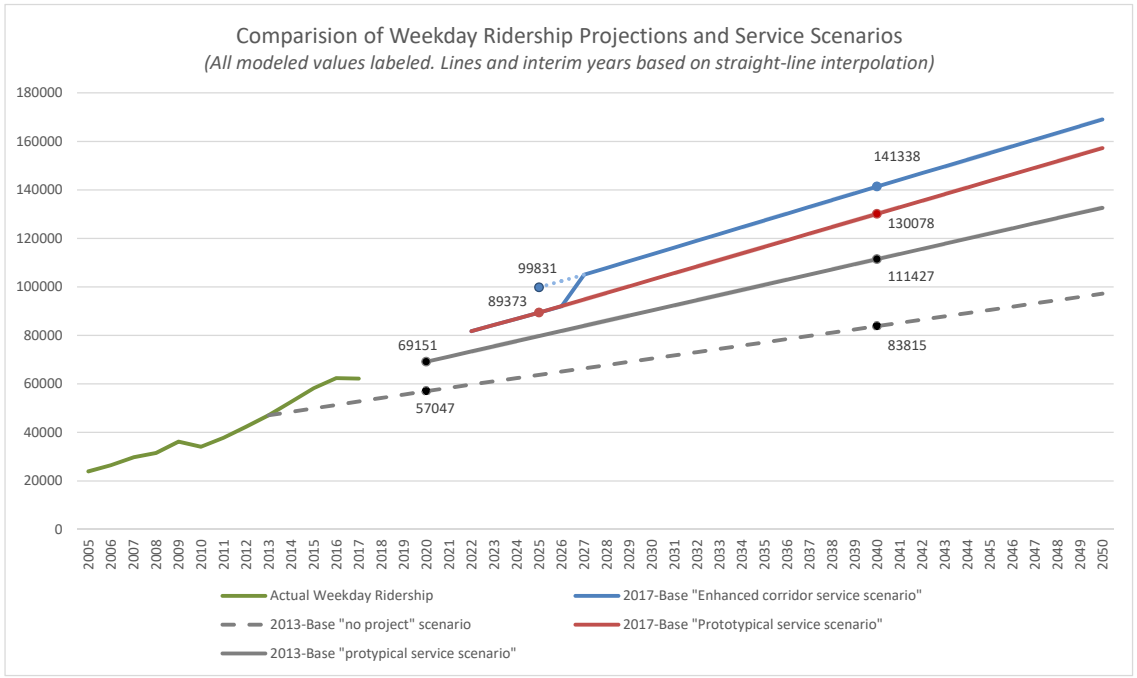
Quantifiable Component 4 - Conversion of Mainline Fleet to all 8-car EMUs										
VMT and KWH Calculations										
VMT calculations are based on a comparision of VMT scenario 1A - 8 and VMT- Scenario 2B										
		Prototypical Schedule w mixed fleet and 8-car EMUs (VMT-Scenario 1A8)			Prototypical Schedule w all 8-car EMUs (VMT-Scenario 2A)				Delta	
Diesel Vehicle VMT (per car)			2,368,080			308,880			(2,059,200)	
Diesel Fuel Used			1,293,761			168,751			(1,125,010)	1,125,009.60
EMU Vehicle VMT (per EMU car)			11,866,800			14,612,400			2,745,600	
Killowat Hours Consumed			110,216,297			133,557,832			23,341,535	
Quantifiable Component 5 - Cumulative "Enhanced" Service Scenario					NOTE - LIKELY REMOVE					
Ridership Increase										
Quantitative basis for ridership calculation is the delta between ridership projections for "prototypical" vs "enhanced service scenarios										
Benefit is characterized as cumulative since additional corridor investments will be required to realize full benefit. "Enahnced" schedule is assumed to come on line in 2027										
Prototypical weekday projection vs Enhanced weekday projections										
		FY2027		FY2052						
		Weekday	Annualized	Weekday	Annualized					
	Prototypical	94800	30,142,245	162642	51,712,845					
	Enhanced	105019	33,391,321	174544	55,497,019					
	Delta	10,219	3,249,077	11,902	3,784,174					
VMT and KWH Calculations										
VMT calculations are based on a comparision of prototypical schedules running 6-car EMU consists vs 8-car consists.										
		Prototypical Schedule w all 8-car EMUs (VMT-Scenario 2A)			Enhanced Schedule w 8-car EMUs (VMT-Scenario 3A)				Delta	
Diesel Vehicle VMT (per car)			308,880			308,880			-	
Diesel Fuel Used			168,751			168,751			-	
EMU Vehicle VMT (per EMU car)			14,612,400			23,764,400			9,152,000	
Killowat Hours Consumed			133,557,832			216,862,947			83,305,116	

Ridership Projection Comparison and Interpolation

Comparision of Weekday Ridership Projections and Service Scenarios

(All modeled values labeled. Lines and interim years based on straight-line interpolation)

Extrapolated enhanced														
2017-Base "Enhanced corridor service scenario"														
2017-Base "Prototypical service scenario"														
2013-Base "protypical service scenario"														
2013-Base "no project" scenario										47060	48487	49914	51341	52768	54195
Actual Weekday Ridership		23947	26533	29760	31507	36232	34120	37779	42354	47060	52611	58245	62416	62190	
	Year	2005	2006	2007	2008	2009	2010	2011	2012	**2013**	2014	2015	2016	2017	2018



Ridership Projection Comparison and Interpolation

Comparision of Weekday Ridership Projections and Service Scenarios

(All modeled values labeled. Lines and interim years based on straight-line interpolation)

						99831	102425	105019						
			81741	84285	86829	89373	91917	105019	107813	110607	113400	116194	118988	121782
			81741	84285	86829	89373	92087	94800	97514	100228	102941	105655	108369	111082
	69151	71265	73379	75493	77607	79721	81835	83949	86063	88177	90291	92405	94519	96633
55622	**57047**	58385	59724	61062	62401	63739	65077	66416	67754	69093	70431	71769	73108	74446
2019	**2020**	2021	2022	2023	2024	**2025**	2026	2027	2028	2029	2030	2031	2032	2033

Ridership Projection Comparison and Interpolation

Comparision of Weekday Ridership Projections and Service Scenarios

(All modeled values labeled. Lines and interim years based on straight-line interpolation)

124575	127369	130163	132957	135750	138544	141338	144105	146872	149639	152407	155174	157941	160708	163475	166242	169009	171776	174544
113796	116510	119223	121937	124651	127364	130078	132792	135505	138219	140933	143646	146360	149074	151787	154501	157215	159928	162642
98747	100861	102975	105089	107203	109317	111427	113541	115655	117769	119883	121997	124111	126225	128339	130453	132567	134681	136795
75785	77123	78461	79800	81138	82477	83815	85153	86492	87830	89169	90507	91845	93184	94522	95861	97199	98537	99876
2034	2035	2036	2037	2038	2039	**2040**	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052

Caltrain Scenarios for STIP
Prepared Dec 2017 CCAG-VTA Bi-County Model

Station	2017 Model	2017 Obs	2025 1A	2025 2A
SF Transbay	NA	NA	NA	NA
SF 4th/King	10,558	15,188	19,153	21,122
22nd St	1,730	1,747	3,182	3,121
Bayshore	567	237	1,243	1,130
SSF	777	481	1,132	742
San Bruno	705	704	794	797
Millbrae	2,120	3,487	5,027	5,879
Broadway	0	0	571	431
Burlingame	949	1,051	1,208	1,083
San Mateo	1,946	2,098	2,489	2,799
Hayward Park	537	376	1,019	723
Hillsdale	2,642	2,943	4,203	4,537
Belmont	636	588	879	883
San Carlos	1,348	1,318	1,969	1,940
Redwood City	2,395	3,813	5,299	5,324
Atherton	0	0	567	551
Menlo Park	1,201	1,725	2,335	2,216
Palo Alto	6,014	7,419	9,937	10,538
California Ave	1,272	1,609	1,858	1,516
San Antonio	727	865	1,066	1,090
Mountain View	3,611	4,551	6,742	6,652
Sunnyvale	2,056	3,302	4,736	4,869
Lawrence	1,329	887	1,609	1,362
Santa Clara	903	1,049	1,374	1,237
College Park	66	101	363	0
SJ Diridon	4,601	4,826	7,144	7,387
Tamien	1,049	1,244	2,242	1,864
Capitol	151	59	81	44
Blossom Hill	155	102	196	134
Morgan Hill	144	180	344	275
San Martin	113	68	111	147
Gilroy	511	171	500	414
All	50,811	62,189	89,373	90,807

By County	2017 Model	2017 Obs	2025 1A	2025 2A
San Francisco	12,855	17,172	23,579	25,373
San Mateo	15,256	18,584	27,492	27,905
Santa Clara	22,701	26,433	38,303	37,529
All	50,811	62,189	89,373	90,807

Caltrain Scenarios for STIP
Prepared Dec 2017 CCAG-VTA Bi-County Model

2025 3A	2040 1B	2040 2B	20403B
NA	21,488	15,206	21,506
23,722	10,584	14,694	10,943
3,769	5,984	3,672	4,770
1,918	3,634	3,356	4,095
912	1,860	1,146	1,283
669	1,391	1,388	1,160
6,850	6,540	7,854	9,778
0	970	664	0
1,493	1,751	1,799	2,103
2,976	3,656	3,799	4,212
681	1,813	1,423	1,222
4,782	6,100	6,347	7,130
1,022	1,312	1,286	1,466
1,929	2,685	2,589	2,579
5,739	7,465	7,367	8,149
0	873	662	0
2,172	3,140	2,972	2,748
10,732	13,759	13,923	14,527
2,087	2,483	2,134	2,926
961	1,542	1,523	1,362
7,276	9,307	8,994	10,030
5,489	6,623	6,872	7,670
1,251	2,447	2,122	1,867
1,925	1,587	1,448	1,760
0	362	0	0
8,159	12,391	12,811	13,662
2,286	2,628	1,979	2,485
46	80	93	84
126	383	280	246
316	581	547	521
94	180	182	143
452	1,012	944	910
99,831	136,611	130,078	141,338

2025 3A	2040 1B	2040 2B	20403B
29,409	41,690	36,928	41,314
29,223	39,556	39,298	41,831
41,199	55,365	53,852	58,193
99,831	136,611	130,078	141,338

Scenario 1A - Mixed Service 2025

Weekday Trains	# of trains by segment			Vehicle Miles		
	50	30	1		10%	
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	0	0	0	0	0	0
6	90	0	0	27000	2700	29700
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	24	6	0	8280	828	9108
7	0	0	0	0	0	0
All Diesel Vehicles	**24**	**6**	**0**	**8280**	**828**	**9108**
All EMU Vehicles	**90**	**0**	**0**	**27000**	**2700**	**29700**

Non-Weekday Trains	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	0	0	0	0	0	0
6	34	0	0	10200	1020	11220
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
All Diesel Vehicles	**0**	**0**	**0**	**0**	**0**	**0**
All EMU Vehicles	**34**	**0**	**0**	**10200**	**1020**	**11220**

Average Weekdays per Year	260
Average Non-Weekdays per Year	105

Annual Totals	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	-	-	-	-	-	-
6	26,970	-	-	8,091,000	809,100	8,900,100
Diesel Cars (# 'vehicles')						
5	-	-	-	-	-	-
6	6,240	1,560	-	2,152,800	215,280	2,368,080
7	-	-	-	-	-	-
All Diesel Vehicles	**6,240**	**1,560**	**-**	**2,152,800**	**215,280**	**2,368,080**
All EMU Vehicles	**26,970**	**-**	**-**	**8,091,000**	**809,100**	**8,900,100**
All Vehciles	**33,210**	**1,560**	**-**	**10,243,800**	**1,024,380**	**11,268,180**

Scenario 1A - Mixed Service 2025 SP - 12/28/2017

Fuel Consumption				Hotel Power Estimate	
	Fuel Consumption				
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	0	385.61	-
0	8.226	0	244312.2	289.21	26,029
2.953	0	0	0	293.80	-
3.278	0	4976.004	0	352.56	8,462
3.639	0	0	0	411.32	-
		4,976			**8,462**
			244,312		**26,029**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	0	385.61	-
0	8.226	0	92296	289.21	9,833
2.953	0	0	0	293.80	-
3.278	0	0	0	352.56	-
3.639	0	0	0	411.32	-
		0			**-**
		0	**92,296**		**9,833**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
-	82	-	-	385.61	-
-	82	-	73,212,223	289.21	7,800,000
2.953	-	-	-	293.80	-
3.278	-	1,293,761	-	352.56	2,200,000
3.639	-	-	-	411.32	-
		1,293,761	**-**		**2,200,000**
		-	**73,212,223**		**7,800,000**
		1,293,761	**73,212,223**	**-**	**10,000,000**

Scenario 1A - Mixed Service 2025

Weekday Trains	# of trains by segment			Vehicle Miles		
	50	30	1		10%	
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	90	0	0	36000	3600	39600
6	0	0	0	0	0	0
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	24	6	0	8280	828	9108
7	0	0	0	0	0	0
All Diesel Vehicles	**24**	**6**	**0**	**8280**	**828**	**9108**
All EMU Vehicles	**90**	**0**	**0**	**36000**	**3600**	**39600**

Non-Weekday Trains	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	34	0	0	13600	1360	14960
6	0	0	0	0	0	0
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
All Diesel Vehicles	**0**	**0**	**0**	**0**	**0**	**0**
All EMU Vehicles	**34**	**0**	**0**	**13600**	**1360**	**14960**

Average Weekdays per Year	260
Average Non-Weekdays per Year	105

Annual Totals	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	26,970	-	-	10,788,000	1,078,800	11,866,800
6	-	-	-	-	-	-
Diesel Cars (# 'vehicles')						
5	-	-	-	-	-	-
6	6,240	1,560	-	2,152,800	215,280	2,368,080
7	-	-	-	-	-	-
All Diesel Vehicles	**6,240**	**1,560**	**-**	**2,152,800**	**215,280**	**2,368,080**
All EMU Vehicles	**26,970**	**-**	**-**	**10,788,000**	**1,078,800**	**11,866,800**
All Vehciles	**33,210**	**1,560**	**-**	**12,940,800**	**1,294,080**	**14,234,880**

Scenario 1A - Mixed Service 2025 SP - 12/28/2017

Fuel Consumption				Hotel Power Estimate	
	Fuel Consumption				
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	325749.6	385.61	34,705.23
0	8.226	0	0	289.21	-
2.953	0	0	0	293.80	-
3.278	0	4976.004	0	352.56	8,462
3.639	0	0	0	411.32	-
		4,976			**8,462**
			325,750		**34,705**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	123061	385.61	13,110.86
0	8.226	0	0	289.21	-
2.953	0	0	0	293.80	-
3.278	0	0	0	352.56	-
3.639	0	0	0	411.32	-
		0			**-**
		0	**123,061**		**13,111**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
-	82	-	97,616,297	385.61	###########
-	82	-	-	289.21	-
2.953	-	-	-	293.80	-
3.278	-	1,293,761	-	352.56	2,200,000
3.639	-	-	-	411.32	-
		1,293,761	**-**		**2,200,000**
		-	**97,616,297**		**10,400,000**
		1,293,761	**97,616,297**	**-**	**12,600,000**

Scenario 2A - prototypical EMU Service 2027

Weekday Trains	# of trains by segment			Vehicle Miles		
	50	30	1		10%	
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	114	0	0	45600	4560	50160
6	0	0	0	0	0	0
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	0	6	0	1080	108	1188
7	0	0	0	0	0	0
All Diesel Vehicles	**0**	**6**	**0**	**1080**	**108**	**1188**
All EMU Vehicles	**114**	**0**	**0**	**45600**	**4560**	**50160**

Non-Weekday Trains	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	34	0	0	13600	1360	14960
6	0	0	0	0	0	0
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
All Diesel Vehicles	**0**	**0**	**0**	**0**	**0**	**0**
All EMU Vehicles	**34**	**0**	**0**	**13600**	**1360**	**14960**

Average Weekdays per Year	260
Average Non-Weekdays per Year	105

Annual Totals	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	33,210	-	-	13,284,000	1,328,400	14,612,400
6	-	-	-	-	-	-
Diesel Cars (# 'vehicles')						
5	-	-	-	-	-	-
6	-	1,560	-	280,800	28,080	308,880
7	-	-	-	-	-	-
All Diesel Vehicles	**-**	**1,560**	**-**	**280,800**	**28,080**	**308,880**
All EMU Vehicles	**33,210**	**-**	**-**	**13,284,000**	**1,328,400**	**14,612,400**
All Vehciles	**33,210**	**1,560**	**-**	**13,564,800**	**1,356,480**	**14,921,280**

Scenario 2A - prototypical EMU Service 2027 SP - 12/28/2017

Fuel Consumption				Hotel Power Estimate	
	Fuel Consumption				
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	412616.16	385.61	43,959.96
0	8.226	0	0	289.21	-
2.953	0	0	0	293.80	-
3.278	0	649.044	0	352.56	2,115
3.639	0	0	0	411.32	-
		649			**2,115**
			412,616		**43,960**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	123061	385.61	13,110.86
0	8.226	0	0	289.21	-
2.953	0	0	0	293.80	-
3.278	0	0	0	352.56	-
3.639	0	0	0	411.32	-
		0			**-**
		0	**123,061**		**13,111**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
-	82	-	120,201,602	385.61	12,806,229.14
-	82	-	-	289.21	-
2.953	-	-	-	293.80	-
3.278	-	168,751	-	352.56	550,000
3.639	-	-	-	411.32	-
		168,751	**-**		**550,000**
		-	**120,201,602**		**12,806,229**
		168,751	**120,201,602**	**-**	**13,356,229**

Scenario 3A - Enhanced EMU Service 2027

Weekday Trains	# of trains by segment			Vehicle Miles		
	50	30	1		10%	
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	194	0	0	77600	7760	85360
6	0	0	0	0	0	0
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	0	6	0	1080	108	1188
7	0	0	0	0	0	0
All Diesel Vehicles	**0**	**6**	**0**	**1080**	**108**	**1188**
All EMU Vehicles	**194**	**0**	**0**	**77600**	**7760**	**85360**

Non-Weekday Trains	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	34	0	0	13600	1360	14960
6	0	0	0	0	0	0
Diesel Cars (# 'vehicles')						
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
All Diesel Vehicles	**0**	**0**	**0**	**0**	**0**	**0**
All EMU Vehicles	**34**	**0**	**0**	**13600**	**1360**	**14960**

Average Weekdays per Year	260
Average Non-Weekdays per Year	105

Annual Totals	# of trains by segment			Vehicle Miles		
Consist Type	Mainline	Gilroy	DTX	Revenue Miles	Non-Revenue Miles	Total Miles
EMU Cars (# 'vehicles')						
8	54,010	-	-	21,604,000	2,160,400	23,764,400
6	-	-	-	-	-	-
Diesel Cars (# 'vehicles')						
5	-	-	-	-	-	-
6	-	1,560	-	280,800	28,080	308,880
7	-	-	-	-	-	-
All Diesel Vehicles	**-**	**1,560**	**-**	**280,800**	**28,080**	**308,880**
All EMU Vehicles	**54,010**	**-**	**-**	**21,604,000**	**2,160,400**	**23,764,400**
All Vehciles	**54,010**	**1,560**	**-**	**21,884,800**	**2,188,480**	**24,073,280**

Scenario 3A - Enhanced EMU Service 2027 SP - 12/28/2017

Fuel Consumption				Hotel Power Estimate	
	Fuel Consumption				
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	702171.36	385.61	74,809.05
0	8.226	0	0	289.21	-
2.953	0	0	0	293.80	-
3.278	0	649.044	0	352.56	2,115
3.639	0	0	0	411.32	-
		649			**2,115**
			702,171		**74,809**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
0	8.226	0	123061	385.61	13,110.86
0	8.226	0	0	289.21	-
2.953	0	0	0	293.80	-
3.278	0	0	0	352.56	-
3.639	0	0	0	411.32	-
		0			**-**
		0	**123,061**		**13,111**

Fuel Consumption				Hotel Power Estimate	
diesel g/mi	kwH/mi	Total diesel gallons	Total Kwh	Per Train per Run	Total KwH
-	82	-	195,485,954	385.61	20,826,992.96
-	82	-	-	289.21	-
2.953	-	-	-	293.80	-
3.278	-	168,751	-	352.56	550,000
3.639	-	-	-	411.32	-
		168,751	**-**		**550,000**
		-	**195,485,954**		**20,826,993**
		168,751	**195,485,954**	**-**	**21,376,993**

Attachment G.

Maps (KML Files)

*See Attached files labeled:

- Caltrain Electrified Tracks KML File
- Caltrain Electrified Tracks Zip File
- CaltrainROW With Acquisition KML File
- Caltrain Stations KMZ File

Attachment H.

Project Programming Request (PPR) Form

STATE OF CALIFORNIA ● DEPARTMENT OF TRANSPORTATION

PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised July 2013)

General Instructions

☑ New Project				Date:	1/11/18
District	**EA**	**Project ID**	**PPNO**	**MPO ID**	
04				MTC	

County	**Route/Corridor**	**PM Bk**	**PM Ahd**	**Project Sponsor/Lead Agency**	
SF	Caltrain			Peninsula Corridor Joint Powers Authority	
SM				**MPO**	**Element**
SCL				MTC	Rail

Project Manager/Contact	**Phone**	**E-mail Address**
Peter Skinner	(650) 622-7818	skinnerp@samtrans.com

Project Title

Peninsula Corridor Electrification Expansion Project (EEP)

Location, Project Limits, Description, Scope of Work ☐ See page 2

The Peninsula Corridor Electrification Expansion Project (EEP) includes a series of incremental investments in the 51-mile Caltrain Corridor between the 4th and King Station (San Francisco) and the Diridon Station (San Jose). These investments are focused on expanding and fully converting Caltrain's mainline diesel fleet to electric train vehicles. Caltrain is also investing in a series of associated projects that will support the fully electrified fleet and ensure maximum benefit of investments, including implementation of wayside bicycle facilities, installation of broadband communications system including public facing Wi-Fi, and planning funds.

☑ GHG Reductions ☑ Integrated Service ☑ Increase Ridership

Component	**Implementing Agency**
PA&ED	Peninsula Corridor Joint Powers Board
PS&E	Peninsula Corridor Joint Powers Board
Right of Way	Peninsula Corridor Joint Powers Board
Construction	Peninsula Corridor Joint Powers Board

Purpose and Need ☐ See page 2

The purpose of the Electrification Expansion Project is to maximize investment in the existing Peninsula Corridor Electrification Project (PCEP), fully funded and under construction, which will provide the initial infrastructure upgrades necessary to electrify Caltrain and operate increased and improved service, increased peak hour capacity, and reduced vehicle GHG emissions. The EEP will further increase peak hour capacity in order to support expanded ridership demands and reduce vehicle GHG emissions. Full electrification of Caltrain's mainline fleet supports eventual blended service with High-Speed Rail as well as the potential redeployment of Caltrain's diesel fleet to support the TAMC's Salinas Rail Extension.

Project Benefits ☐ See page 2

The EEP builds upon the existing Peninsula Corridor Electrification Project (PCEP) to further increase peak hour capacity, increase ridership through additional capacity, reduce vehicle GHG emissions, support active transportation, and provide necessary infrastructure for future High-Speed Rail operations.

☑ Supports Sustainable Communities Strategy (SCS) Goals ☑ Disadvantaged Communities

Project Milestone			**Proposed**
Project Study Report Approved			**N/A**
Begin Environmental (PA&ED) Phase			**01/31/13**
Circulate Draft Environmental Document	**Document Type**	EIR/EIS	**02/01/14**
Draft Project Report			N/A
End Environmental Phase (PA&ED Milestone)			01/08/15
Begin Design (PS&E) Phase			06/01/18
End Design Phase (Ready to List for Advertisement Milestone)			05/31/19
Begin Right of Way Phase			N/A
End Right of Way Phase (Right of Way Certification Milestone)			N/A
Begin Construction Phase (Contract Award Milestone)			06/01/19
End Construction Phase (Construction Contract Acceptance Milestone)			06/30/22
Begin Closeout Phase			06/30/22
End Closeout Phase (Closeout Report)			06/30/25

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STATE OF CALIFORNIA ● DEPARTMENT OF TRANSPORTATION

PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised May 2013)

General Instructions

☑ New Project				**Date:**	1/11/18
District	**EA**	**Project ID**	**PPNO**	**MPO ID**	
04				MTC	

Project Title

Peninsula Corridor Electrification Expansion Project (EEP)

Additional Information

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STATE OF CALIFORNIA ● DEPARTMENT OF TRANSPORTATION

PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised July 2013)

Date: 1/11/18

District	County	Route	EA	Project ID	PPNO	
04	SF, SM, SCL	Caltrain				
Project Title:	Peninsula Corridor Electrification Expansion Project (EEP)					

Proposed Total Project Cost ($1,000s)

Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total
E&P (PA&ED)	84,250					1,000	5,000	90,250
PS&E								
R/W SUP (CT)								
CON SUP (CT)								
R/W								
CON	1,896,002						626,000	2,522,002
TOTAL	1,980,252					1,000	631,000	2,612,252

Notes

Note: Construction cost in year FY20 is $625.5, and total project cost is $631.5.

Fund No. 1: Transit and Intercity Rail Capital Program (TIRCP)

Program Code

Proposed Funding ($1,000s)

Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total
E&P (PA&ED)						1,000	5,000	6,000
PS&E								
R/W SUP (CT)								
CON SUP (CT)								
R/W								
CON	20,000						626,000	646,000
TOTAL	20,000					1,000	631,000	652,000

Funding Agency

CalSTA

Note: Construction funds requested in year FY20 is $625.5M, and total project funds requested are $631.5M.

Fund No. 2: Low Carbon Transportation Operations Funds

Program Code

Proposed Funding ($1,000s)

Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total
E&P (PA&ED)								
PS&E								
R/W SUP (CT)								
CON SUP (CT)								
R/W								
CON	9,000							9,000
TOTAL	9,000							9,000

Funding Agency

Caltrans

Fund No. 3: CHSRA Funds (Prop 1A and Non-Prop 1A)

Program Code

Proposed Funding ($1,000s)

Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total
E&P (PA&ED)								
PS&E								
R/W SUP (CT)								
CON SUP (CT)								
R/W								
CON	713,000							713,000
TOTAL	713,000							713,000

Funding Agency

CHSRA

STATE OF CALIFORNIA ● DEPARTMENT OF TRANSPORTATION

PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised July 2013)

Date: 1/11/18

District	County	Route	EA	Project ID	PPNO	
04	SF, SM, SCL	Caltrain				
Project Title:	Peninsula Corridor Electrification Expansion Project (EEP)					

Fund No. 4:	**Federal Transit Administration Core Capacity Grant**								**Program Code**
	Proposed Funding ($1,000s)								
Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total	**Funding Agency**
E&P (PA&ED)									FTA
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON	647,000							647,000	
TOTAL	647,000							647,000	

Fund No. 5:	**Federal Transit Administration Formula Funding**								**Program Code**
	Proposed Funding ($1,000s)								
Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total	**Funding Agency**
E&P (PA&ED)	20,911							20,911	FTA
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON	309,766							309,766	
TOTAL	330,677							330,677	

Fund No. 6:	**Proposition 1B**								**Program Code**
	Proposed Funding ($1,000s)								
Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total	**Funding Agency**
E&P (PA&ED)	8,000							8,000	Caltrans
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON									
TOTAL	8,000							8,000	

Fund No. 7:	**Carl Moyer Funds**								**Program Code**
	Proposed Funding ($1,000s)								
Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total	**Funding Agency**
E&P (PA&ED)									BAAQMD
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON	20,000							20,000	
TOTAL	20,000							20,000	

STATE OF CALIFORNIA ● DEPARTMENT OF TRANSPORTATION

PROJECT PROGRAMMING REQUEST

DTP-0001 (Revised July 2013)

Date: 1/11/18

District	County	Route	EA	Project ID	PPNO	
04	SF, SM, SCL	Caltrain				
Project Title:	Peninsula Corridor Electrification Expansion Project (EEP)					

Fund No. 8:	**Regional Bridge Toll Funds**								**Program Code**
	Proposed Funding ($1,000s)								
Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total	**Funding Agency**
E&P (PA&ED)									MTC
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON	39,430							39,430	
TOTAL	39,430							39,430	

Fund No. 9:	**JPB Member Agency Funds**								**Program Code**
	Proposed Funding ($1,000s)								
Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total	**Funding Agency**
E&P (PA&ED)	55,339							55,339	JPB Members
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON	137,806							137,806	
TOTAL	193,145							193,145	

Fund No. 10:									**Program Code**
	Proposed Funding ($1,000s)								
Component	Prior	14/15	15/16	16/17	17/18	18/19	19/20+	Total	**Funding Agency**
E&P (PA&ED)									
PS&E									
R/W SUP (CT)									
CON SUP (CT)									
R/W									
CON									
TOTAL									

APPENDIX O-SCAS

Comment Letter O-SCAS Attachment

eBird Field Checklist

Jan 23 2018 data from the last 10 years

	Common Name	Campus (10 years)	Campus (all years)	BeWell	Arizona	Lagunita	Papua
1	Acorn Woodpecker	1	1	1	1	1	1
2	Allen's Hummingbird	1	1				
3	American Avocet		1				
4	American Coot	1	1			1	
5	American Crow	1	1	1	1	1	1
6	American Goldfinch	1	1	1		1	
7	American Kestrel	1	1			1	
8	American Pipit	1	1			1	
9	American Robin	1	1	1	1	1	1
10	American White Pelican		1				
11	American Wigeon	1	1			1	
12	Anna's Hummingbird	1	1	1	1	1	1
13	Ash-throated Flycatcher	1	1			1	
14	Bald Eagle	1	1				
15	Band-tailed Pigeon	1	1			1	
16	Barn Owl	1	1			1	
17	Barn Swallow	1	1	1		1	
18	Belted Kingfisher	1	1				
19	Bewick's Wren	1	1	1	1	1	
20	Black Phoebe	1	1		1	1	1
21	Black-crowned Night-Heron	1	1			1	
22	Black-headed Grosbeak	1	1			1	
23	Black-necked Stilt		1			1	
24	Black-throated Gray Warbler	1	1		1		
25	Blue-gray Gnatcatcher	1	1			1	
26	Bobolink					1	
27	Brewer's Blackbird	1	1	1	1	1	
28	Brown Creeper	1	1		1	1	
29	Brown Pelican		1				
30	Brown-headed Cowbird	1	1			1	
31	Bufflehead	1	1			1	
32	Bullock's Oriole	1	1		1	1	

33	Bushtit	1	1		1		1	
34	Cackling Goose	1	1					
35	California Condor		1					
36	California Gull	1	1		1		1	
37	California Quail	1	1				1	
38	California Scrub-Jay	1	1	1	1		1	
39	California Thrasher	1	1				1	
40	California Towhee	1	1	1	1		1	1
41	Canada Goose	1	1				1	
42	Canvasback		1					
43	Caspian Tern	1	1				1	
44	Cedar Waxwing	1	1		1		1	1
45	Chestnut-backed Chickade	1	1	1	1		1	1
46	Chipping Sparrow	1	1				1	
47	Cinnamon Teal						1	
48	Cliff Swallow	1	1	1			1	
49	Common Goldeneye	1	1				1	
50	Common Merganser	1	1				1	
51	Common Raven	1	1	1	1		1	1
52	Common Yellowthroat	1	1				1	
53	Cooper's Hawk	1	1	1	1		1	
54	Dark-eyed Junco	1	1	1	1		1	1
55	Double-crested Cormorant	1	1				1	
56	Downy Woodpecker	1	1		1		1	
57	Eared Grebe	1	1				1	
58	Eurasian Collared-Dove	1	1				1	
59	European Starling	1	1	1	1		1	
60	Ferruginous Hawk		1					
61	Forster's Tern		1					
62	Fox Sparrow	1	1		1		1	
63	Gadwall						1	
64	Glaucous-winged Gull	1	1				1	
65	Golden Eagle	1	1					
66	Golden-crowned Kinglet		1					

67	Golden-crowned Sparrow	1	1	1	1	1		
68	Great Blue Heron	1	1		1	1		
69	Great Egret	1	1			1		
70	Great Horned Owl	1	1			1		
71	Great-tailed Grackle	1	1			1		
72	Greater Scaup		1			1		
73	Greater Yellowlegs	1	1			1		
74	Green Heron					1		
75	Green-winged Teal	1	1			1		
76	Hairy Woodpecker	1	1		1	1		
77	Hermit Thrush	1	1		1	1		
78	Herring Gull	1	1			1		
79	Hooded Merganser	1	1			1		
80	Hooded Oriole	1	1		1	1		
81	Horned Grebe					1		
82	House Finch	1	1	1	1	1		
83	House Sparrow	1	1			1	1	
84	House Wren	1	1			1		
85	Hutton's Vireo	1	1		1	1	1	
86	Iceland Gull					1		
87	Killdeer	1	1			1		
88	Lazuli Bunting	1	1			1		
89	Lesser Goldfinch	1	1	1	1	1	1	
90	Lesser Scaup	1	1			1		
91	Lincoln's Sparrow	1	1	1		1		
92	Loggerhead Shrike	1	1					
93	MacGillivray's Warbler	1	1					
94	Mallard	1	1			1		
95	Mallard (Domestic type)					1		
96	Marsh Wren	1	1					
97	Merlin	1	1			1		
98	Mew Gull	1	1			1		
99	Mourning Dove	1	1	1	1	1		
100	Nashville Warbler	1	1					

101	Northern Flicker	1	1		1	1		
102	Northern Harrier	1	1		1	1		
103	Northern Mockingbird	1	1			1		
104	Northern Pintail					1		
105	Northern Rough-winged Sv	1	1	1		1		
106	Northern Shoveler	1	1			1		
107	Nuttall's Woodpecker	1	1		1	1	1	
108	Oak Titmouse	1	1	1	1	1	1	
109	Olive-sided Flycatcher		1					
110	Orange-crowned Warbler	1	1			1		
111	Pacific-slope Flycatcher	1	1		1	1		
112	Palm Warbler					1		
113	Peregrine Falcon	1	1		1	1		
114	Phainopepla	1	1					
115	Pied-billed Grebe	1	1			1		
116	Pine Siskin	1	1			1		
117	Purple Finch	1	1			1	1	
118	Pygmy Nuthatch	1	1					
119	Red-breasted Nuthatch	1	1					
120	Red-breasted Sapsucker	1	1		1	1		
121	Red-eyed Vireo	1	1					
122	Red-necked Phalarope					1		
123	Red-shouldered Hawk	1	1		1	1		
124	Red-tailed Hawk	1	1	1	1	1		
125	Red-winged Blackbird	1	1	1		1		
126	Redhead		1			1		
127	Ring-billed Gull	1	1			1		
128	Ring-necked Duck		1			1		
129	Rock Pigeon	1	1		1	1		
130	Ruby-crowned Kinglet	1	1	1	1	1		
131	Ruddy Duck	1	1			1		
132	Savannah Sparrow	1	1			1		
134	Say's Phoebe	1	1		1	1		
135	Sharp-shinned Hawk	1	1	1		1	1	

136	Snowy Egret	1	1			1		
137	Song Sparrow	1	1	1	1	1		
138	Sora					1		
139	Spotted Sandpiper					1		
140	Spotted Towhee	1	1	1	1	1		
141	Steller's Jay	1	1		1	1		
142	Summer Tanager	1	1					
144	Townsend's Warbler	1	1		1	1		
145	Tree Swallow	1	1			1	1	
146	Tricolored Blackbird		1					
147	Turkey Vulture	1	1		1	1		
148	Varied Thrush	1	1			1		
149	Vaux's Swift	1	1	1		1		
150	Violet-green Swallow	1	1	1	1	1		
151	Virginia Rail					1		
152	Warbling Vireo	1	1			1		
153	Western Bluebird	1	1	1	1	1	1	
154	Western Gull	1	1			1		
155	Western Kingbird	1	1			1		
156	Western Meadowlark	1	1	1		1		
157	Western Screech-Owl	1	1			1		
158	Western Tanager	1	1			1		
159	Western Wood-Pewee	1	1					
160	White-breasted Nuthatch	1	1	1	1	1		
161	White-crowned Sparrow	1	1	1	1	1		
162	White-tailed Kite	1	1			1		
163	White-throated Sparrow	1	1			1		
164	White-throated Swift	1	1	1	1	1		
165	Wild Turkey	1	1					
166	Willow Flycatcher		1					
167	Wilson's Snipe					1		
168	Wilson's Warbler	1	1			1		
169	Wood Duck	1	1			1		
171	Wrentit	1	1			1		

172	Yellow Warbler	1	1			1
173	Yellow-rumped Warbler	1	1	1	1	1
174	Zonotrichia sp.	1	1			1
		142	157	37	54	143

APPENDIX O-SCOPE

Comment Letter O-SCOPE Attachments

Appendix A:

Housing Nexus Calculations

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
Non-Instructional	Full-time non-instructional staff		0													
Non-Instructional	Postsecondary Teachers - Research	125.9	283													
Non-Instructional	Postsecondary Teachers - Public service		0													
Non-Instructional	**Librarians, Curators, Archivists, other teaching and Instructional support**	**154.8**	**348**													
				254010	41.09	0.32	$119,249.80	0.0	0.0	0.0	0.3	0.0	25-4012	Curators	0.086	$66,620.00
				254020	41.09	2.40	$150,270.50	0.0	0.0	0.0	0.0	0.0	25-4021	Librarians	0.636	$83,950.00
				254030	41.09	2.66	$92,202.90	0.0	0.0	0.0	2.7	0.0	25-4031	Library Technicians	0.706	$51,510.00
				25-2000	41.09	16.32	$70,937.70	0.0	0.0	16.3	0.0	0.0	25-2011	Preschool Teachers, Except Special Education	4.332	$39,630.00
					41.09	3.67	$112,000.30	0.0	0.0	0.0	3.7	0.0	25-2012	Kindergarten Teachers, Except Special Education	0.975	$62,570.00
					41.09	35.12	$133,319.20	0.0	0.0	0.0	0.0	0.0	25-2021	Elementary School Teachers, Except Special Education	9.323	$74,480.00
					41.09	12.82	$132,531.60	0.0	0.0	0.0	0.0	0.0	25-2022	Middle School Teachers, Except Special and Career/Techı	3.402	$74,040.00
					41.09	15.23	$142,484.00	0.0	0.0	0.0	0.0	0.0	25-2031	Secondary School Teachers, Except Special and Career/Te	4.044	$79,600.00
					41.09	3.49	$122,131.70	0.0	0.0	0.0	3.5	0.0	25-2052	Special Education Teachers, Kindergarten and Elementar	0.926	$68,230.00
					41.09	0.98	$129,739.20	0.0	0.0	0.0	0.0	0.0	25-2053	Special Education Teachers, Middle School	0.259	$72,480.00
					41.09	0.00	$174,578.70	0.0	0.0	0.0	0.0	0.0	25-2054	Special Education Teachers, Secondary School	**	$97,530.00
				25-3000	41.09	0.00	$125,622.20	0.0	0.0	0.0	0.0	0.0	25-3011	Adult Basic and Secondary Education and Literacy Teache	**	$70,180.00
					41.09	7.98	$93,259.00	0.0	0.0	0.0	8.0	0.0	25-3021	Self-Enrichment Education Teachers	2.118	$52,100.00
					41.09	5.82	$86,367.50	0.0	0.0	0.0	5.8	0.0	25-3097	Teachers and Instructors, All Other, Except Substitute Tea	1.545	$48,250.00
					41.09	15.92	$77,220.60	0.0	0.0	0.0	15.9	0.0	25-3098	Substitute Teachers	4.227	$43,140.00
				25-9000	41.09	0.42	$96,176.70	0.0	0.0	0.0	0.4	0.0	25-9011	Audio-Visual and Multimedia Collections Specialists	0.111	$53,730.00
					41.09	3.67	$141,929.10	0.0	0.0	0.0	0.0	0.0	25-9031	Instructional Coordinators	0.974	$79,290.00
					41.09	25.97	$61,468.60	0.0	0.0	26.0	0.0	0.0	25-9041	Teacher Assistants	6.894	$34,340.00
					41.09	2.01	$97,913.00	0.0	0.0	0.0	2.0	0.0	25-9099	Education, Training, and Library Workers, All Other	0.534	$54,700.00
Non-Instructional	**Management**	**333.2**	**749**													
				110000	**-**	**-**	**$298,196.10**	**-**	**-**	**-**	**-**	**1.0**	**11-2000**	**Management Occupations**	**81.347**	**$166,590.00**
					81.27	8.45	$446,479.70	0.0	0.0	0.0	0.0	0.0	11-1011	Chief Executives	2.061	$249,430.00
					81.27	68.17	$288,351.10	0.0	0.0	0.0	0.0	0.0	11-1021	General and Operations Managers	16.629	$161,090.00
					81.27	0.30	$91,540.60	0.0	0.0	0.0	0.3	0.0	11-1031	Legislators	0.072	$51,140.00
					81.27	0.50	$195,414.30	0.0	0.0	0.0	0.0	0.0	11-2011	Advertising and Promotions Managers	0.121	$109,170.00
					81.27	25.24	$360,470.20	0.0	0.0	0.0	0.0	0.0	11-2021	Marketing Managers	6.156	$201,380.00
					81.27	24.80	$283,607.60	0.0	0.0	0.0	0.0	0.0	11-2022	Sales Managers	6.051	$158,440.00
					81.27	1.83	$273,243.50	0.0	0.0	0.0	0.0	0.0	11-2031	Public Relations and Fundraising Managers	0.446	$152,650.00
					81.27	11.81	$229,710.70	0.0	0.0	0.0	0.0	0.0	11-3011	Administrative Services Managers	2.88	$128,330.00
					81.27	53.68	$349,515.40	0.0	0.0	0.0	0.0	0.0	11-3021	Computer and Information Systems Managers	13.096	$195,260.00
					81.27	27.00	$316,865.80	0.0	0.0	0.0	0.0	0.0	11-3031	Financial Managers	6.587	$177,020.00
					81.27	7.64	$265,063.20	0.0	0.0	0.0	0.0	0.0	11-3051	Industrial Production Managers	1.863	$148,080.00
					81.27	3.96	$256,220.60	0.0	0.0	0.0	0.0	0.0	11-3061	Purchasing Managers	0.967	$143,140.00
					81.27	2.63	$203,648.30	0.0	0.0	0.0	0.0	0.0	11-3071	Transportation, Storage, and Distribution Managers	0.641	$113,770.00
					81.27	0.64	$298,249.80	0.0	0.0	0.0	0.0	0.0	11-3111	Compensation and Benefits Managers	0.157	$166,620.00
					81.27	6.63	$295,206.80	0.0	0.0	0.0	0.0	0.0	11-3121	Human Resources Managers	1.618	$164,920.00
					81.27	1.61	$306,304.80	0.0	0.0	0.0	0.0	0.0	11-3131	Training and Development Managers	0.392	$171,120.00
					81.27	7.48	$262,772.00	0.0	0.0	0.0	0.0	0.0	11-9021	Construction Managers	1.825	$146,800.00
					81.27	2.47	$108,026.50	0.0	0.0	0.0	2.5	0.0	11-9031	Education Administrators, Preschool and Childcare Cente	0.602	$60,350.00
					81.27	4.76	$214,334.60	0.0	0.0	0.0	0.0	0.0	11-9032	Education Administrators, Elementary and Secondary Sch	1.16	$119,740.00
					81.27	5.26	$235,295.50	0.0	0.0	0.0	0.0	0.0	11-9033	Education Administrators, Postsecondary	1.284	$131,450.00
					81.27	1.10	$169,709.90	0.0	0.0	0.0	0.0	0.0	11-9039	Education Administrators, All Other	0.268	$94,810.00
					81.27	25.29	$347,027.30	0.0	0.0	0.0	0.0	0.0	11-9041	Architectural and Engineering Managers	6.169	$193,870.00
					81.27	6.77	$99,291.30	0.0	0.0	0.0	6.8	0.0	11-9051	Food Service Managers	1.651	$55,470.00
					81.27	0.34	$140,676.10	0.0	0.0	0.0	0.0	0.0	11-9061	Funeral Service Managers	0.082	$78,590.00
					81.27	0.73	$132,764.30	0.0	0.0	0.0	0.0	0.0	11-9081	Lodging Managers	0.178	$74,170.00
					81.27	7.91	$285,147.00	0.0	0.0	0.0	0.0	0.0	11-9111	Medical and Health Services Managers	1.93	$159,300.00
					81.27	2.49	$304,926.50	0.0	0.0	0.0	0.0	0.0	11-9121	Natural Sciences Managers	0.608	$170,350.00
					81.27	5.86	$144,327.70	0.0	0.0	0.0	0.0	0.0	11-9141	Property, Real Estate, and Community Association Manag	1.43	$80,630.00
					81.27	3.03	$139,065.10	0.0	0.0	0.0	0.0	0.0	11-9151	Social and Community Service Managers	0.738	$77,690.00
					81.27	14.80	$297,784.40	0.0	0.0	0.0	0.0	0.0	11-9199	Managers, All Other	3.611	$166,360.00
Non-Instructional	**Business and Financial Operations**	**838.9**	**1886**													
				130000	**-**	**-**	**$181,595.50**	**-**	**-**	**-**	**-**	**1.0**	**13-0000**	**Business and Financial Operations Occupations**	**72.592**	**$101,450.00**
					57.12	0.56	$97,107.50	0.0	0.0	0.0	0.6	0.0	13-1011	Agents and Business Managers of Artists, Performers, an	0.038	$54,250.00
					57.12	20.16	$102,065.80	0.0	0.0	0.0	20.2	0.0	13-1022	Wholesale and Retail Buyers, Except Farm Products	1.373	$57,020.00
					57.12	61.82	$147,012.70	0.0	0.0	0.0	0.0	0.0	13-1023	Purchasing Agents, Except Wholesale, Retail, and Farm P	4.209	$82,130.00
					57.12	0.00	$125,317.90	0.0	0.0	0.0	0.0	0.0	13-1031	Claims Adjusters, Examiners, and Investigators	**	$70,010.00
					57.12	21.65	$169,029.70	0.0	0.0	0.0	0.0	0.0	13-1041	Compliance Officers	1.474	$94,430.00
					57.12	24.39	$157,072.50	0.0	0.0	0.0	0.0	0.0	13-1051	Cost Estimators	1.661	$87,750.00
					57.12	65.85	$157,931.70	0.0	0.0	0.0	0.0	0.0	13-1071	Human Resources Specialists	4.484	$88,230.00
					57.12	7.17	$162,066.60	0.0	0.0	0.0	0.0	0.0	13-1075	Labor Relations Specialists	0.488	$90,540.00
					57.12	24.81	$191,923.80	0.0	0.0	0.0	0.0	0.0	13-1081	Logisticians	1.689	$107,220.00
					57.12	106.35	$219,973.10	0.0	0.0	0.0	0.0	0.0	13-1111	Management Analysts	7.241	$122,890.00
					57.12	8.62	$120,556.50	0.0	0.0	0.0	8.6	0.0	13-1121	Meeting, Convention, and Event Planners	0.587	$67,350.00
					57.12	4.14	$125,264.20	0.0	0.0	0.0	0.0	0.0	13-1131	Fundraisers	0.282	$69,980.00
					57.12	0.00	$152,150.00	0.0	0.0	0.0	0.0	0.0	13-1141	Compensation, Benefits, and Job Analysis Specialists	**	$85,000.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					57.12	0.00	$154,763.40	0.0	0.0	0.0	0.0	0.0	13-1151	Training and Development Specialists	**	$86,460.00
					57.12	0.00	$199,370.20	0.0	0.0	0.0	0.0	0.0	13-1161	Market Research Analysts and Marketing Specialists	**	$111,380.00
					57.12	153.08	$179,948.70	0.0	0.0	0.0	0.0	0.0	13-1199	Business Operations Specialists, All Other	10.423	$100,530.00
					57.12	191.31	$180,915.30	0.0	0.0	0.0	0.0	0.0	13-2011	Accountants and Auditors	13.026	$101,070.00
					57.12	3.03	-	0.0	0.0	0.0	0.0	0.0	13-2021	Appraisers and Assessors of Real Estate	0.206	*
					57.12	6.14	$166,649.00	0.0	0.0	0.0	0.0	0.0	13-2031	Budget Analysts	0.418	$93,100.00
					57.12	6.30	$153,027.10	0.0	0.0	0.0	0.0	0.0	13-2041	Credit Analysts	0.429	$85,490.00
					57.12	60.88	$214,155.60	0.0	0.0	0.0	0.0	0.0	13-2051	Financial Analysts	4.145	$119,640.00
					57.12	17.40	$299,377.50	0.0	0.0	0.0	0.0	0.0	13-2052	Personal Financial Advisors	1.185	$167,250.00
					57.12	1.85	$144,882.60	0.0	0.0	0.0	0.0	0.0	13-2053	Insurance Underwriters	0.126	$80,940.00
					57.12	1.50	$168,940.20	0.0	0.0	0.0	0.0	0.0	13-2061	Financial Examiners	0.102	$94,380.00
					57.12	1.81	-	0.0	0.0	0.0	0.0	0.0	13-2071	Credit Counselors	0.123	*
					57.12	18.51	$181,792.40	0.0	0.0	0.0	0.0	0.0	13-2072	Loan Officers	1.26	$101,560.00
					57.12	3.00	$164,357.80	0.0	0.0	0.0	0.0	0.0	13-2081	Tax Examiners and Collectors, and Revenue Agents	0.204	$91,820.00
					57.12	14.30	$126,982.60	0.0	0.0	0.0	0.0	0.0	13-2082	Tax Preparers	0.974	$70,940.00
					57.12	14.30	$160,240.80	0.0	0.0	0.0	0.0	0.0	13-2099	Financial Specialists, All Other	0.974	$89,520.00
Non-Instructional	**Computer, Engineering, and Science**	**405.7**	**912**													
				150000	**-**	**-**	**$221,244.00**	**-**	**-**	**-**	**-**	**1.0**	**15-0000**	**Computer and Mathematical Occupations**	**124.88**	**$123,600.00**
					124.84	3.39	$263,720.70	0.0	0.0	0.0	0.0	0.0	15-1111	Computer and Information Research Scientists	1.044	$147,330.00
					124.84	46.89	$208,588.70	0.0	0.0	0.0	0.0	0.0	15-1121	Computer Systems Analysts	14.431	$116,530.00
					124.84	3.76	$221,512.50	0.0	0.0	0.0	0.0	0.0	15-1122	Information Security Analysts	1.156	$123,750.00
					124.84	19.06	$173,057.20	0.0	0.0	0.0	0.0	0.0	15-1131	Computer Programmers	5.865	$96,680.00
					124.84	128.96	$238,087.90	0.0	0.0	0.0	0.0	0.0	15-1132	Software Developers, Applications	39.689	$133,010.00
					124.84	89.11	$262,467.70	0.0	0.0	0.0	0.0	0.0	15-1133	Software Developers, Systems Software	27.423	$146,630.00
					124.84	8.42	$182,723.20	0.0	0.0	0.0	0.0	0.0	15-1134	Web Developers	2.59	$102,080.00
					124.84	5.89	$172,591.80	0.0	0.0	0.0	0.0	0.0	15-1141	Database Administrators	1.814	$96,420.00
					124.84	20.39	$188,397.50	0.0	0.0	0.0	0.0	0.0	15-1142	Network and Computer Systems Administrators	6.275	$105,250.00
					124.84	12.52	$247,986.60	0.0	0.0	0.0	0.0	0.0	15-1143	Computer Network Architects	3.853	$138,540.00
					124.84	31.35	$134,232.10	0.0	0.0	0.0	0.0	0.0	15-1151	Computer User Support Specialists	9.647	$74,990.00
					124.84	9.65	$163,176.40	0.0	0.0	0.0	0.0	0.0	15-1152	Computer Network Support Specialists	2.971	$91,160.00
					124.84	14.59	$227,795.40	0.0	0.0	0.0	0.0	0.0	15-1199	Computer Occupations, All Other	4.49	$127,260.00
					124.84	0.00	$197,275.90	0.0	0.0	0.0	0.0	0.0	15-2021	Mathematicians	**	$110,210.00
					124.84	10.71	$191,905.90	0.0	0.0	0.0	0.0	0.0	15-2031	Operations Research Analysts	3.295	$107,210.00
					124.84	0.81	$193,552.70	0.0	0.0	0.0	0.0	0.0	15-2041	Statisticians	0.25	$108,130.00
					124.84	0.17	-	0.0	0.0	0.0	0.0	0.0	15-2099	Mathematical Science Occupations, All Other	0.051	*
				170000	**-**	**-**	**$205,867.90**	**-**	**-**	**-**	**-**	**1.0**	**17-0000**	**Architecture and Engineering Occupations**	**54.275**	**$115,010.00**
					53.86	0.00	$159,811.20	0.0	0.0	0.0	0.0	0.0	17-1011	Architects, Except Landscape and Naval	0.496	$89,280.00
					53.86	0.00	$164,089.30	0.0	0.0	0.0	0.0	0.0	17-1012	Landscape Architects	0.106	$91,670.00
					53.86	0.00	$133,372.90	0.0	0.0	0.0	0.0	0.0	17-1021	Cartographers and Photogrammetrists	0.123	$74,510.00
					53.86	0.00	$145,902.90	0.0	0.0	0.0	0.0	0.0	17-1022	Surveyors	0.236	$81,510.00
					53.86	0.00	$208,767.70	0.0	0.0	0.0	0.0	0.0	17-2011	Aerospace Engineers	2.065	$116,630.00
					53.86	0.00	$237,998.40	0.0	0.0	0.0	0.0	0.0	17-2031	Biomedical Engineers	0.56	$132,960.00
					53.86	0.00	$219,257.10	0.0	0.0	0.0	0.0	0.0	17-2041	Chemical Engineers	0.139	$122,490.00
					53.86	0.00	$198,636.30	0.0	0.0	0.0	0.0	0.0	17-2051	Civil Engineers	2.497	$110,970.00
					53.86	0.00	$256,220.60	0.0	0.0	0.0	0.0	0.0	17-2061	Computer Hardware Engineers	11.726	$143,140.00
					53.86	0.00	$231,984.00	0.0	0.0	0.0	0.0	0.0	17-2071	Electrical Engineers	5.876	$129,600.00
					53.86	0.00	$239,698.90	0.0	0.0	0.0	0.0	0.0	17-2072	Electronics Engineers, Except Computer	5.846	$133,910.00
					53.86	0.00	$162,174.00	0.0	0.0	0.0	0.0	0.0	17-2081	Environmental Engineers	0.469	$90,600.00
					53.86	0.00	$210,378.70	0.0	0.0	0.0	0.0	0.0	17-2111	Health and Safety Engineers, Except Mining Safety Engine	0.172	$117,530.00
					53.86	0.00	$217,288.10	0.0	0.0	0.0	0.0	0.0	17-2112	Industrial Engineers	4.042	$121,390.00
					53.86	0.00	$220,832.30	0.0	0.0	0.0	0.0	0.0	17-2131	Materials Engineers	1.06	$123,370.00
					53.86	0.00	$217,431.30	0.0	0.0	0.0	0.0	0.0	17-2141	Mechanical Engineers	3.637	$121,470.00
					53.86	0.00	$224,430.20	0.0	0.0	0.0	0.0	0.0	17-2199	Engineers, All Other	2.722	$125,380.00
					53.86	0.00	$109,064.70	0.0	0.0	0.0	0.0	0.0	17-3011	Architectural and Civil Drafters	0.762	$60,930.00
					53.86	0.00	$151,272.90	0.0	0.0	0.0	0.0	0.0	17-3012	Electrical and Electronics Drafters	0.703	$84,510.00
					53.86	0.00	$120,413.30	0.0	0.0	0.0	0.0	0.0	17-3013	Mechanical Drafters	0.32	$67,270.00
					53.86	0.00	$114,058.80	0.0	0.0	0.0	0.0	0.0	17-3019	Drafters, All Other	0.041	$63,720.00
					53.86	0.00	$128,271.40	0.0	0.0	0.0	0.0	0.0	17-3021	Aerospace Engineering and Operations Technicians	0.576	$71,660.00
					53.86	0.00	$103,462.00	0.0	0.0	0.0	0.0	0.0	17-3022	Civil Engineering Technicians	0.382	$57,800.00
					53.86	0.00	$119,607.80	0.0	0.0	0.0	0.0	0.0	17-3023	Electrical and Electronics Engineering Technicians	6.461	$66,820.00
					53.86	0.00	$109,744.90	0.0	0.0	0.0	0.0	0.0	17-3024	Electro-Mechanical Technicians	0.297	$61,310.00
					53.86	0.00	$127,877.60	0.0	0.0	0.0	0.0	0.0	17-3025	Environmental Engineering Technicians	0.207	$71,440.00
					53.86	0.00	$130,186.70	0.0	0.0	0.0	0.0	0.0	17-3026	Industrial Engineering Technicians	0.543	$72,730.00
					53.86	0.00	$120,091.10	0.0	0.0	0.0	0.0	0.0	17-3027	Mechanical Engineering Technicians	0.579	$67,090.00
					53.86	0.00	$141,857.50	0.0	0.0	0.0	0.0	0.0	17-3029	Engineering Technicians, Except Drafters, All Other	1.214	$79,250.00
					53.86	0.00	$114,345.20	0.0	0.0	0.0	0.0	0.0	17-3031	Surveying and Mapping Technicians	**	$63,880.00
				190000	**-**	**-**	**$162,979.50**	**-**	**-**	**-**	**-**	**1.0**	**19-0000**	**Life, Physical, and Social Science Occupations**	**11.288**	**$91,050.00**
					9.34	0.00	$202,860.70	0.0	0.0	0.0	0.0	0.0	19-1012	Food Scientists and Technologists	0.225	$113,330.00
					9.34	0.00	$202,359.50	0.0	0.0	0.0	0.0	0.0	19-1021	Biochemists and Biophysicists	0.572	$113,050.00
					9.34	0.00	$192,926.20	0.0	0.0	0.0	0.0	0.0	19-1029	Biological Scientists, All Other	0.196	$107,780.00
					9.34	0.00	$204,149.50	0.0	0.0	0.0	0.0	0.0	19-1042	Medical Scientists, Except Epidemiologists	1.75	$114,050.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					9.34	0.00	$199,925.10	0.0	0.0	0.0	0.0	0.0	19-1099	Life Scientists, All Other	0.227	$111,690.00
					9.34	0.00	$243,440.00	0.0	0.0	0.0	0.0	0.0	19-2012	Physicists	0.191	$136,000.00
					9.34	0.00	$196,112.40	0.0	0.0	0.0	0.0	0.0	19-2031	Chemists	0.766	$109,560.00
					9.34	0.00	$236,065.20	0.0	0.0	0.0	0.0	0.0	19-2032	Materials Scientists	0.227	$131,880.00
					9.34	0.00	$141,338.40	0.0	0.0	0.0	0.0	0.0	19-2041	Environmental Scientists and Specialists, Including Health	0.572	$78,960.00
					9.34	0.00	$188,558.60	0.0	0.0	0.0	0.0	0.0	19-2042	Geoscientists, Except Hydrologists and Geographers	0.125	$105,340.00
					9.34	0.00	$223,678.40	0.0	0.0	0.0	0.0	0.0	19-2099	Physical Scientists, All Other	0.349	$124,960.00
					9.34	0.00	$235,581.90	0.0	0.0	0.0	0.0	0.0	19-3011	Economists	**	$131,610.00
					9.34	0.00	$184,065.70	0.0	0.0	0.0	0.0	0.0	19-3031	Clinical, Counseling, and School Psychologists	0.568	$102,830.00
					9.34	0.00	$154,512.80	0.0	0.0	0.0	0.0	0.0	19-3039	Psychologists, All Other	0.108	$86,320.00
					9.34	0.00	$164,966.40	0.0	0.0	0.0	0.0	0.0	19-3051	Urban and Regional Planners	0.225	$92,160.00
					9.34	0.00	$92,936.80	0.0	0.0	0.0	0.0	0.0	19-4011	Agricultural and Food Science Technicians	0.292	$51,920.00
					9.34	0.00	$104,052.70	0.0	0.0	0.0	0.0	0.0	19-4021	Biological Technicians	0.911	$58,130.00
					9.34	0.00	$94,440.40	0.0	0.0	0.0	0.0	0.0	19-4031	Chemical Technicians	0.669	$52,760.00
					9.34	0.00	$88,766.10	0.0	0.0	0.0	0.0	0.0	19-4061	Social Science Research Assistants	**	$49,590.00
					9.34	0.00	$99,720.90	0.0	0.0	0.0	0.0	0.0	19-4091	Environmental Science and Protection Technicians, Includ	0.232	$55,710.00
					9.34	0.00	$138,205.90	0.0	0.0	0.0	0.0	0.0	19-4092	Forensic Science Technicians	0.093	$77,210.00
					9.34	0.00	$111,391.70	0.0	0.0	0.0	0.0	0.0	19-4099	Life, Physical, and Social Science Technicians, All Other	1.043	$62,230.00
Non-Instructional	**Community Service, Legal, Arts, and Media**	**138.3**	**311**													
				210000	**-**	**-**	**$101,707.80**	**-**	**-**	**-**	**-**	**1.0**	**21-0000**	**Community and Social Service Occupations**	**10.115**	**$56,820.00**
					8.66	9.24	$70,758.70	0.0	0.0	9.2	0.0	0.0	21-1011	Substance Abuse and Behavioral Disorder Counselors	0.578	$39,530.00
					8.66	19.26	$135,288.20	0.0	0.0	0.0	0.0	0.0	21-1012	Educational, Guidance, School, and Vocational Counselor	1.205	$75,580.00
					8.66	0.00	$85,794.70	0.0	0.0	0.0	0.0	0.0	21-1013	Marriage and Family Therapists	**	$47,930.00
					8.66	10.12	$76,629.90	0.0	0.0	0.0	10.1	0.0	21-1014	Mental Health Counselors	0.633	$42,810.00
					8.66	6.22	$75,233.70	0.0	0.0	6.2	0.0	0.0	21-1015	Rehabilitation Counselors	0.389	$42,030.00
					8.66	1.45	$105,985.90	0.0	0.0	0.0	1.5	0.0	21-1019	Counselors, All Other	0.091	$59,210.00
					8.66	16.37	$90,377.10	0.0	0.0	0.0	16.4	0.0	21-1021	Child, Family, and School Social Workers	1.024	$50,490.00
					8.66	10.17	$149,321.80	0.0	0.0	0.0	0.0	0.0	21-1022	Healthcare Social Workers	0.636	$83,420.00
					8.66	11.36	$97,519.20	0.0	0.0	0.0	11.4	0.0	21-1023	Mental Health and Substance Abuse Social Workers	0.711	$54,480.00
					8.66	0.00	$150,270.50	0.0	0.0	0.0	0.0	0.0	21-1029	Social Workers, All Other	**	$83,950.00
					8.66	5.00	$125,765.40	0.0	0.0	0.0	0.0	0.0	21-1091	Health Educators	0.313	$70,260.00
					8.66	0.00	$144,166.60	0.0	0.0	0.0	0.0	0.0	21-1092	Probation Officers and Correctional Treatment Specialists	**	$80,540.00
					8.66	29.01	$80,406.80	0.0	0.0	0.0	29.0	0.0	21-1093	Social and Human Service Assistants	1.815	$44,920.00
					8.66	2.77	$103,104.00	0.0	0.0	0.0	2.8	0.0	21-1094	Community Health Workers	0.173	$57,600.00
					8.66	10.63	$76,218.20	0.0	0.0	10.6	0.0	0.0	21-1099	Community and Social Service Specialists, All Other	0.665	$42,580.00
					8.66	4.01	$107,883.30	0.0	0.0	0.0	4.0	0.0	21-2011	Clergy	0.251	$60,270.00
					8.66	2.73	$85,311.40	0.0	0.0	0.0	2.7	0.0	21-2021	Directors, Religious Activities and Education	0.171	$47,660.00
				230000	**-**	**-**	**$281,209.00**	**-**	**-**	**-**	**-**	**1.0**	**23-0000**	**Legal Occupations**	**7.447**	**$157,100.00**
					7.11	0.00	$353,202.80	0.0	0.0	0.0	0.0	0.0	23-1011	Lawyers	4.946	$197,320.00
					7.11	0.00	$215,498.10	0.0	0.0	0.0	0.0	0.0	23-1021	Administrative Law Judges, Adjudicators, and Hearing Offi	0.037	$120,390.00
					7.11	0.00	$134,769.10	0.0	0.0	0.0	0.0	0.0	23-2011	Paralegals and Legal Assistants	1.819	$75,290.00
					7.11	0.00	$106,648.20	0.0	0.0	0.0	0.0	0.0	23-2093	Title Examiners, Abstractors, and Searchers	**	$59,580.00
					7.11	0.00	$139,083.00	0.0	0.0	0.0	0.0	0.0	23-2099	Legal Support Workers, All Other	0.304	$77,700.00
				270000	**-**	**-**	**$127,680.70**	**-**	**-**	**-**	**-**	**1.0**	**27-0000**	**Arts, Design, Entertainment, Sports, and Media Occupat**	**14.002**	**$71,330.00**
					13.61	0.00	$219,131.80	0.0	0.0	0.0	0.0	0.0	27-1011	Art Directors	0.302	$122,420.00
					13.61	0.00	$150,324.20	0.0	0.0	0.0	0.0	0.0	27-1014	Multimedia Artists and Animators	0.973	$83,980.00
					13.61	0.00	$144,327.70	0.0	0.0	0.0	0.0	0.0	27-1021	Commercial and Industrial Designers	0.238	$80,630.00
					13.61	0.00	-	0.0	0.0	0.0	0.0	0.0	27-1022	Fashion Designers	0.076	*
					13.61	0.00	$55,633.20	0.0	0.0	0.0	0.0	0.0	27-1023	Floral Designers	0.153	$31,080.00
					13.61	0.00	$137,239.30	0.0	0.0	0.0	0.0	0.0	27-1024	Graphic Designers	1.656	$76,670.00
					13.61	0.00	$84,255.30	0.0	0.0	0.0	0.0	0.0	27-1025	Interior Designers	0.422	$47,070.00
					13.61	0.00	$60,681.00	0.0	0.0	0.0	0.0	0.0	27-1026	Merchandise Displayers and Window Trimmers	0.498	$33,900.00
					13.61	0.00	$83,073.90	0.0	0.0	0.0	0.0	0.0	27-1027	Set and Exhibit Designers	0.067	$46,410.00
					13.61	0.00	$137,686.80	0.0	0.0	0.0	0.0	0.0	27-1029	Designers, All Other	0.042	$76,920.00
					13.61	0.00	-	0.0	0.0	0.0	0.0	0.0	27-2011	Actors	0.109	*
					13.61	0.00	$184,083.60	0.0	0.0	0.0	0.0	0.0	27-2012	Producers and Directors	0.39	$102,840.00
					13.61	0.00	$74,052.30	0.0	0.0	0.0	0.0	0.0	27-2022	Coaches and Scouts	2.701	$41,370.00
					13.61	0.00	$75,180.00	0.0	0.0	0.0	0.0	0.0	27-2023	Umpires, Referees, and Other Sports Officials	**	$42,000.00
					13.61	0.00	$100,598.00	0.0	0.0	0.0	0.0	0.0	27-2041	Music Directors and Composers	0.089	$56,200.00
					13.61	0.00	-	0.0	0.0	0.0	0.0	0.0	27-2042	Musicians and Singers	0.152	*
					13.61	0.00	-	0.0	0.0	0.0	0.0	0.0	27-2099	Entertainers and Performers, Sports and Related Workers	**	*
					13.61	0.00	$121,433.60	0.0	0.0	0.0	0.0	0.0	27-3011	Radio and Television Announcers	**	$67,840.00
					13.61	0.00	$71,438.90	0.0	0.0	0.0	0.0	0.0	27-3012	Public Address System and Other Announcers	0.085	$39,910.00
					13.61	0.00	$110,872.60	0.0	0.0	0.0	0.0	0.0	27-3022	Reporters and Correspondents	0.152	$61,940.00
					13.61	0.00	$171,303.00	0.0	0.0	0.0	0.0	0.0	27-3031	Public Relations Specialists	1.882	$95,700.00
					13.61	0.00	$159,310.00	0.0	0.0	0.0	0.0	0.0	27-3041	Editors	0.599	$89,000.00
					13.61	0.00	$187,556.20	0.0	0.0	0.0	0.0	0.0	27-3042	Technical Writers	1.107	$104,780.00
					13.61	0.00	$129,005.30	0.0	0.0	0.0	0.0	0.0	27-3043	Writers and Authors	0.453	$72,070.00
					13.61	0.00	$116,403.70	0.0	0.0	0.0	0.0	0.0	27-3091	Interpreters and Translators	0.214	$65,030.00
					13.61	0.00	$94,386.70	0.0	0.0	0.0	0.0	0.0	27-3099	Media and Communication Workers, All Other	0.233	$52,730.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					13.61	0.00	$88,103.80	0.0	0.0	0.0	0.0	0.0	27-4011	Audio and Video Equipment Technicians	0.513	$49,220.00
					13.61	0.00	$70,705.00	0.0	0.0	0.0	0.0	0.0	27-4012	Broadcast Technicians	0.069	$39,500.00
					13.61	0.00	-	0.0	0.0	0.0	0.0	0.0	27-4014	Sound Engineering Technicians	0.054	*
					13.61	0.00	$90,269.70	0.0	0.0	0.0	0.0	0.0	27-4021	Photographers	0.126	$50,430.00
					13.61	0.00	-	0.0	0.0	0.0	0.0	0.0	27-4032	Film and Video Editors	0.166	*
					13.61	0.00	$115,598.20	0.0	0.0	0.0	0.0	0.0	27-4099	Media and Communication Equipment Workers, All Othe	0.087	$64,580.00
Non-Instructional	Healthcare Practioners and Technical	-	**45**													
				290000	-	-	**$203,182.90**	-	-	-	-	**1.0**	**29-0000**	**Healthcare Practitioners and Technical Occupations**	**40.552**	**$113,510.00**
					39.73	0.00	$134,106.80	0.0	0.0	0.0	0.0	0.0	29-1011	Chiropractors	0.242	$74,920.00
					39.73	0.00	$303,190.20	0.0	0.0	0.0	0.0	0.0	29-1021	Dentists, General	1.217	$169,380.00
					39.73	0.00	$140,461.30	0.0	0.0	0.0	0.0	0.0	29-1031	Dietitians and Nutritionists	0.331	$78,470.00
					39.73	0.00	$194,841.50	0.0	0.0	0.0	0.0	0.0	29-1041	Optometrists	0.4	$108,850.00
					39.73	0.00	$258,493.90	0.0	0.0	0.0	0.0	0.0	29-1051	Pharmacists	1.411	$144,410.00
					39.73	0.00	$506,176.20	0.0	0.0	0.0	0.0	0.0	29-1061	Anesthesiologists	**	$282,780.00
					39.73	0.00	$349,891.30	0.0	0.0	0.0	0.0	0.0	29-1062	Family and General Practitioners	0.826	$195,470.00
					39.73	0.00	$406,455.30	0.0	0.0	0.0	0.0	0.0	29-1063	Internists, General	0.189	$227,070.00
					39.73	0.00	$482,530.30	0.0	0.0	0.0	0.0	0.0	29-1064	Obstetricians and Gynecologists	0.075	$269,570.00
					39.73	0.00	$268,374.70	0.0	0.0	0.0	0.0	0.0	29-1065	Pediatricians, General	0.171	$149,930.00
					39.73	0.00	$466,670.90	0.0	0.0	0.0	0.0	0.0	29-1066	Psychiatrists	**	$260,710.00
					39.73	0.00	$478,628.10	0.0	0.0	0.0	0.0	0.0	29-1067	Surgeons	0.194	$267,390.00
					39.73	0.00	$451,885.50	0.0	0.0	0.0	0.0	0.0	29-1069	Physicians and Surgeons, All Other	1.58	$252,450.00
					39.73	0.00	$220,170.00	0.0	0.0	0.0	0.0	0.0	29-1071	Physician Assistants	0.613	$123,000.00
					39.73	0.00	$235,295.50	0.0	0.0	0.0	0.0	0.0	29-1081	Podiatrists	**	$131,450.00
					39.73	0.00	$185,802.00	0.0	0.0	0.0	0.0	0.0	29-1122	Occupational Therapists	0.511	$103,800.00
					39.73	0.00	$182,794.80	0.0	0.0	0.0	0.0	0.0	29-1123	Physical Therapists	1.067	$102,120.00
					39.73	0.00	$229,782.30	0.0	0.0	0.0	0.0	0.0	29-1124	Radiation Therapists	0.09	$128,370.00
					39.73	0.00	$108,295.00	0.0	0.0	0.0	0.0	0.0	29-1125	Recreational Therapists	0.084	$60,500.00
					39.73	0.00	$157,806.40	0.0	0.0	0.0	0.0	0.0	29-1126	Respiratory Therapists	0.926	$88,160.00
					39.73	0.00	$172,663.40	0.0	0.0	0.0	0.0	0.0	29-1127	Speech-Language Pathologists	0.558	$96,460.00
					39.73	0.00	$98,306.80	0.0	0.0	0.0	0.0	0.0	29-1129	Therapists, All Other	0.176	$54,920.00
					39.73	0.00	$224,591.30	0.0	0.0	0.0	0.0	0.0	29-1131	Veterinarians	0.331	$125,470.00
					39.73	0.00	$216,017.20	0.0	0.0	0.0	0.0	0.0	29-1141	Registered Nurses	14.72	$120,680.00
					39.73	0.00	$427,559.40	0.0	0.0	0.0	0.0	0.0	29-1151	Nurse Anesthetists	**	$238,860.00
					39.73	0.00	$261,698.00	0.0	0.0	0.0	0.0	0.0	29-1161	Nurse Midwives	0.064	$146,200.00
					39.73	0.00	$260,409.20	0.0	0.0	0.0	0.0	0.0	29-1171	Nurse Practitioners	0.746	$145,480.00
					39.73	0.00	$156,249.10	0.0	0.0	0.0	0.0	0.0	29-1181	Audiologists	**	$87,290.00
					39.73	0.00	$139,602.10	0.0	0.0	0.0	0.0	0.0	29-1199	Health Diagnosing and Treating Practitioners, All Other	0.465	$77,990.00
					39.73	0.00	$160,043.90	0.0	0.0	0.0	0.0	0.0	29-2011	Medical and Clinical Laboratory Technologists	0.818	$89,410.00
					39.73	0.00	$94,887.90	0.0	0.0	0.0	0.0	0.0	29-2012	Medical and Clinical Laboratory Technicians	0.933	$53,010.00
					39.73	0.00	$174,310.20	0.0	0.0	0.0	0.0	0.0	29-2021	Dental Hygienists	1.266	$97,380.00
					39.73	0.00	$136,863.40	0.0	0.0	0.0	0.0	0.0	29-2031	Cardiovascular Technologists and Technicians	0.15	$76,460.00
					39.73	0.00	$191,691.10	0.0	0.0	0.0	0.0	0.0	29-2032	Diagnostic Medical Sonographers	0.325	$107,090.00
					39.73	0.00	$216,876.40	0.0	0.0	0.0	0.0	0.0	29-2033	Nuclear Medicine Technologists	0.049	$121,160.00
					39.73	0.00	$171,750.50	0.0	0.0	0.0	0.0	0.0	29-2034	Radiologic Technologists	0.711	$95,950.00
					39.73	0.00	$172,233.80	0.0	0.0	0.0	0.0	0.0	29-2035	Magnetic Resonance Imaging Technologists	0.113	$96,220.00
					39.73	0.00	$85,955.80	0.0	0.0	0.0	0.0	0.0	29-2041	Emergency Medical Technicians and Paramedics	0.279	$48,020.00
					39.73	0.00	$74,678.80	0.0	0.0	0.0	0.0	0.0	29-2051	Dietetic Technicians	0.341	$41,720.00
					39.73	0.00	$81,641.90	0.0	0.0	0.0	0.0	0.0	29-2052	Pharmacy Technicians	1.488	$45,610.00
					39.73	0.00	$118,730.70	0.0	0.0	0.0	0.0	0.0	29-2053	Psychiatric Technicians	0.089	$66,330.00
					39.73	0.00	$93,509.60	0.0	0.0	0.0	0.0	0.0	29-2054	Respiratory Therapy Technicians	**	$52,240.00
					39.73	0.00	$122,561.30	0.0	0.0	0.0	0.0	0.0	29-2055	Surgical Technologists	0.602	$68,470.00
					39.73	0.00	$75,645.40	0.0	0.0	0.0	0.0	0.0	29-2056	Veterinary Technologists and Technicians	0.409	$42,260.00
					39.73	0.00	$77,865.00	0.0	0.0	0.0	0.0	0.0	29-2057	Ophthalmic Medical Technicians	0.225	$43,500.00
					39.73	0.00	$108,653.00	0.0	0.0	0.0	0.0	0.0	29-2061	Licensed Practical and Licensed Vocational Nurses	2.086	$60,700.00
					39.73	0.00	$110,156.60	0.0	0.0	0.0	0.0	0.0	29-2071	Medical Records and Health Information Technicians	0.848	$61,540.00
					39.73	0.00	$81,964.10	0.0	0.0	0.0	0.0	0.0	29-2081	Opticians, Dispensing	0.299	$45,790.00
					39.73	0.00	$102,280.60	0.0	0.0	0.0	0.0	0.0	29-2099	Health Technologists and Technicians, All Other	0.945	$57,140.00
					39.73	0.00	$182,347.30	0.0	0.0	0.0	0.0	0.0	29-9011	Occupational Health and Safety Specialists	0.291	$101,870.00
					39.73	0.00	$114,434.70	0.0	0.0	0.0	0.0	0.0	29-9012	Occupational Health and Safety Technicians	0.098	$63,930.00
					39.73	0.00	$94,315.10	0.0	0.0	0.0	0.0	0.0	29-9091	Athletic Trainers	0.105	$52,690.00
					39.73	0.00	$179,286.40	0.0	0.0	0.0	0.0	0.0	29-9092	Genetic Counselors	0.031	$100,160.00
					39.73	0.00	$195,575.40	0.0	0.0	0.0	0.0	0.0	29-9099	Healthcare Practitioners and Technical Workers, All Othe	0.237	$109,260.00
Non-Instructional	Service	641.9	**456**													
				310000	-	-	**$75,699.10**	-	-	-	-	**1.0**	**31-0000**	**Healthcare Support Occupations**	**16.684**	**$42,290.00**
					156.73	3.49	$52,482.80	0.0	3.5	0.0	0.0	0.0	31-1011	Home Health Aides	0.852	$29,320.00
					156.73	17.91	$66,104.70	0.0	0.0	17.9	0.0	0.0	31-1014	Nursing Assistants	4.374	$36,930.00
					156.73	0.93	$78,061.90	0.0	0.0	0.0	0.9	0.0	31-1015	Orderlies	0.226	$43,610.00
					156.73	0.14	$104,750.80	0.0	0.0	0.0	0.1	0.0	31-2011	Occupational Therapy Assistants	0.033	$58,520.00
					156.73	0.75	$123,152.00	0.0	0.0	0.0	0.0	0.0	31-2021	Physical Therapist Assistants	0.182	$68,800.00
					156.73	1.39	$58,210.80	0.0	0.0	1.4	0.0	0.0	31-2022	Physical Therapist Aides	0.339	$32,520.00
					156.73	2.90	$85,687.30	0.0	0.0	0.0	2.9	0.0	31-9011	Massage Therapists	0.707	$47,870.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					156.73	11.74	$85,633.60	0.0	0.0	0.0	11.7	0.0	31-9091	Dental Assistants	2.867	$47,840.00
					156.73	17.93	$80,585.80	0.0	0.0	0.0	17.9	0.0	31-9092	Medical Assistants	4.378	$45,020.00
					156.73	1.89	$97,143.30	0.0	0.0	0.0	1.9	0.0	31-9093	Medical Equipment Preparers	0.461	$54,270.00
					156.73	0.52	$90,645.60	0.0	0.0	0.0	0.5	0.0	31-9094	Medical Transcriptionists	0.126	$50,640.00
					156.73	0.00	$60,591.50	0.0	0.0	0.0	0.0	0.0	31-9095	Pharmacy Aides	**	$33,850.00
					156.73	2.17	$55,776.40	0.0	0.0	2.2	0.0	0.0	31-9096	Veterinary Assistants and Laboratory Animal Caretakers	0.53	$31,160.00
					156.73	2.13	$73,748.00	0.0	0.0	2.1	0.0	0.0	31-9097	Phlebotomists	0.521	$41,200.00
					156.73	2.08	$93,259.00	0.0	0.0	0.0	2.1	0.0	31-9099	Healthcare Support Workers, All Other	0.509	$52,100.00
				330000	-	-	**$109,422.70**	-	-	-	-	**1.0**	**33-0000**	**Protective Service Occupations**	**16.514**	**$61,130.00**
					156.73	0.51	$290,982.40	0.0	0.0	0.0	0.0	0.0	33-1012	First-Line Supervisors of Police and Detectives	0.124	$162,560.00
					156.73	0.41	$222,461.20	0.0	0.0	0.0	0.0	0.0	33-1021	First-Line Supervisors of Fire Fighting and Prevention Wo	0.101	$124,280.00
					156.73	2.00	$86,134.80	0.0	0.0	0.0	2.0	0.0	33-1099	First-Line Supervisors of Protective Service Workers, All C	0.488	$48,120.00
					156.73	4.52	$151,111.80	0.0	0.0	0.0	0.0	0.0	33-2011	Firefighters	1.103	$84,420.00
					156.73	0.17	$157,394.70	0.0	0.0	0.0	0.0	0.0	33-2022	Forest Fire Inspectors and Prevention Specialists	0.041	$87,930.00
					156.73	0.72	$188,916.60	0.0	0.0	0.0	0.0	0.0	33-3021	Detectives and Criminal Investigators	0.177	$105,540.00
					156.73	0.26	$99,631.40	0.0	0.0	0.0	0.3	0.0	33-3041	Parking Enforcement Workers	0.063	$55,660.00
					156.73	15.46	$210,933.60	0.0	0.0	0.0	0.0	0.0	33-3051	Police and Sheriff's Patrol Officers	3.776	$117,840.00
					156.73	0.15	$109,172.10	0.0	0.0	0.0	0.1	0.0	33-9011	Animal Control Workers	0.036	$60,990.00
					156.73	0.00	$136,612.80	0.0	0.0	0.0	0.0	0.0	33-9021	Private Detectives and Investigators	**	$76,320.00
					156.73	32.82	$61,289.60	0.0	0.0	32.8	0.0	0.0	33-9032	Security Guards	8.013	$34,240.00
					156.73	1.77	$69,684.70	0.0	0.0	1.8	0.0	0.0	33-9091	Crossing Guards	0.431	$38,930.00
					156.73	2.93	$46,736.90	0.0	2.9	0.0	0.0	0.0	33-9092	Lifeguards, Ski Patrol, and Other Recreational Protective	0.715	$26,110.00
					156.73	1.03	$81,695.60	0.0	0.0	0.0	1.0	0.0	33-9093	Transportation Security Screeners	0.252	$45,640.00
					156.73	2.53	$74,231.30	0.0	0.0	2.5	0.0	0.0	33-9099	Protective Service Workers, All Other	0.619	$41,470.00
				350000	-	**0.00**	**$51,963.70**	-	-	-	-	**1.0**	**35-0000**	**Food Preparation and Serving Related Occupations**	**74.596**	**$29,030.00**
					156.73	4.01	$105,753.20	0.0	0.0	0.0	4.0	0.0	35-1011	Chefs and Head Cooks	0.978	$59,080.00
					156.73	19.04	$71,832.70	0.0	0.0	19.0	0.0	0.0	35-1012	First-Line Supervisors of Food Preparation and Serving W	4.65	$40,130.00
					156.73	18.01	$42,136.60	0.0	18.0	0.0	0.0	0.0	35-2011	Cooks, Fast Food	4.398	$23,540.00
					156.73	7.91	$59,947.10	0.0	0.0	7.9	0.0	0.0	35-2012	Cooks, Institution and Cafeteria	1.932	$33,490.00
					156.73	26.63	$52,984.00	0.0	26.6	0.0	0.0	0.0	35-2014	Cooks, Restaurant	6.502	$29,600.00
					156.73	5.07	$48,419.50	0.0	5.1	0.0	0.0	0.0	35-2015	Cooks, Short Order	1.238	$27,050.00
					156.73	0.26	$57,136.80	0.0	0.0	0.3	0.0	0.0	35-2019	Cooks, All Other	0.064	$31,920.00
					156.73	22.09	$47,435.00	0.0	22.1	0.0	0.0	0.0	35-2021	Food Preparation Workers	5.395	$26,500.00
					156.73	10.84	$61,504.40	0.0	0.0	10.8	0.0	0.0	35-3011	Bartenders	2.648	$34,360.00
					156.73	73.84	$44,266.70	0.0	73.8	0.0	0.0	0.0	35-3021	Combined Food Preparation and Serving Workers, Includ	18.03	$24,730.00
					156.73	10.74	$47,882.50	0.0	10.7	0.0	0.0	0.0	35-3022	Counter Attendants, Cafeteria, Food Concession, and Cof	2.622	$26,750.00
					156.73	57.86	$57,799.10	0.0	0.0	57.9	0.0	0.0	35-3031	Waiters and Waitresses	14.129	$32,290.00
					156.73	6.26	$60,054.50	0.0	0.0	6.3	0.0	0.0	35-3041	Food Servers, Nonrestaurant	1.529	$33,550.00
					156.73	16.81	$48,330.00	0.0	16.8	0.0	0.0	0.0	35-9011	Dining Room and Cafeteria Attendants and Bartender He	4.105	$27,000.00
					156.73	16.24	$43,622.30	0.0	16.2	0.0	0.0	0.0	35-9021	Dishwashers	3.966	$24,370.00
					156.73	6.53	$45,770.30	0.0	6.5	0.0	0.0	0.0	35-9031	Hosts and Hostesses, Restaurant, Lounge, and Coffee Sho	1.594	$25,570.00
					156.73	0.00	$42,763.10	0.0	0.0	0.0	0.0	0.0	35-9099	Food Preparation and Serving Related Workers, All Other	**	$23,890.00
				370000	-	-	**$59,445.90**	-	-	-	-	**1.0**	**37-0000**	**Building and Grounds Cleaning and Maintenance Occup**	**26.708**	**$33,210.00**
					156.73	3.55	$101,886.80	0.0	0.0	0.0	3.5	0.0	37-1011	First-Line Supervisors of Housekeeping and Janitorial Wo	0.866	$56,920.00
					156.73	1.58	$90,842.50	0.0	0.0	0.0	1.6	0.0	37-1012	First-Line Supervisors of Landscaping, Lawn Service, and	0.387	$50,750.00
					156.73	60.99	$53,861.10	0.0	0.0	61.0	0.0	0.0	37-2011	Janitors and Cleaners, Except Maids and Housekeeping C	14.892	$30,090.00
					156.73	17.92	$56,080.70	0.0	0.0	17.9	0.0	0.0	37-2012	Maids and Housekeeping Cleaners	4.375	$31,330.00
					156.73	2.15	$86,260.10	0.0	0.0	0.0	2.2	0.0	37-2021	Pest Control Workers	0.525	$48,190.00
					156.73	19.59	$61,701.30	0.0	0.0	19.6	0.0	0.0	37-3011	Landscaping and Groundskeeping Workers	4.783	$34,470.00
					156.73	2.29	$93,294.80	0.0	0.0	0.0	2.3	0.0	37-3013	Tree Trimmers and Pruners	0.56	$52,120.00
					156.73	0.00	$78,706.30	0.0	0.0	0.0	0.0	0.0	37-3019	Grounds Maintenance Workers, All Other	**	$43,970.00
				390000	-	-	**$55,024.60**	-	-	-	-	**1.0**	**39-0000**	**Personal Care and Service Occupations**	**25.815**	**$30,740.00**
					156.73	4.23	$74,947.30	0.0	0.0	4.2	0.0	0.0	39-1021	First-Line Supervisors of Personal Service Workers	1.033	$41,870.00
					156.73	0.00	$75,197.90	0.0	0.0	0.0	0.0	0.0	39-2011	Animal Trainers	**	$42,010.00
					156.73	3.59	$56,993.60	0.0	0.0	3.6	0.0	0.0	39-2021	Nonfarm Animal Caretakers	0.877	$31,840.00
					156.73	0.00	$39,773.80	0.0	0.0	0.0	0.0	0.0	39-3011	Gaming Dealers	**	$22,220.00
					156.73	6.06	$44,266.70	0.0	6.1	0.0	0.0	0.0	39-3031	Ushers, Lobby Attendants, and Ticket Takers	1.48	$24,730.00
					156.73	7.99	$45,483.90	0.0	8.0	0.0	0.0	0.0	39-3091	Amusement and Recreation Attendants	1.952	$25,410.00
					156.73	0.13	$71,385.20	0.0	0.0	0.1	0.0	0.0	39-3092	Costume Attendants	0.031	$39,880.00
					156.73	0.25	$51,534.10	0.0	0.3	0.0	0.0	0.0	39-3093	Locker Room, Coatroom, and Dressing Room Attendants	0.062	$28,790.00
					156.73	0.00	$55,203.60	0.0	0.0	0.0	0.0	0.0	39-3099	Entertainment Attendants and Related Workers, All Othe	**	$30,840.00
					156.73	0.38	$64,243.10	0.0	0.0	0.4	0.0	0.0	39-4021	Funeral Attendants	0.092	$35,890.00
					156.73	0.32	$100,347.40	0.0	0.0	0.0	0.3	0.0	39-4031	Morticians, Undertakers, and Funeral Directors	0.078	$56,060.00
					156.73	9.89	$52,930.30	0.0	9.9	0.0	0.0	0.0	39-5012	Hairdressers, Hairstylists, and Cosmetologists	2.416	$29,570.00
					156.73	7.12	$43,640.20	0.0	7.1	0.0	0.0	0.0	39-5092	Manicurists and Pedicurists	1.738	$24,380.00
					156.73	1.60	$64,565.30	0.0	0.0	1.6	0.0	0.0	39-5094	Skincare Specialists	0.391	$36,070.00
					156.73	0.66	$51,480.40	0.0	0.7	0.0	0.0	0.0	39-6011	Baggage Porters and Bellhops	0.161	$28,760.00
					156.73	0.57	$66,462.70	0.0	0.0	0.6	0.0	0.0	39-6012	Concierges	0.14	$37,130.00
					156.73	0.38	$59,159.50	0.0	0.0	0.4	0.0	0.0	39-7011	Tour Guides and Escorts	0.092	$33,050.00
					156.73	10.93	$53,288.30	0.0	10.9	0.0	0.0	0.0	39-9011	Childcare Workers	2.668	$29,770.00
					156.73	25.43	$47,023.30	0.0	25.4	0.0	0.0	0.0	39-9021	Personal Care Aides	6.209	$26,270.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					156.73	9.18	$87,119.30	0.0	0.0	0.0	9.2	0.0	39-9031	Fitness Trainers and Aerobics Instructors	2.241	$48,670.00
					156.73	10.92	$62,864.80	0.0	0.0	10.9	0.0	0.0	39-9032	Recreation Workers	2.667	$35,120.00
					156.73	0.79	$59,750.20	0.0	0.0	0.8	0.0	0.0	39-9041	Residential Advisors	0.194	$33,380.00
					156.73	0.00	$42,369.30	0.0	0.0	0.0	0.0	0.0	39-9099	Personal Care and Service Workers, All Other	**	$23,670.00
Non-Instructional	**Sales and related**	**0.0**	**0**													
				410000	**-**	**-**	**$101,027.60**	**-**	**-**	**-**	**-**	**1.0**	**41-0000**	**Sales and Related Occupations**	**92.197**	**$56,440.00**
					92.03	0.00	$87,352.00	0.0	0.0	0.0	0.0	0.0	41-1011	First-Line Supervisors of Retail Sales Workers	5.461	$48,800.00
					92.03	0.00	$187,413.00	0.0	0.0	0.0	0.0	0.0	41-1012	First-Line Supervisors of Non-Retail Sales Workers	2.203	$104,700.00
					92.03	0.00	$47,291.80	0.0	0.0	0.0	0.0	0.0	41-2011	Cashiers	19.349	$26,420.00
					92.03	0.00	$63,903.00	0.0	0.0	0.0	0.0	0.0	41-2021	Counter and Rental Clerks	4.263	$35,700.00
					92.03	0.00	$67,071.30	0.0	0.0	0.0	0.0	0.0	41-2022	Parts Salespersons	0.951	$37,470.00
					92.03	0.00	$55,221.50	0.0	0.0	0.0	0.0	0.0	41-2031	Retail Salespersons	21.315	$30,850.00
					92.03	0.00	$134,894.40	0.0	0.0	0.0	0.0	0.0	41-3011	Advertising Sales Agents	0.64	$75,360.00
					92.03	0.00	$169,781.50	0.0	0.0	0.0	0.0	0.0	41-3021	Insurance Sales Agents	1.085	$94,850.00
					92.03	0.00	$121,165.10	0.0	0.0	0.0	0.0	0.0	41-3031	Securities, Commodities, and Financial Services Sales Age	2.334	$67,690.00
					92.03	0.00	$71,582.10	0.0	0.0	0.0	0.0	0.0	41-3041	Travel Agents	0.701	$39,990.00
					92.03	0.00	$144,846.80	0.0	0.0	0.0	0.0	0.0	41-3099	Sales Representatives, Services, All Other	15.71	$80,920.00
					92.03	0.00	$207,801.10	0.0	0.0	0.0	0.0	0.0	41-4011	Sales Representatives, Wholesale and Manufacturing, Te	6.278	$116,090.00
					92.03	0.00	$138,367.00	0.0	0.0	0.0	0.0	0.0	41-4012	Sales Representatives, Wholesale and Manufacturing, Ex	6.102	$77,300.00
					92.03	0.00	$67,089.20	0.0	0.0	0.0	0.0	0.0	41-9011	Demonstrators and Product Promoters	0.753	$37,480.00
					92.03	0.00	-	0.0	0.0	0.0	0.0	0.0	41-9021	Real Estate Brokers	0.139	*
					92.03	0.00	$111,517.00	0.0	0.0	0.0	0.0	0.0	41-9022	Real Estate Sales Agents	0.829	$62,300.00
					92.03	0.00	$248,774.20	0.0	0.0	0.0	0.0	0.0	41-9031	Sales Engineers	2.837	$138,980.00
					92.03	0.00	$62,900.60	0.0	0.0	0.0	0.0	0.0	41-9041	Telemarketers	0.335	$35,140.00
					92.03	0.00	$89,858.00	0.0	0.0	0.0	0.0	0.0	41-9099	Sales and Related Workers, All Other	0.741	$50,200.00
Non-Instructional	**Office and Administrative Support**	**441.3**	**992**													
				430000	**-**	**-**	**$87,817.40**	**-**	**-**	**-**	**-**	**1.0**	**43-0000**	**Office and Administrative Support Occupations**	**124.867**	**$49,060.00**
					123.81	30.05	$129,345.40	0.0	0.0	0.0	0.0	0.0	43-1011	First-Line Supervisors of Office and Administrative Suppo	8.432	$72,260.00
					123.81	1.44	$63,276.50	0.0	0.0	1.4	0.0	0.0	43-2011	Switchboard Operators, Including Answering Service	0.405	$35,350.00
					123.81	4.81	$88,605.00	0.0	0.0	0.0	4.8	0.0	43-3011	Bill and Account Collectors	1.35	$49,500.00
					123.81	8.70	$88,963.00	0.0	0.0	0.0	8.7	0.0	43-3021	Billing and Posting Clerks	2.44	$49,700.00
					123.81	35.66	$87,871.10	0.0	0.0	0.0	35.7	0.0	43-3031	Bookkeeping, Accounting, and Auditing Clerks	10.005	$49,090.00
					123.81	4.69	$102,925.00	0.0	0.0	0.0	4.7	0.0	43-3051	Payroll and Timekeeping Clerks	1.316	$57,500.00
					123.81	2.88	$98,414.20	0.0	0.0	0.0	2.9	0.0	43-3061	Procurement Clerks	0.807	$54,980.00
					123.81	5.97	$59,141.60	0.0	0.0	6.0	0.0	0.0	43-3071	Tellers	1.675	$33,040.00
					123.81	0.57	$86,510.70	0.0	0.0	0.0	0.6	0.0	43-3099	Financial Clerks, All Other	0.161	$48,330.00
					123.81	0.57	$119,554.10	0.0	0.0	0.0	0.6	0.0	43-4011	Brokerage Clerks	0.161	$66,790.00
					123.81	1.18	$77,703.90	0.0	0.0	0.0	1.2	0.0	43-4031	Court, Municipal, and License Clerks	0.331	$43,410.00
					123.81	0.31	$74,159.70	0.0	0.0	0.3	0.0	0.0	43-4041	Credit Authorizers, Checkers, and Clerks	0.087	$41,430.00
					123.81	38.90	$89,500.00	0.0	0.0	0.0	38.9	0.0	43-4051	Customer Service Representatives	10.915	$50,000.00
					123.81	0.00	$93,312.70	0.0	0.0	0.0	0.0	0.0	43-4061	Eligibility Interviewers, Government Programs	**	$52,130.00
					123.81	2.59	$63,688.20	0.0	0.0	2.6	0.0	0.0	43-4071	File Clerks	0.726	$35,580.00
					123.81	4.29	$50,406.40	0.0	4.3	0.0	0.0	0.0	43-4081	Hotel, Motel, and Resort Desk Clerks	1.204	$28,160.00
					123.81	4.13	$80,317.30	0.0	0.0	0.0	4.1	0.0	43-4111	Interviewers, Except Eligibility and Loan	1.159	$44,870.00
					123.81	1.81	$75,645.40	0.0	0.0	1.8	0.0	0.0	43-4121	Library Assistants, Clerical	0.507	$42,260.00
					123.81	2.61	$85,597.80	0.0	0.0	0.0	2.6	0.0	43-4131	Loan Interviewers and Clerks	0.731	$47,820.00
					123.81	0.86	$93,796.00	0.0	0.0	0.0	0.9	0.0	43-4141	New Accounts Clerks	0.24	$52,400.00
					123.81	9.34	$72,530.80	0.0	0.0	9.3	0.0	0.0	43-4151	Order Clerks	2.62	$40,520.00
					123.81	4.10	$84,595.40	0.0	0.0	0.0	4.1	0.0	43-4161	Human Resources Assistants, Except Payroll and Timekee	1.15	$47,260.00
					123.81	18.17	$67,429.30	0.0	0.0	18.2	0.0	0.0	43-4171	Receptionists and Information Clerks	5.097	$37,670.00
					123.81	1.34	$73,336.30	0.0	0.0	1.3	0.0	0.0	43-4181	Reservation and Transportation Ticket Agents and Travel	0.375	$40,970.00
					123.81	3.70	$80,782.70	0.0	0.0	0.0	3.7	0.0	43-4199	Information and Record Clerks, All Other	1.039	$45,130.00
					123.81	0.55	$79,995.10	0.0	0.0	0.0	0.5	0.0	43-5011	Cargo and Freight Agents	0.154	$44,690.00
					123.81	1.95	$71,224.10	0.0	0.0	1.9	0.0	0.0	43-5021	Couriers and Messengers	0.547	$39,790.00
					123.81	1.32	$148,462.60	0.0	0.0	0.0	0.0	0.0	43-5031	Police, Fire, and Ambulance Dispatchers	0.369	$82,940.00
					123.81	3.34	$78,742.10	0.0	0.0	0.0	3.3	0.0	43-5032	Dispatchers, Except Police, Fire, and Ambulance	0.936	$43,990.00
					123.81	0.46	$118,301.10	0.0	0.0	0.0	0.5	0.0	43-5041	Meter Readers, Utilities	0.128	$66,090.00
					123.81	1.11	$90,753.00	0.0	0.0	0.0	1.1	0.0	43-5051	Postal Service Clerks	0.312	$50,700.00
					123.81	5.91	$95,657.60	0.0	0.0	0.0	5.9	0.0	43-5052	Postal Service Mail Carriers	1.658	$53,440.00
					123.81	1.96	$90,359.20	0.0	0.0	0.0	2.0	0.0	43-5053	Postal Service Mail Sorters, Processors, and Processing M	0.551	$50,480.00
					123.81	12.96	$127,072.10	0.0	0.0	0.0	0.0	0.0	43-5061	Production, Planning, and Expediting Clerks	3.636	$70,990.00
					123.81	16.72	$67,429.30	0.0	0.0	16.7	0.0	0.0	43-5071	Shipping, Receiving, and Traffic Clerks	4.691	$37,670.00
					123.81	40.94	$56,456.60	0.0	0.0	40.9	0.0	0.0	43-5081	Stock Clerks and Order Fillers	11.486	$31,540.00
					123.81	1.40	$62,882.70	0.0	0.0	1.4	0.0	0.0	43-5111	Weighers, Measurers, Checkers, and Samplers, Recordke	0.394	$35,130.00
					123.81	33.06	$132,424.20	0.0	0.0	0.0	0.0	0.0	43-6011	Executive Secretaries and Executive Administrative Assist	9.275	$73,980.00
					123.81	3.69	$121,737.90	0.0	0.0	0.0	3.7	0.0	43-6012	Legal Secretaries	1.035	$68,010.00
					123.81	15.93	$91,146.80	0.0	0.0	0.0	15.9	0.0	43-6013	Medical Secretaries	4.471	$50,920.00
					123.81	41.86	$82,590.60	0.0	0.0	0.0	41.9	0.0	43-6014	Secretaries and Administrative Assistants, Except Legal, M	11.744	$46,140.00
					123.81	0.76	$95,729.20	0.0	0.0	0.0	0.8	0.0	43-9011	Computer Operators	0.213	$53,480.00
					123.81	2.98	$58,013.90	0.0	0.0	3.0	0.0	0.0	43-9021	Data Entry Keyers	0.835	$32,410.00
					123.81	0.87	$85,418.80	0.0	0.0	0.0	0.9	0.0	43-9022	Word Processors and Typists	0.243	$47,720.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					123.81	0.26	$110,693.60	0.0	0.0	0.0	0.3	0.0	43-9031	Desktop Publishers	0.073	$61,840.00
					123.81	4.79	$75,896.00	0.0	0.0	4.8	0.0	0.0	43-9041	Insurance Claims and Policy Processing Clerks	1.343	$42,400.00
					123.81	0.58	$64,243.10	0.0	0.0	0.6	0.0	0.0	43-9051	Mail Clerks and Mail Machine Operators, Except Postal Se	0.162	$35,890.00
					123.81	50.91	$77,614.40	0.0	0.0	0.0	50.9	0.0	43-9061	Office Clerks, General	14.283	$43,360.00
					123.81	1.04	$69,183.50	0.0	0.0	1.0	0.0	0.0	43-9071	Office Machine Operators, Except Computer	0.291	$38,650.00
					123.81	0.27	$79,207.50	0.0	0.0	0.0	0.3	0.0	43-9081	Proofreaders and Copy Markers	0.075	$44,250.00
					123.81	7.01	$81,373.40	0.0	0.0	0.0	7.0	0.0	43-9199	Office and Administrative Support Workers, All Other	1.968	$45,460.00
Non-Instructional	Natural Resources, Construction, and Maintenance	432.1	307													
				450000	-		**$44,302.50**	-	-	-	-	**1.0**	**45-0000**	**Farming, Fishing, and Forestry Occupations**	**3.103**	**$24,750.00**
					60.89	0.41	$74,070.20	0.0	0.0	0.4	0.0	0.0	45-1011	First-Line Supervisors of Farming, Fishing, and Forestry W	0.058	$41,380.00
					60.89	0.23	$58,568.80	0.0	0.0	0.2	0.0	0.0	45-2041	Graders and Sorters, Agricultural Products	0.033	$32,720.00
					60.89	20.72	$43,031.60	0.0	20.7	0.0	0.0	0.0	45-2092	Farmworkers and Laborers, Crop, Nursery, and Greenhou	2.92	$24,040.00
					60.89	0.23	$55,382.60	0.0	0.0	0.2	0.0	0.0	45-2093	Farmworkers, Farm, Ranch, and Aquacultural Animals	0.033	$30,940.00
				470000	-	-	**$114,667.40**	-	-	-	-	**1.0**	**47-0000**	**Construction and Extraction Occupations**	**34.862**	**$64,060.00**
					60.89	21.92	$166,129.90	0.0	0.0	0.0	0.0	0.0	47-1011	First-Line Supervisors of Construction Trades and Extracti	3.088	$92,810.00
					60.89	1.27	$109,064.70	0.0	0.0	0.0	1.3	0.0	47-2021	Brickmasons and Blockmasons	0.179	$60,930.00
					60.89	36.86	$111,678.10	0.0	0.0	0.0	36.9	0.0	47-2031	Carpenters	5.193	$62,390.00
					60.89	2.90	$98,825.90	0.0	0.0	0.0	2.9	0.0	47-2041	Carpet Installers	0.408	$55,210.00
					60.89	1.54	$90,126.50	0.0	0.0	0.0	1.5	0.0	47-2042	Floor Layers, Except Carpet, Wood, and Hard Tiles	0.217	$50,350.00
					60.89	4.90	$84,989.20	0.0	0.0	0.0	4.9	0.0	47-2044	Tile and Marble Setters	0.691	$47,480.00
					60.89	10.92	$97,716.10	0.0	0.0	0.0	10.9	0.0	47-2051	Cement Masons and Concrete Finishers	1.539	$54,590.00
					60.89	30.87	$89,858.00	0.0	0.0	0.0	30.9	0.0	47-2061	Construction Laborers	4.35	$50,200.00
					60.89	1.36	$99,237.60	0.0	0.0	0.0	1.4	0.0	47-2071	Paving, Surfacing, and Tamping Equipment Operators	0.191	$55,440.00
					60.89	7.79	$130,150.90	0.0	0.0	0.0	0.0	0.0	47-2073	Operating Engineers and Other Construction Equipment (	1.097	$72,710.00
					60.89	9.75	$119,912.10	0.0	0.0	0.0	9.8	0.0	47-2081	Drywall and Ceiling Tile Installers	1.374	$66,990.00
					60.89	4.51	$108,993.10	0.0	0.0	0.0	4.5	0.0	47-2082	Tapers	0.635	$60,890.00
					60.89	31.58	$143,182.10	0.0	0.0	0.0	0.0	0.0	47-2111	Electricians	4.45	$79,990.00
					60.89	0.00	$121,899.00	0.0	0.0	0.0	0.0	0.0	47-2121	Glaziers	**	$68,100.00
					60.89	16.91	$100,651.70	0.0	0.0	0.0	16.9	0.0	47-2141	Painters, Construction and Maintenance	2.383	$56,230.00
					60.89	1.21	$97,107.50	0.0	0.0	0.0	1.2	0.0	47-2151	Pipelayers	0.171	$54,250.00
					60.89	20.06	$109,297.40	0.0	0.0	0.0	20.1	0.0	47-2152	Plumbers, Pipefitters, and Steamfitters	2.827	$61,060.00
					60.89	2.42	$93,813.90	0.0	0.0	0.0	2.4	0.0	47-2161	Plasterers and Stucco Masons	0.341	$52,410.00
					60.89	0.38	$91,540.60	0.0	0.0	0.0	0.4	0.0	47-2171	Reinforcing Iron and Rebar Workers	0.054	$51,140.00
					60.89	8.41	$102,298.50	0.0	0.0	0.0	8.4	0.0	47-2181	Roofers	1.185	$57,150.00
					60.89	4.34	$128,826.30	0.0	0.0	0.0	0.0	0.0	47-2211	Sheet Metal Workers	0.612	$71,970.00
					60.89	2.28	$108,277.10	0.0	0.0	0.0	2.3	0.0	47-2221	Structural Iron and Steel Workers	0.321	$60,490.00
					60.89	1.94	$81,516.60	0.0	0.0	0.0	1.9	0.0	47-2231	Solar Photovoltaic Installers	0.273	$45,540.00
					60.89	0.89	$64,475.80	0.0	0.0	0.0	0.9	0.0	47-3011	Helpers--Brickmasons, Blockmasons, Stonemasons, and T	0.126	$36,020.00
					60.89	1.60	$56,581.90	0.0	0.0	0.0	1.6	0.0	47-3012	Helpers--Carpenters	0.225	$31,610.00
					60.89	0.00	$69,613.10	0.0	0.0	0.0	0.0	0.0	47-3013	Helpers--Electricians	**	$38,890.00
					60.89	0.49	$62,990.10	0.0	0.0	0.0	0.5	0.0	47-3014	Helpers--Painters, Paperhangers, Plasterers, and Stucco M	0.069	$35,190.00
					60.89	0.00	$68,270.60	0.0	0.0	0.0	0.0	0.0	47-3015	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitte	**	$38,140.00
					60.89	0.00	$60,502.00	0.0	0.0	0.0	0.0	0.0	47-3019	Helpers, Construction Trades, All Other	**	$33,800.00
					60.89	3.77	$155,855.30	0.0	0.0	0.0	0.0	0.0	47-4011	Construction and Building Inspectors	0.531	$87,070.00
					60.89	0.94	$77,524.90	0.0	0.0	0.0	0.9	0.0	47-4041	Hazardous Materials Removal Workers	0.132	$43,310.00
					60.89	2.34	$101,672.00	0.0	0.0	0.0	2.3	0.0	47-4051	Highway Maintenance Workers	0.33	$56,800.00
					60.89	0.00	$92,435.60	0.0	0.0	0.0	0.0	0.0	47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	**	$51,640.00
					60.89	0.86	$98,575.30	0.0	0.0	0.0	0.9	0.0	47-4099	Construction and Related Workers, All Other	0.121	$55,070.00
				490000	-	-	**$102,549.10**	-	-	-	-	**1.0**	**49-0000**	**Installation, Maintenance, and Repair Occupations**	**25.541**	**$57,290.00**
					60.89	15.29	$149,966.20	0.0	0.0	0.0	0.0	0.0	49-1011	First-Line Supervisors of Mechanics, Installers, and Repai	2.155	$83,780.00
					60.89	7.56	$78,330.40	0.0	0.0	0.0	7.6	0.0	49-2011	Computer, Automated Teller, and Office Machine Repair	1.065	$43,760.00
					60.89	0.84	-	0.0	0.0	0.0	0.0	0.0	49-2021	Radio, Cellular, and Tower Equipment Installers and Repa	0.119	*
					60.89	11.89	$109,315.30	0.0	0.0	0.0	11.9	0.0	49-2022	Telecommunications Equipment Installers and Repairers,	1.675	$61,070.00
					60.89	0.58	$125,837.00	0.0	0.0	0.0	0.0	0.0	49-2091	Avionics Technicians	0.082	$70,300.00
					60.89	0.35	$75,036.80	0.0	0.0	0.4	0.0	0.0	49-2092	Electric Motor, Power Tool, and Related Repairers	0.05	$41,920.00
					60.89	0.63	$144,578.30	0.0	0.0	0.0	0.0	0.0	49-2093	Electrical and Electronics Installers and Repairers, Transp	0.089	$80,770.00
					60.89	4.38	$99,309.20	0.0	0.0	0.0	4.4	0.0	49-2094	Electrical and Electronics Repairers, Commercial and Indu	0.617	$55,480.00
					60.89	0.00	$156,052.20	0.0	0.0	0.0	0.0	0.0	49-2095	Electrical and Electronics Repairers, Powerhouse, Substat	**	$87,180.00
					60.89	0.00	$46,343.10	0.0	0.0	0.0	0.0	0.0	49-2096	Electronic Equipment Installers and Repairers, Motor Veh	**	$25,890.00
					60.89	4.07	$102,047.90	0.0	0.0	0.0	4.1	0.0	49-2098	Security and Fire Alarm Systems Installers	0.574	$57,010.00
					60.89	1.43	$128,164.00	0.0	0.0	0.0	0.0	0.0	49-3011	Aircraft Mechanics and Service Technicians	0.201	$71,600.00
					60.89	5.66	$90,144.40	0.0	0.0	0.0	5.7	0.0	49-3021	Automotive Body and Related Repairers	0.797	$50,360.00
					60.89	21.22	$95,979.80	0.0	0.0	0.0	21.2	0.0	49-3023	Automotive Service Technicians and Mechanics	2.99	$53,620.00
					60.89	4.93	$120,413.30	0.0	0.0	0.0	4.9	0.0	49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	0.695	$67,270.00
					60.89	2.47	$109,351.10	0.0	0.0	0.0	2.5	0.0	49-3042	Mobile Heavy Equipment Mechanics, Except Engines	0.348	$61,090.00
					60.89	0.61	$88,175.40	0.0	0.0	0.0	0.6	0.0	49-3052	Motorcycle Mechanics	0.086	$49,260.00
					60.89	0.44	$55,543.70	0.0	0.0	0.4	0.0	0.0	49-3053	Outdoor Power Equipment and Other Small Engine Mech	0.062	$31,030.00
					60.89	2.29	$62,864.80	0.0	0.0	2.3	0.0	0.0	49-3093	Tire Repairers and Changers	0.323	$35,120.00
					60.89	0.62	$120,717.60	0.0	0.0	0.0	0.6	0.0	49-9012	Control and Valve Installers and Repairers, Except Mecha	0.088	$67,440.00
					60.89	11.11	$135,091.30	0.0	0.0	0.0	0.0	0.0	49-9021	Heating, Air Conditioning, and Refrigeration Mechanics a	1.565	$75,470.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					60.89	0.54	$88,318.60	0.0	0.0	0.0	0.5	0.0	49-9031	Home Appliance Repairers	0.076	$49,340.00
					60.89	6.66	$114,363.10	0.0	0.0	0.0	6.7	0.0	49-9041	Industrial Machinery Mechanics	0.939	$63,890.00
					60.89	3.15	$97,662.40	0.0	0.0	0.0	3.2	0.0	49-9043	Maintenance Workers, Machinery	0.444	$54,560.00
					60.89	3.92	$132,388.40	0.0	0.0	0.0	0.0	0.0	49-9052	Telecommunications Line Installers and Repairers	0.552	$73,960.00
					60.89	1.03	$125,192.60	0.0	0.0	0.0	0.0	0.0	49-9062	Medical Equipment Repairers	0.145	$69,940.00
					60.89	1.01	$114,434.70	0.0	0.0	0.0	1.0	0.0	49-9069	Precision Instrument and Equipment Repairers, All Other	0.143	$63,930.00
					60.89	46.84	$89,786.40	0.0	0.0	0.0	46.8	0.0	49-9071	Maintenance and Repair Workers, General	6.6	$50,160.00
					60.89	0.47	$56,707.20	0.0	0.0	0.5	0.0	0.0	49-9091	Coin, Vending, and Amusement Machine Servicers and R	0.066	$31,680.00
					60.89	2.34	$101,421.40	0.0	0.0	0.0	2.3	0.0	49-9094	Locksmiths and Safe Repairers	0.33	$56,660.00
					60.89	5.48	$65,370.80	0.0	0.0	5.5	0.0	0.0	49-9098	Helpers--Installation, Maintenance, and Repair Workers	0.772	$36,520.00
					60.89	7.69	$78,509.40	0.0	0.0	0.0	7.7	0.0	49-9099	Installation, Maintenance, and Repair Workers, All Other	1.084	$43,860.00
Non-Instructional	**Production, Transportation, and Material Moving**	**0.0**	**0**													
				510000	-	-	**$75,860.20**	-	-	-	-	**1.0**	**51-0000**	**Production Occupations**	**50.024**	**$42,380.00**
					82.30	0.00	$130,437.30	0.0	0.0	0.0	0.0	0.0	51-1011	First-Line Supervisors of Production and Operating Worke	3.055	$72,870.00
					82.30	0.00	$66,820.70	0.0	0.0	0.0	0.0	0.0	51-2022	Electrical and Electronic Equipment Assemblers	8.361	$37,330.00
					82.30	0.00	$73,461.60	0.0	0.0	0.0	0.0	0.0	51-2023	Electromechanical Equipment Assemblers	1.303	$41,040.00
					82.30	0.00	$93,455.90	0.0	0.0	0.0	0.0	0.0	51-2031	Engine and Other Machine Assemblers	**	$52,210.00
					82.30	0.00	$60,179.80	0.0	0.0	0.0	0.0	0.0	51-2092	Team Assemblers	4.344	$33,620.00
					82.30	0.00	$72,924.60	0.0	0.0	0.0	0.0	0.0	51-2099	Assemblers and Fabricators, All Other	1.732	$40,740.00
					82.30	0.00	$52,285.90	0.0	0.0	0.0	0.0	0.0	51-3011	Bakers	1.817	$29,210.00
					82.30	0.00	$61,772.90	0.0	0.0	0.0	0.0	0.0	51-3021	Butchers and Meat Cutters	1.198	$34,510.00
					82.30	0.00	$48,634.30	0.0	0.0	0.0	0.0	0.0	51-3022	Meat, Poultry, and Fish Cutters and Trimmers	0.414	$27,170.00
					82.30	0.00	$43,443.30	0.0	0.0	0.0	0.0	0.0	51-3023	Slaughterers and Meat Packers	**	$24,270.00
					82.30	0.00	-	0.0	0.0	0.0	0.0	0.0	51-3091	Food and Tobacco Roasting, Baking, and Drying Machine	0.057	*
					82.30	0.00	$52,912.40	0.0	0.0	0.0	0.0	0.0	51-3092	Food Batchmakers	0.38	$29,560.00
					82.30	0.00	$49,404.00	0.0	0.0	0.0	0.0	0.0	51-3093	Food Cooking Machine Operators and Tenders	0.173	$27,600.00
					82.30	0.00	$43,926.60	0.0	0.0	0.0	0.0	0.0	51-3099	Food Processing Workers, All Other	**	$24,540.00
					82.30	0.00	$80,764.80	0.0	0.0	0.0	0.0	0.0	51-4011	Computer-Controlled Machine Tool Operators, Metal and	0.7	$45,120.00
					82.30	0.00	$126,033.90	0.0	0.0	0.0	0.0	0.0	51-4012	Computer Numerically Controlled Machine Tool Program	0.356	$70,410.00
					82.30	0.00	$71,850.60	0.0	0.0	0.0	0.0	0.0	51-4021	Extruding and Drawing Machine Setters, Operators, and T	0.171	$40,140.00
					82.30	0.00	$89,285.20	0.0	0.0	0.0	0.0	0.0	51-4023	Rolling Machine Setters, Operators, and Tenders, Metal a	**	$49,880.00
					82.30	0.00	$66,140.50	0.0	0.0	0.0	0.0	0.0	51-4031	Cutting, Punching, and Press Machine Setters, Operators,	0.963	$36,950.00
					82.30	0.00	$74,875.70	0.0	0.0	0.0	0.0	0.0	51-4032	Drilling and Boring Machine Tool Setters, Operators, and	**	$41,830.00
					82.30	0.00	$69,487.80	0.0	0.0	0.0	0.0	0.0	51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Se	0.613	$38,820.00
					82.30	0.00	$71,653.70	0.0	0.0	0.0	0.0	0.0	51-4034	Lathe and Turning Machine Tool Setters, Operators, and T	0.332	$40,030.00
					82.30	0.00	$71,814.80	0.0	0.0	0.0	0.0	0.0	51-4035	Milling and Planing Machine Setters, Operators, and Tend	0.219	$40,120.00
					82.30	0.00	$92,560.90	0.0	0.0	0.0	0.0	0.0	51-4041	Machinists	2.89	$51,710.00
					82.30	0.00	$83,360.30	0.0	0.0	0.0	0.0	0.0	51-4061	Model Makers, Metal and Plastic	**	$46,570.00
					82.30	0.00	$65,066.50	0.0	0.0	0.0	0.0	0.0	51-4072	Molding, Coremaking, and Casting Machine Setters, Oper	0.192	$36,350.00
					82.30	0.00	$113,378.60	0.0	0.0	0.0	0.0	0.0	51-4081	Multiple Machine Tool Setters, Operators, and Tenders, M	**	$63,340.00
					82.30	0.00	$120,663.90	0.0	0.0	0.0	0.0	0.0	51-4111	Tool and Die Makers	0.1	$67,410.00
					82.30	0.00	$81,266.00	0.0	0.0	0.0	0.0	0.0	51-4121	Welders, Cutters, Solderers, and Brazers	1.523	$45,400.00
					82.30	0.00	$79,672.90	0.0	0.0	0.0	0.0	0.0	51-4122	Welding, Soldering, and Brazing Machine Setters, Operat	0.168	$44,510.00
					82.30	0.00	$79,511.80	0.0	0.0	0.0	0.0	0.0	51-4192	Layout Workers, Metal and Plastic	**	$44,420.00
					82.30	0.00	$65,514.00	0.0	0.0	0.0	0.0	0.0	51-4193	Plating and Coating Machine Setters, Operators, and Ten	0.498	$36,600.00
					82.30	0.00	$83,664.60	0.0	0.0	0.0	0.0	0.0	51-5111	Prepress Technicians and Workers	**	$46,740.00
					82.30	0.00	$78,795.80	0.0	0.0	0.0	0.0	0.0	51-5112	Printing Press Operators	0.517	$44,020.00
					82.30	0.00	$68,521.20	0.0	0.0	0.0	0.0	0.0	51-5113	Print Binding and Finishing Workers	0.328	$38,280.00
					82.30	0.00	$50,334.80	0.0	0.0	0.0	0.0	0.0	51-6011	Laundry and Dry-Cleaning Workers	0.63	$28,120.00
					82.30	0.00	$48,383.70	0.0	0.0	0.0	0.0	0.0	51-6021	Pressers, Textile, Garment, and Related Materials	**	$27,030.00
					82.30	0.00	$48,204.70	0.0	0.0	0.0	0.0	0.0	51-6031	Sewing Machine Operators	0.276	$26,930.00
					82.30	0.00	$67,751.50	0.0	0.0	0.0	0.0	0.0	51-6052	Tailors, Dressmakers, and Custom Sewers	0.062	$37,850.00
					82.30	0.00	$57,924.40	0.0	0.0	0.0	0.0	0.0	51-6093	Upholsterers	0.113	$32,360.00
					82.30	0.00	$69,094.00	0.0	0.0	0.0	0.0	0.0	51-7011	Cabinetmakers and Bench Carpenters	0.292	$38,600.00
					82.30	0.00	$58,461.40	0.0	0.0	0.0	0.0	0.0	51-7041	Sawing Machine Setters, Operators, and Tenders, Wood	0.064	$32,660.00
					82.30	0.00	$48,974.40	0.0	0.0	0.0	0.0	0.0	51-7042	Woodworking Machine Setters, Operators, and Tenders,	0.117	$27,360.00
					82.30	0.00	$129,810.80	0.0	0.0	0.0	0.0	0.0	51-8013	Power Plant Operators	0.073	$72,520.00
					82.30	0.00	$141,374.20	0.0	0.0	0.0	0.0	0.0	51-8021	Stationary Engineers and Boiler Operators	0.142	$78,980.00
					82.30	0.00	$135,055.50	0.0	0.0	0.0	0.0	0.0	51-8031	Water and Wastewater Treatment Plant and System Ope	0.422	$75,450.00
					82.30	0.00	$92,346.10	0.0	0.0	0.0	0.0	0.0	51-9011	Chemical Equipment Operators and Tenders	0.077	$51,590.00
					82.30	0.00	$93,545.40	0.0	0.0	0.0	0.0	0.0	51-9012	Separating, Filtering, Clarifying, Precipitating, and Still Ma	0.177	$52,260.00
					82.30	0.00	$77,041.60	0.0	0.0	0.0	0.0	0.0	51-9021	Crushing, Grinding, and Polishing Machine Setters, Opera	0.176	$43,040.00
					82.30	0.00	$56,277.60	0.0	0.0	0.0	0.0	0.0	51-9022	Grinding and Polishing Workers, Hand	0.242	$31,440.00
					82.30	0.00	$67,196.60	0.0	0.0	0.0	0.0	0.0	51-9023	Mixing and Blending Machine Setters, Operators, and Te	0.587	$37,540.00
					82.30	0.00	$66,498.50	0.0	0.0	0.0	0.0	0.0	51-9032	Cutting and Slicing Machine Setters, Operators, and Tend	0.171	$37,150.00
					82.30	0.00	$48,347.90	0.0	0.0	0.0	0.0	0.0	51-9051	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tend	**	$27,010.00
					82.30	0.00	$90,556.10	0.0	0.0	0.0	0.0	0.0	51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	4.331	$50,590.00
					82.30	0.00	$75,878.10	0.0	0.0	0.0	0.0	0.0	51-9071	Jewelers and Precious Stone and Metal Workers	**	$42,390.00
					82.30	0.00	$85,848.40	0.0	0.0	0.0	0.0	0.0	51-9081	Dental Laboratory Technicians	**	$47,960.00
					82.30	0.00	$80,854.30	0.0	0.0	0.0	0.0	0.0	51-9082	Medical Appliance Technicians	0.235	$45,170.00

Worker Type	IPEDS Worker Category	Job Projection	IPEDS Job Count (from Worker Count sheet)	SOC Category	Group Jobs_1000	Projected Jobs	HHINC	EXT_LOW	VERY_LOW	LOW	MODERATE	IS_MAJOR_CAT	OCC_CODE	OCC_TITLE	JOBS_1000	A_MEAN
					82.30	0.00	$57,101.00	0.0	0.0	0.0	0.0	0.0	51-9111	Packaging and Filling Machine Operators and Tenders	1.331	$31,900.00
					82.30	0.00	$66,391.10	0.0	0.0	0.0	0.0	0.0	51-9121	Coating, Painting, and Spraying Machine Setters, Operatc	0.371	$37,090.00
					82.30	0.00	$88,050.10	0.0	0.0	0.0	0.0	0.0	51-9122	Painters, Transportation Equipment	0.306	$49,190.00
					82.30	0.00	$75,412.70	0.0	0.0	0.0	0.0	0.0	51-9141	Semiconductor Processors	1.644	$42,130.00
					82.30	0.00	$69,452.00	0.0	0.0	0.0	0.0	0.0	51-9151	Photographic Process Workers and Processing Machine C	0.211	$38,800.00
					82.30	0.00	$65,156.00	0.0	0.0	0.0	0.0	0.0	51-9192	Cleaning, Washing, and Metal Pickling Equipment Operat	0.169	$36,400.00
					82.30	0.00	$72,906.70	0.0	0.0	0.0	0.0	0.0	51-9194	Etchers and Engravers	**	$40,730.00
					82.30	0.00	$66,856.50	0.0	0.0	0.0	0.0	0.0	51-9195	Molders, Shapers, and Casters, Except Metal and Plastic	0.184	$37,350.00
					82.30	0.00	$72,727.70	0.0	0.0	0.0	0.0	0.0	51-9196	Paper Goods Machine Setters, Operators, and Tenders	**	$40,630.00
					82.30	0.00	$52,822.90	0.0	0.0	0.0	0.0	0.0	51-9198	Helpers--Production Workers	1.366	$29,510.00
					82.30	0.00	$60,734.70	0.0	0.0	0.0	0.0	0.0	51-9199	Production Workers, All Other	0.614	$33,930.00
				530000	-	-	**$68,449.60**	-	-	-	-	**1.0**	**53-0000**	**Transportation and Material Moving Occupations**	**37.001**	**$38,240.00**
					82.30	0.00	$94,637.30	0.0	0.0	0.0	0.0	0.0	53-1011	Aircraft Cargo Handling Supervisors	0.031	$52,870.00
					82.30	0.00	$90,108.60	0.0	0.0	0.0	0.0	0.0	53-1021	First-Line Supervisors of Helpers, Laborers, and Material	0.601	$50,340.00
					82.30	0.00	$128,915.80	0.0	0.0	0.0	0.0	0.0	53-1031	First-Line Supervisors of Transportation and Material-Mo	0.696	$72,020.00
					82.30	0.00	$97,125.40	0.0	0.0	0.0	0.0	0.0	53-2012	Commercial Pilots	0.058	$54,260.00
					82.30	0.00	$141,696.40	0.0	0.0	0.0	0.0	0.0	53-2022	Airfield Operations Specialists	0.041	$79,160.00
					82.30	0.00	$103,497.80	0.0	0.0	0.0	0.0	0.0	53-3021	Bus Drivers, Transit and Intercity	1.116	$57,820.00
					82.30	0.00	$69,702.60	0.0	0.0	0.0	0.0	0.0	53-3022	Bus Drivers, School or Special Client	1.165	$38,940.00
					82.30	0.00	$59,034.20	0.0	0.0	0.0	0.0	0.0	53-3031	Driver/Sales Workers	1.832	$32,980.00
					82.30	0.00	$82,053.60	0.0	0.0	0.0	0.0	0.0	53-3032	Heavy and Tractor-Trailer Truck Drivers	4.275	$45,840.00
					82.30	0.00	$70,794.50	0.0	0.0	0.0	0.0	0.0	53-3033	Light Truck or Delivery Services Drivers	3.676	$39,550.00
					82.30	0.00	$55,722.70	0.0	0.0	0.0	0.0	0.0	53-3041	Taxi Drivers and Chauffeurs	0.859	$31,130.00
					82.30	0.00	$91,325.80	0.0	0.0	0.0	0.0	0.0	53-3099	Motor Vehicle Operators, All Other	0.219	$51,020.00
					82.30	0.00	$47,470.80	0.0	0.0	0.0	0.0	0.0	53-6021	Parking Lot Attendants	0.805	$26,520.00
					82.30	0.00	$57,369.50	0.0	0.0	0.0	0.0	0.0	53-6031	Automotive and Watercraft Service Attendants	0.316	$32,050.00
					82.30	0.00	$99,738.80	0.0	0.0	0.0	0.0	0.0	53-6041	Traffic Technicians	**	$55,720.00
					82.30	0.00	$66,301.60	0.0	0.0	0.0	0.0	0.0	53-6099	Transportation Workers, All Other	**	$37,040.00
					82.30	0.00	$60,340.90	0.0	0.0	0.0	0.0	0.0	53-7011	Conveyor Operators and Tenders	0.068	$33,710.00
					82.30	0.00	$123,510.00	0.0	0.0	0.0	0.0	0.0	53-7021	Crane and Tower Operators	**	$69,000.00
					82.30	0.00	$126,714.10	0.0	0.0	0.0	0.0	0.0	53-7032	Excavating and Loading Machine and Dragline Operators	0.11	$70,790.00
					82.30	0.00	$71,779.00	0.0	0.0	0.0	0.0	0.0	53-7051	Industrial Truck and Tractor Operators	1.42	$40,100.00
					82.30	0.00	$47,793.00	0.0	0.0	0.0	0.0	0.0	53-7061	Cleaners of Vehicles and Equipment	1.782	$26,700.00
					82.30	0.00	$62,095.10	0.0	0.0	0.0	0.0	0.0	53-7062	Laborers and Freight, Stock, and Material Movers, Hand	11.859	$34,690.00
					82.30	0.00	$57,351.60	0.0	0.0	0.0	0.0	0.0	53-7063	Machine Feeders and Offbearers	0.319	$32,040.00
					82.30	0.00	$46,862.20	0.0	0.0	0.0	0.0	0.0	53-7064	Packers and Packagers, Hand	3.223	$26,180.00
					82.30	0.00	$91,182.60	0.0	0.0	0.0	0.0	0.0	53-7081	Refuse and Recyclable Material Collectors	1.045	$50,940.00
Instructional Staff	Professor		689				-	0.0	0.0	0.0	0.0					
Instructional Staff	Associate professor		181				-	0.0	0.0	0.0	0.0					
Instructional Staff	Assistant professor		232				-	0.0	0.0	0.0	0.0					
	Total	3512	7391													

2017 State Income Limits for SCC	
Extremely Low Income	$32,250.00
Very Low Income	$53,750.00
Low Income	$76,400.00
Modterate Income	$122,350.00

Source: http://www.hcd.ca.gov/grants-funding/income-limits/state-and-federal-income-limits/docs/inc2k17.pdf

					Total Affordability Gap	**GUP Projected Buildout to 2035 (sq. ft.)**	**BMR Fee (affordability gap / sq. ft.)**
Total Units	0.0	295.7	476.6	766.1	-	-	-
Affordability Gap (Palo Alto Based)	0.0	$90,539,881.46	$120,226,888.28	$191,225,579.78	**$401,992,349.52**	2275000	**$176.7**
Affordability Gap (San Jose Based)	0.0	$55,004,566.02	$71,967,034.27	$92,702,988.64	**$219,674,588.93**	2275000	**$96.6**

Palo Alto Nexus Study Affordability Gap	
Very Low Income	$306,164
Low Income	$252,258
Moderate Income	$249,596

Source: http://www.cityofpaloalto.org/civicax/filebank/documents/50935 pg 7

San Jose Nexus Study Affordability Gap	
Extremely Low Income	$256,000
Very Low Income	$186,000
Low Income	$151,000
Moderate Income	$121,000

Source: http://www.sanjoseca.gov/DocumentCenter/View/32877 pg 4

Appendix B:

Student Influx Calculations

	Total Freshman	California	Non-California US UG	International	Percent Non-California of USA Students	Master's Matriculants	Percent Master's International	International Master's	Extrapolated Non-California Master's	Doctoral Matriculants	Percent Doctoral International	International Doctoral	Extrapolated Non-California Doctoral	Extrapolated Total Out of State	Total Matriculated	Extrapolated Percent Californian
2006-2007	1646	679	871	96	56.2%	2476	39%	966	849	897	31%	278	348	3407	5019	32%
2007-2008	1721	715	880	126	55.2%	2461	38%	935	842	935	31%	290	356	3429	5117	33%
2008-2009	1703	617	963	123	60.9%	2481	36%	893	968	917	31%	284	386	3617	5101	29%
2009-2010	1692	678	886	128	56.6%	2562	36%	922	929	868	30%	260	344	3470	5122	32%
2010-2011	1672	626	908	138	59.2%	2684	36%	966	1017	937	30%	281	388	3698	5293	30%
2011-2012	1704	671	891	142	57.0%	2427	37%	898	872	1117	30%	335	446	3584	5248	32%
2012-2013	1762	671	962	129	58.9%	2445	38%	929	893	989	30%	297	408	3618	5196	30%
2013-2014	1674	596	914	164	60.5%	2481	39%	968	916	1052	30%	316	446	3723	5207	29%
2014-2015	1677	563	986	128	63.7%	2392	39%	933	929	1033	30%	310	460	3746	5102	27%
2015-2016	1719	566	976	177	63.3%	2308	39%	900	891	1069	30%	321	474	3739	5096	27%
Average	1697	638.2	923.7	135.1	59.1%	2471.7	39%	931	911	981.4	30%	297	406	3603	5150.1	30%

Appendix C:

Worker VMT Calculations

Revised Worker VMT Analysis

Workers	Workers/Students	Commute Population	Commute Frequency	Vehicle Mode Split	Vehicle Occup	Total Daily Vehicle Trips	Home Work Trip Length	VMT	VMT / Capita	Days per Year	VT	VMT	VMT/Capita
Benefit Eligible Employees													
Off Campus - Faculty	2,195	2,195	92%	58%	1.14	2,055	12.84	26,392	12.02	222	456,172	5,859,117	2,669
Off Campus - Staff	11,423	11,423	92%	58%	1.14	10,694	12.84	137,349	12.02	222	2,373,964	30,491,430	13,891
University Terrace	180	180	92%	58%	1	192	2.06	396	2.20	222	42,645	87,849	8
On Campus - Faculty/Staff in Faculty Subdivision	899	899	92%	58%	1	959	2.06	1,976	2.20	222	212,990	438,759	488
On Campus - Faculty/Staff within GUP Study Area	588	588	92%	58%	1	628	1.03	646	1.10	222	139,308	143,487	244
Post-Docs													
Off Campus - Post-Doc	3,336	3,336	96%	31%	1.18	1,683	9.76	16,431	4.93	222	373,560	3,647,586	1,093
On Campus - Post-Doc	28	28	96%	0%	1	0	9.79	0	0.00	222	0	0	0
Casual	2,746	2,746	20%	80%	1.1	799	13.79	11,017	4.01	222	177,342	2,445,843	891
Contingent	1294	1294	52%	63%	1.09	778	12.62	9,814	7.58	222	172,677	2,178,753	1,684
Temporary	1,835	1,835	78%	65%	1.16	1,604	13.14	21,082	11.49	222	356,098	4,680,119	2,550
Non-Employee Affiliates													
Non-Employee Affiliates: 20% FTEs	1,662	1,662	17%	83%	1.05	447	12.24	5,466	3.29	222	99,163	1,213,404	730
Non-Employee Affiliates: FTEs	1,818	1,818	85%	83%	1.05	2,443	12.24	29,894	16.44	222	542,356	6,636,487	3,650
Subtotal Workers (Stanford Employees)	**28,004**	**28,004**				**22,281**		**260,463**	**9.30**	**222**	**4,946,274**	**57,822,833**	**2,065**
Third Party Contractors	396	396	100%	87%	1.07	644	14.64	9,425	23.80	222	142,960	2,092,401	5,284
Janitorial Shift Workers	316	316	100%	87%	1.07	514	14.64	7,521	23.80	222	114,079	1,669,694	5,284
Construction	1,200	1,200	100%	87%	1.07	1,951	14.64	28,561	23.80	222	433,211	6,340,609	5,284
Subtotal Workers (Contract Workers)	**1,912**	**1,912**				**3,109**	**-**	**45,508**	**23.80**	**na**	**690,250**	**10,102,704**	**5,284**
First mile to transit all workers (carpool)			94%	1%	2	281	5.17	1,454	0.05	222	62,429	322,794	11
First mile to transit all workers (drive alone)			91%	9%	1	4,900	4.20	20,593	0.69	222	1,087,853	4,571,595	153
First Mile to Transit (all workers)						**5,181**	**-**	**22,047**	**0.74**	**na**	**1,150,282**	**4,894,389**	**163.6**
Total Workers (excluding students)	**29,916**	**29,916**				**30,571**	**-**	**328,018**	**10.96**	**na**	**6,786,806**	**72,819,927**	**2,434**

APPENDIX RA-MP

Comment Letter RA-MP Attachment

CITY OF MENLO PARK

February 1, 2018

Mr. David Rader
County of Santa Clara
Department of Planning and Development
County Government Center
70 West Hedding St.
San Jose, CA 95110

RE: Stanford University "2018 General Use Permit", Draft EIR Comments

Dear Mr. Rader,

Please find attached the City of Menlo Park's comments on the Draft Environmental Impact Report (DEIR) for the Stanford University "2018 General Use Permit" (GUP) Project (File #: 7165-16P-16GP-16Z-16EIR).

The attached comments highlight several significant deficiencies in the Draft EIR that must be addressed in a recirculated Draft EIR with sufficient mitigation measures to mitigate any impacts identified prior to the County considering the 2018 GUP for approvals. The City appreciates the opportunity to comment on the proposed project. Please contact Assistant Public Works Director, Nikki Nagaya at 650-330-6770 or nhnagaya@menlopark.org with any questions.

Sincerely,

Peter Ohtaki
Mayor

Enclosure

Project Description Concerns and Questions

1. Stanford is seeking "flexibility with accountability." The application and DEIR indicate that the total amount of academic square footage may take many forms, from classroom buildings to art galleries to energy facilities. Similarly, the anticipated housing units/beds will include a range of products from undergraduate dormitories to single-family homes for faculty. These different uses will have disparate impacts. Without specificity as to the amount, location and intensity of the various uses, there are no assurances that the impacts have been adequately assessed in the DEIR. Further, there is no mention in the DEIR that further study will be conducted to determine whether what does eventually get built is within the parameters of the DEIR or creates additional impacts that require additional mitigation. This seems critically important for a document that is anticipated to govern development for the next approximately 17 years in an area that is seeing rapid transition in local and regional conditions and circumstances. The City requests that clear accounting of the proposed uses and location of such uses be documented, and no changes to the provided allotments of developable area be allowed without a full assessment of any further environmental impacts. Further, as evidenced by the Center for Academic Medicine project application, any transfer of development request needs to include explicit consultation with and notice to the City of Menlo Park, particularly in the area of traffic concerns. The City has included recommended revisions to Condition of Approval G11 from the 2000 GUP, which are outlined below in comment 6.

2. The 2018 GUP should preserve the Academic Growth Boundary and the extra increment of foothill protections (i.e., the 4/5ths vote for development west of Junipero Serra Boulevard) in order to ensure ongoing open space and conservation efforts are recognized as a serious concern. The City requests the Academic Growth Boundary be preserved for at least the next 50 years.

3. The maximum build out of the Stanford campus should be identified, defined and evaluated in the 2018 GUP and DEIR. Such definition was required during the 2000 GUP development, as a condition of approval, but has not yet be identified or imposed here. This is important to provide the community and neighboring jurisdictions a clear picture of when growth limits would be reached; further, the current process provides no assurances to the maximum extent of growth and development on the campus.

4. Stanford will be increasing the population of students, faculty, staff and other workers from 41,217 in 2018 to 50,827 by 2035. However, it is not clear that these numbers reflect the full picture and include families of students and faculty, deliveries, consultants, contractors and various visitors who travel to and from Stanford. The assumptions should be clearly outlined in the DEIR.

5. The 2018 GUP and DEIR should evaluate changes in the Project Description, or as mitigation

measures to:

a. Prohibit an increase in net new parking spaces
b. Provide a direct roadway connection from Campus Drive West to I-280 between Page Mill Road and Alpine Road without a connection at Junipero Serra Boulevard. Also force traffic to use Page Mill Road over Alpine Road since there are limited residences along Page Mill frontage
c. Add locations for traffic monitoring at gateways to Stanford Land beyond the cordon locations that are specific to unincorporated Santa Clara County to account for development in the Quarry, Lathrop and San Juan districts (see comment 7.k.ii. below)
d. Require trip credits to have some spatial or geographic relevance based on Gateways and cordon limits around the Stanford campus

6. In the 2000 GUP conditions of approval, condition G11 required project-specific traffic studies for certain projects. Subsequent to adoption of the 2000 GUP and conditions, the County prepared *Scoping of Project-Specific Transportation Studies under Stanford GUP Condition of Approval G11* (dated January 16, 2002). These documents do not directly address the need for a project-specific traffic study for relocation of planned development levels across Campus district boundaries, and the City requests this document be modified, if to be carried over for use subsequent to the 2018 GUP. Further, the City requests that a project-specific traffic study be completed for all projects that generate over 50 peak hour trips to ensure transparency and consistency across future proposals. The City has documented suggested revisions, as included in Attachment A. Further, the City requests that the Board of Supervisors must consider any request to relocate development to a different district, and approval be required to reach a 4/5 vote in favor, including the Supervisor from the District.

Transportation

7. The transportation analysis shows several deficiencies with respect to[1]:

    a. Existing congested conditions are not reflected in the intersection analysis.

        The existing conditions analysis does not reflect congested conditions on the Bayfront Expressway, Willow Road, University Avenue, El Camino Real, and Sand Hill Road corridors as of the time the existing counts were taken in 2016. The reported results at the following locations do not reflect field observed conditions:

        i. Bayfront Expressway/University Avenue
        ii. Bayfront Expressway/Willow Road
        iii. Willow Road intersections

[1] All page number references within this comment point to the Transportation Impact Analysis, Part 2 in Appendix TIA of the Draft EIR. Similar comments apply to the same content shown in the Draft EIR.

iv. Sand Hill Road/Santa Cruz Avenue-Alpine Road

The existing congested conditions on the corridors and intersections listed above are not taken into account by isolated intersection analysis. As summarized in the City of Menlo Park's General Plan (ConnectMenlo) Draft Environmental Impact Report published in 2016, isolated intersection analysis does not account for the queue spillback between intersections on the approaches to the Dumbarton Bridge, including those on Bayfront Expressway, Willow Road, and University Avenue. The TRAFFIX 8.0 software that was used for the analysis is not sufficient to reflect the existing or future (2018 or 2035) congestion levels. The TIA (Section 4.8, page 94-95) describes the observed queues and congested conditions on El Camino Real and Sand Hill Road, but does not use this information to validate the calculated existing levels of service (Figure 4-2 on page 54 and Table 4-1 on pages 55-60) on the corridors. Field observed conditions are not described on Willow Road and the Dumbarton Bridge approaches. These level of service calculations need to be updated in order to present an accurate existing scenario to assess impacts of the 2018 GUP. Otherwise, potential impacts are underestimated. The Draft EIR should be updated and recirculated with corrected information that mitigates all additional impacts.

b. Existing congested conditions are not reflected in the freeway and ramp analysis.

Similarly, the freeway ramp analysis at the US 101/Willow Road interchange and the I-280/Sand Hill Road interchange do not reflect existing congested conditions, and therefore the volume-to-capacity analysis conducted does not take into account the unserved peak period demand and queue spillback. Analysis based on these existing results therefore underestimates potential impacts of the 2018 GUP. The analysis must be updated and the Draft EIR recirculated with the corrected information, including appropriate mitigation for all additional impacts.

c. The No Net New Commute Trips mitigation program does not fully mitigate transportation impacts and must be modified.

The 2018 GUP application materials and Draft EIR describe Stanford's continued participation in the No Net New Commute Trips mitigation program. The program limits peak hour, peak direction vehicular trips associated with Stanford University. However, this program is fundamentally flawed and does not fully mitigate transportation impacts for several reasons:

i. Congested conditions in the region are no longer limited to a single morning and evening peak hour. The monitoring program should be expanded to capture the hours of congestion across the peak periods, at a minimum from 7:00 – 9:00am and 4:00 – 7:00pm, since the program encourages peak spreading to shoulder and off-peak hours. Daily trip limits should also be considered to reduce potential air quality and greenhouse

gas impacts.

ii. While traffic flows still see some directionality, reverse peak direction patterns are increasing and even reverse direction trips in the peak hours can contribute to congestion.

The proposed 2018 GUP is estimated to add 428 AM and 600 PM peak hour trips in the reverse commute direction. This represents a significant proportion of the proposed growth in traffic, representing 36% of morning and 44% of evening peak hour traffic. The proposed analysis does not isolate the potential impacts of these trips, and they are not mitigated by the No Net New Commute Trips mitigation program, which only limits the peak direction trips. Therefore all reverse peak trips are added to the roadway network, with undetermined impacts, and are not currently mitigated.

The City requests that an analysis of the reverse direction trips be conducted and appropriate mitigation measures be identified. The mitigation program should could be expanded to limit any new impacts from reverse commute trips by including them in the No Net New Trips program, and no growth in such trips should be allowed over existing conditions. This analysis should be prepared and the DEIR recirculated with this significant new information.

iii. Monitoring of the program is infrequent and does not assure neighboring jurisdictions that the program achieves its goals on a typical basis. Monitoring occurs twice per year, and while conducted in typical traffic conditions, this limited frequency allows the potential for ongoing violations. The City requests the County modify the monitoring program to provide consistent, daily monitoring. Such monitoring and enforcement is conducted by the City for the Facebook Campus site in Menlo Park, and provides assurances that the trip limits are met on a daily basis throughout the year. This increased frequency is enabled more readily, since under the current proposal, Stanford and the County propose to use automated technology to conduct the counts in the future. The City requests that no new development be allowed beyond the 2000 GUP until such automated equipment and increased monitoring is in place.

iv. The use of "cordon credits" and a campus-wide monitoring methodology allow Stanford to offset peak hour, peak direction vehicle trips occurring anywhere in the cordon area at the expense of other potentially affected roadways. In particular, the Sand Hill Road and El Camino Real (north of Stanford) corridors have not seen investment in infrastructure or program support to reduce vehicle traffic levels approaching the University from these directions, and traffic congestion has increased since the 2001 GUP analysis. In addition, the 2014 Annual Traffic Monitoring Report claimed 402 trip credits for bus trips across the cordon points and the number of transit passengers served outside the cordon area in

the evening peak hour, but no data is provided about how the individual cordon locations have increased or decreased over time. The City's own traffic counts on Sand Hill Road (near the City of Menlo Park and Palo Alto border) show an increase in average daily traffic volumes from 30,550 vehicles to 33,900 vehicles per day between 1998 and 2017. The DEIR also does not disclose Marguerite transit ridership by route and stop to demonstrate which corridors are achieving trip credits per the allowance of "cordon credits". The City requests the historic raw cordon count data and Marguerite ridership data be included in a revised and recirculated DEIR. The City requests that the cordon trip limits be established by sub-area or district to ensure that the levels of traffic in any one corridor are not adversely affected at the expense of others.

v. Chapter 8 of the TIA details the tiered mitigation program steps if Stanford does not achieve the No Net New Commute Trips goal. However, as described in Section 8.1.1.3 through 8.1.1.5, Stanford would fund infrastructure changes and programs to reduce vehicle trips in the vicinity of the campus if the No Net New Commute Trip goal is not successful. This shifts the burden of mitigation to neighboring cities, when the mitigation is necessitated by Stanford's non-compliance with the mitigation measure. Stanford should instead assume responsibility, in collaboration with neighboring agencies to design and construct physical infrastructure and provide resources to help implement necessary programs to reduce trips as identified in these sections. The City requests that a contribution towards the Middle Avenue Pedestrian/Bicycle Crossing, Dumbarton Rail Corridor, and Sand Hill Road-Santa Cruz Avenue-Alameda de las Pulgas-Alpine Road corridor improvements be prioritized for mitigation. The City also requests that penalties be assessed if the trip reduction goals are not met.

vi. Section 8.1.1.5 of Chapter 8 of the TIA further outlines the payment methodology to determine Stanford's fair share of the intersection improvements on a per trip basis. This section outlines that the proposed payments would be on an annual basis, and since the 2018 GUP is projected to carry development through 2035 (17 years), the total contribution towards all intersection improvements would be divided by 17. This proposed methodology does not mitigate Stanford's contribution towards impacts in the City, and other neighboring agencies, as sufficient funds would not accrue to cover the construction cost of the necessary mitigation – which since a Project level impact (see comment 7.g. below) – is necessary to reduce the Project's impact to a less-than-significant level. The proposed methods also do not account for escalation in construction costs over the life of the proposed 2018 GUP.

d. All relevant near term projects should be included in the analysis. According to Table 2 in Appendix CON, the Stanford Shopping Center Expansion and Stanford Redwood City campus are not currently included as near-term projects, and should be included in the DEIR's evaluation. Notably, the traffic analysis should be revised to include these projects, as traffic from the Shopping Center directly overlaps with the traffic accessing the University

from El Camino Real and Sand Hill Road; and traffic from the Stanford Redwood City campus will occur on Marsh Road, Bay Road, Bayfront Expressway, Middlefield Road and El Camino Real, among other streets in the area, which are also studied in the 2018 GUP DEIR. Not including the Stanford Shopping Center and Redwood City campus underestimates the near-term and cumulative traffic impacts. Further the DEIR should explicitly describe the anticipated interaction between the Stanford University campus and the Stanford Redwood City campus. The City requested this information in its NOP letter (comments 5, 6, and 8), but it was not provided in the DEIR.

e. At the time the Stanford Hospital Expansion was considered by the City of Palo Alto, the City of Menlo Park challenged the traffic projections as underestimating the likely impacts of the project due to a significant allowance for TDM reductions. The City requests that the County independently evaluate the traffic projections used for the Hospital Expansion in the Background conditions of the DEIR transportation analysis and TIA.

f. The traffic projections shown on El Camino Real and Sand Hill Road appear to be underestimated. The DEIR and TIA should be revised to correct the underestimation, impacts reevaluated, and recirculated with this substantial new information. For example:

   i. Sand Hill Road/Santa Cruz Avenue (study intersection 7 in the TIA): certain traffic movements are shown to have less traffic under Background as compared to Cumulative conditions: the westbound left-turn (decreases by approximately 50 vehicles) and the northbound right-turn (experiences no change from Existing conditions, even with anticipated build out of the Stanford Hospital, 2000 GUP, and other projects in the area). Similarly in the cumulative conditions the westbound left-turn, southbound right-turn, eastbound left- and right-turns, and northbound left- and right-turns experience decreases of up to 200 vehicles per hour.
   ii. El Camino Real/Ravenswood Avenue (study intersection 41 in the TIA): Background conditions does not appear to adequately account for the buildout of projects in the area as listed. In particular, the growth shown between Existing and Background conditions at certain movements in the 2018 GUP DEIR and TIA is less than that shown for the Middle Plaza at 500 El Camino Real project alone. For example, the westbound left-turn in the 2018 GUP DEIR shows growth of 9 vehicles in the AM peak hour, while the Middle Plaza EIR shows 70 vehicles. Similar concerns exist for the northbound through and right-turn movements, eastbound right-turn and southbound through movement.

g. Project level impacts identified under Background Conditions should be fully mitigated.

   The DEIR and TIA identify mitigation measures for Background plus Project conditions as fair-share payment towards potential physical improvements. CEQA, in sections PRC

20112(a) & 14 CCR 15126.4, requires that project-level impacts be mitigated. The Project should be responsible for construction of mitigation measures that result from Project-level impacts.

h. Comments on specific mitigation measures

i. I-280 Northbound Ramp/Sand Hill Road. A fair share contribution is not adequate, per comment 7.g above. Bike lane is not protected, as stated on page 172.
ii. El Camino Real intersections. A fair share contribution is not adequate, per comment 7.g above, and proposed improvements conflict with recent City direction and Middle Plaza at 500 ECR DEIR recommendations.

i. Bicycle and pedestrian impact evaluation and proposed mitigation

While the effort to assess mitigation measures impacts on multi-modal travel, in addition to identifying vehicular improvements to mitigate traffic impacts, is appreciated, this assessment does not address bicycle and pedestrian demand and facility needs as a result of this Project. Key access routes to the Campus were recently evaluated as part of the Bicycle Access Plan, and gaps in the existing networks should be evaluated and mitigated appropriately. Similar efforts for the pedestrian network should also be completed. The City requested such an analysis in its NOP letter, an analysis of a 5-mile commute shed around the proposed General Use Permit development area. As noted in the permit application, Stanford owns land throughout the mid-Peninsula, including proposed development sites in Menlo Park and an approved project site in Redwood City. The City requested that the DEIR assess walking, bicycling, and traffic conditions across Stanford properties located across these multiple jurisdictions. This comment on the NOP was not addressed and the DEIR should be revised to include such an analysis and recirculated.

Further, Section 8.4.2 on page 218 discloses that the Project does not conflict with a planned facility or local agency policy. The City's El Camino Real/Downtown Specific Plan, and follow up work through the El Camino Real Corridor Study, identify potential bicycle lanes on El Camino Real. The proposed mitigation conflicts with these plans. This is not addressed in the DEIR and the analysis should be revised and DEIR recirculated with identification of appropriate mitigation.

In addition, without provisions for bicycling and walking, Safe Routes to Schools within the City of Menlo Park are anticipated to be impacted by increased traffic as a result of the 2018 GUP. The City requests financial assistance for crossing guards.

j. Neighborhood street impacts are not fully addressed

Neighborhood street impacts (Section 8.3 on page 199) in the Willows and Belle Haven

neighborhoods in Menlo Park are not addressed. The Crescent Park neighborhood in Palo Alto was evaluated, and cut-through traffic from that area also directly impacts the Willows, across the Pope-Chaucer bridge over San Francisquito Creek. Additional traffic added to Bayfront Expressway, Willow Road and University Avenue will also lead to additional cut-through in the Belle Haven neighborhood as commuters seek out alternative routes. Both of these should be addressed. The City of Menlo Park has adopted standards and thresholds of significance that should be used to evaluate increases in daily roadway traffic volumes on local streets in lieu of the TIRE Indices Analyses prepared following the City of Palo Alto standards. Based on Table 8-5 on page 217, cut-through volumes on Lytton Avenue and Hamilton Avenue near Pope-Chaucer are between 76 and 145 daily trips. These increases in traffic through the Willows would be considered significant following City of Menlo Park impact standards, and need to be evaluated and mitigated accordingly in a recirculated DEIR.

k. The DEIR does not address the NOP comments the City provided as listed below.

   i. Stanford is requesting continuation of a program to provide trip credit for off-campus transportation infrastructure improvements within the Cordon Credit Area, which includes properties owned by Stanford outside of Santa Clara County, including 500 El Camino Real and 2131 Sand Hill Road. The City requests that any required measures to reduce or mitigate impacts from the Middle Plaza at 500 El Camino Real project recently approved or 2131 Sand Hill Road project currently under review are not eligible for credits under the General Use Permit program, since this would result in double-counting the benefits of such measures.

   ii. The Draft EIR did not address how vehicle trips from the proposed development areas outside the traffic cordon area, including Quarry, Lathrop, and San Juan in particular, will be addressed by the No Net New Commute Trips condition. The City requested the County modify the cordon area to incorporate these zones with additional proposed development.

Housing

8. The proposed $20 per square foot (plus CPI adjustment inflator) affordable housing impact fee is not adequate to mitigate the increased demand for affordable housing by the proposed 2018 GUP. The rate of housing construction costs has generally outpaced the CPI, so the fee as proposed does not keep pace with rising costs and will not allow construction of the identified housing unit demand within Menlo Park.

9. In addition, when Stanford University purchases or develops property for the provision of faculty and staff housing in adjacent jurisdictions, including both the City of Menlo Park and local school districts, the City and school districts lose property tax revenues from the property in perpetuity,

since Stanford does not pay property taxes on lands used to support the University. This creates a two-fold negative impact to the City and other affected agencies, since the City loses revenues and has to continue to provide the municipal services necessitated by the residential properties. It also further increases the cost of housing in the region, as the market-rate housing supply is decreased by such actions. Requiring Stanford to provide all housing on campus will avoid this impact. Further, the City requests that any growth in academic or support facilities be offset with commensurate growth in housing units on campus.

10. As availability of affordable housing continues to be a regional concern, the City requests that the County maximize additional benefits for housing supply for faculty, staff, and students, as well as for workers that may not be employed directly by Stanford, but work within the General Use Permit area. Specifically, the City requests that the full housing burden generated by the 2018 GUP be absorbed on the Stanford Campus, within the 2018 GUP development area. Further, the City requests the County retain the 6-mile radius for use of affordable housing fees, since the impacts are most concentrated locally near the Stanford University campus. Further, the City requests that funding from housing fees be dedicated to impacted cities, commensurate with the level of anticipated impacts (e.g., proportional to the number of units needed to house Stanford employees). The provision of such fees is one of the few strategies that can be used to help offset the housing impacts identified as a result of the 2018 GUP and should be maintained.

11. The DEIR acknowledges that Stanford's growth pursuant to the 2018 GUP will require housing in adjacent jurisdictions such as Menlo Park. The DEIR anticipates 153 new housing units in Menlo Park. Since the growth with the 2018 General Use Permit is anticipated to be at the same rate as the 2000 General Use Permit, the anticipated units in Menlo Park may be under estimated because 215 units associated with the 2000 General Use Permit have been approved for construction in Menlo Park at the Middle Plaza at 500 El Camino Real site.

Air Quality and Noise

12. Given the comments regarding peak spreading, the air quality and greenhouse gas analysis should be reevaluated to determine the continued accuracy of the conclusions relative to reductions in pollutants, especially since a full 1/3 of emissions are anticipated from transportation sources.

13. Stanford is proposing to construct up to 40,000 net new square feet of child care centers and other services on campus. However, in the chapter regarding air quality (see Figure 5.2-1), the DEIR does not consider on-site sensitive receptors like the new proposed day care centers and should be revised to reflect this change.

14. Noise impacts on the Sand Hill Road corridor should be mitigated near residential uses.

Hydrology/Water Quality

15. Stanford should be required to coordinate and cooperate, including funding, with the San Francisquito Creek Joint Powers Authority to provide meaningful large-scale upstream detention facilities to attenuate and manage flows in San Francisquito Creek.

16. The DEIR did not adequately respond to the City request that Stanford continue to work with the City of Menlo Park and other jurisdictions to develop a specific proposal for the detention of floodwaters on Stanford land that will result in a significant and measurable reduction in floodwaters reaching the floodplain areas within Menlo Park and neighboring jurisdictions. The City requests that existing and proposed runoff calculations from the project area for both the 10-year and 100-year storm event be provided for the City to review and that the impact be evaluated in a revised and recirculated DEIR. In addition, the City requests that any plans that show existing and proposed impervious improvements and potential alteration of drainage patterns be provided. Combined with the improvements downstream within San Francisquito Creek, the detention on Stanford land shall result in containment of flows from the 10-year and 100-year storm events within the detention site(s) and within the Creek to the extent feasible. The detention plan shall be designed and implemented by Stanford within a specific time line that is relative to the proposed development.

17. In addition, the City requests that the proposed General Use Permit include measures that either mitigate for increase flows and/or create no net increase in storm water runoff to the neighboring downstream communities that are located within the San Francisquito Creek Watershed Area.

Other Issues

18. The DEIR dismisses the impact of new students, faculty and staff on neighboring library facilities positing that Stanford is an academic university with libraries and visiting a local library is not necessary. However, there are many reasons to visit a library--a college student's reason may be different from a faculty member who has a toddler and wishes to participate in story time at the library. If Stanford does not provide such services at its libraries, it is likely that there will be more visits to libraries in surrounding jurisdictions and potential impacts. The same is true of the impacts on parks and other community based recreation programs.

19. In anticipation of the Final EIR review period, the City requests that a minimum of 30 days be granted for public review.

Scoping of Project-Specific Transportation Studies under Stanford GUP Condition of Approval G11

1/16/02

Background

On December 12, 2000, Santa Clara County approved Stanford University's draft Community Plan and General Use Permit application and certified the associated Environmental Impact Report (2000 GUP EIR). This EIR analyzed the impacts associated with the construction of approximately 2 million gross square feet of academic and academic support uses, approximately 3,000 new housing units, and approximately 2,900 new parking spaces (the number of new parking spaces was limited to 2,300 in the final approval).

The traffic study in the 2000 GUP EIR estimated the new trips "generated" by additional students, faculty, and staff on campus and additional resident population from new housing. The additional generated trips were then "distributed" within the network and were allocated among traffic analysis zones, taking into consideration the anticipated location of housing areas and parking lots, as well as existing traffic patterns.

Mitigation measures to address the impacts of the 2000 GUP development were developed, and Conditions of Approval were attached to the 2000 GUP. These mitigation measures and conditions approached the impacts in a comprehensive manner, so that individual projects that were approved under the 2000 GUP would already have identified required mitigations. A summary of these comprehensive conditions follow:

Condition G3:	Stanford will meet a no net new commute trips standard
Condition G9:	If Stanford does not meet the no net new commute trip standard for any 2 out of 3 years, it will contribute funding for its proportional impacts at 15 intersections.
Condition G10:	If a neighborhood traffic study (of "cut-through traffic") is initiated by a local jurisdiction, Stanford will participate in the study
Condition G11:	Certain projects will require project-specific traffic studies
Condition H2:	Stanford will allocate funding of $100.000 to the City of Palo Alto for a residential parking permit program

This memorandum outlines a proposed methodology for defining the scope of project-specific traffic studies required under Stanford GUP Condition of Approval G11. The scoping process recognizes that the project-specific traffic studies for projects that are fully consistent with the assumptions used in completing the 2000 GUP EIR should be limited to evaluation of site-specific impacts that were not previously addressed in the Program EIR (such as site access and safety). On the other hand, projects that could result in a substantially different trip distribution than evaluated in the 2000 GUP EIR, or that could substantially increase overall traffic beyond that evaluated in the 2000 GUP EIR, should receive a more detailed level of analysis. This more-detailed analysis, if warranted, would be documented in the project-specific traffic study, and would include analysis of intersection congestion. This memorandum describes the methods to be used for applying Condition G11 to future Stanford development. It defines: 1) applicable projects, 2) the intent of the Condition regarding the potential impacts of such projects, and 3) the methods through which the impacts of potential concern under Condition G11 should be examined. This memorandum is meant to be a guidance document that can evolve over the life of the 2000 GUP.

Projects Triggering Condition G11

The following Stanford GUP projects will require project-specific transportation studies under Condition G11.

- Projects specifically defined as items (a) through (f) in the Condition. This includes: additional housing in Escondido Village exceeding 100 units, West Campus and Lagunita faculty/staff housing development. basketball arena expansion or replacement, performing arts center, Stanford Avenue faculty/staff housing, parking lots or structures with a net increase of 400 spaces or more, and
- Projects of similar size and scale to those listed above. This includes: new or enlarged event venues that would result in peak hour traffic generation equal or greater than that of the basketball arena (assumed 12,000 seats) or performing arts center (1,500 to 1,800 seats in main hall and two smaller halls of 200 and 800 seats), or housing projects of more than 100 units near the border of campus.

Need to justify how 400 spaces or 100 housing units was determined. A preferred measure would be an equivalent number of vehicular trips instead of parking spaces or unit counts. These levels of development would easily trigger CMP review criteria alone. The City requests that a "trigger" of 50 peak hour trips be used to consistently and transparently address impacts.

Projects that would relocate academic square footage, housing units, and/or parking to districts beyond the level of development contemplated in the GUP.

As described below, the site-specific traffic study for projects meeting these criteria would include both: 1) an analysis of localized vehicular, bicycle and pedestrian access operations and safety, and 2) a screening analysis to determine whether the project might result in new or substantially more severe impacts on intersections than the impacts identified in the 2000 GUP EIR. If the screening analysis finds possible new or substantially more severe

intersection impacts than were disclosed in the 2000 GUP EIR, then a detailed intersection impact and mitigation analysis will also be prepared.

Academic projects not meeting any of the above criteria would not be subject to project-specific traffic studies under Condition G11. As discussed above, the traffic impacts of academic projects in the core of the campus have been assessed in the programmatic 2000 GUP EIR. In addition, traffic impacts are not dependent on the location of academic projects, because the occupants of these buildings will travel to parking areas, not to the buildings themselves, and large parking areas are subject to Condition G11. In addition, the County's design review procedures address pedestrian, bicycle, delivery and vehicular access safety and efficiency for academic projects.

Intent of Condition G11

Condition G11 was imposed to address two potential situations: I.) projects that could increase congestion if new driveways would slow passing traffic, or would conflict with pedestrians and bicycles using bicycle paths, and II.) projects differing substantially from the assumptions in the 2000 GUP EIR, such that they would necessitate possible re-evaluation of GUP off-site impacts at the intersections previously studied in the 2000 GUP EIR.

I. The first concern was that, at a more micro-scale than the program-level issues addressed in the GUP EIR, a specific development project could affect conditions at individual site access points or along frontages at or near (i.e. within 1/4 mile) the project site. For example, in the case of EV 5/6, new traffic using the Escondido Village driveways could potentially slow passing traffic on Stanford Avenue or could conflict with pedestrians and bicycles using the adjoining bicycle path. To address this concern, Condition G11 calls for analysis of the effects within a project site, at project driveways, along project frontages, and at crossings up to about 1/4 mile of the site. Such an analysis typically covers project design details related to operations and safety of driveways, parking lots, access-point dimensions and access controls, emergency access, loading areas for passengers and material deliveries/ pick-up, street frontages, on-street parking/ loading, and bus stops. It also addresses bike lanes, bike racks and storage, sidewalks, and paths adjacent to and near the project site. This type of study will be performed for all projects subject to Condition G11.

II. The second concern addressed by Condition G11 is that the scale or location of a specific building or parking lot could change relative to the GUP EIR assumptions, so that GUP traffic could exceed the EIR's projection of buildout GUP traffic at EIR intersections. In addition, large-scale special event projects could create off-peak traffic impacts that were

not analyzed in the GUP EIR. To address these concerns, the Condition calls for a project-specific traffic study to:

A. assess whether the characteristics of each applicable project might cause impacts at a GUP EIR intersection in excess of what the GUP EIR predicted would occur, and

B. if additional significant impact might reasonably occur, to quantify the impact and, if significant, identify appropriate mitigations.

Procedure for Defining Study Scope and Content

I. Localized Access and Circulation Studies

Localized access and circulation studies will address traffic, transit, pedestrian and bicycle safety and efficiency within a project site, at project driveways, along project frontages, and at crossings up to about 1/4 mile of the site. The analysis will cover project design details related to operations and safety of driveways, parking lots, access-point dimensions and access controls, emergency access, loading areas for passengers and material deliveries/ pick-up, street frontages, on-street parking/ loading, and bus stops. It will also address bike lanes, bike racks and storage, sidewalks, and paths adjacent to and near the project site. Analysis methods will involve application of relevant County, City and/or Caltrans design standards, and techniques described in AASHTO and the Highway Capacity Manual. Stanford will submit the proposed scope of work to the County for comment prior to commencing the study. Stanford will also identify the proposed source of design standards and analysis techniques to be applied to the particular situation. for County acceptance prior to the study.

II. GUP EIR Intersection Impacts

Stage A: "Screening" Analysis

The Condition is fairly explicit on the methods for determining whether any excess impacts could reasonably be expected. However, to assure concurrence on assumptions and methods, Stanford will re-confirm the study scope with the County prior to initiating any Stage A analysis. This will include the assumptions on completed GUP projects to be included in the running-total cumulative analysis.

In general, the Stage A study scope will address the following.

Add 3. Whether local traffic conditions have changed substantially that differing impacts of the project could be reasonably expected.

1. Whether the project type and scale is similar to the examples listed as (a) through (f) in the Condition, *and*

2. Whether trip distribution analysis indicates that the location or size of the applicable project would differ substantially from the assumptions in the GUP EIR in a manner that would increase the expected amount of GUP buildout traffic at one or more GUP EIR intersection(s).

Each screening analysis report will contain a cumulative running total, by campus planning area, of the parking spaces created and removed under the GUP, and the number and type of housing units constructed under the GUP. These running cumulative totals will be compared to the area-specific buildout housing and parking totals assumed in the GUP EIR. If the running total exceeds the GUP EIR buildout total in any area, Stage B impact analysis will be conducted to determine the potential effects on EIR intersection(s).

This type of screening analysis should be performed for each project subject to Condition G11 in the site-specific traffic study. If a Stage A "Screening" analysis indicates that a specific project would raise the level of GUP parking or housing in any area of campus to a level greater than anticipated in the GUP EIR, then a Stage B analysis of the impact significance and mitigation would become necessary.

Stage B: Impact Assessment and Mitigation Approach

Like each Stage A report, each Stage B analysis report will contain the cumulative running total of parking spaces, housing and the student, faculty and staff population used to calculate project trip generation. It will compare those figures to the assumptions in the GUP EIR used to calculate trip generation and trip distribution. Each report will indicate the number of trips that the applicable project would add to each GUP intersection as well as the cumulative running-total of other GUP projects approved to date, using the same trip generation and distribution methods used in the EIR. The running cumulative trip total for each intersection will be compared to the GUP buildout trip total as reported in the GUP EIR. If the current total exceeds the GUP EIR buildout total at any EIR intersection, further Stage B impact analysis will be conducted at the affected intersection(s).

During the life of the 2018 GUP, it is expected that state law changes will result in modifications to the standards of significance, analysis methods and mitigation selection with regard to transportation and potentially GHG and Air Quality analyses. The conditions and required follow up analysis should acknowledge that these conditions may necessitate evolution of standards of significance, analysis methods and mitigation selection over time.

For consistency with the 2000 EIR, the further Stage B analysis will adhere to the established CEQA criteria for standards of significance, analysis methods, and mitigation selection. Stanford will prepare a draft scope of work for the Stage B project-specific traffic analysis and submit it to the County for review and comment. The scope will adhere to the following guidelines:

1. For housing and parking projects, the assessment of traffic impacts at GUP intersections will use the same peak periods and same horizon year as used in the 2000 GUP EIR. The Condition G11 analysis will focus on the commute traffic peak periods, consistent with the 2000 GUP EIR. For special-event projects, such as the performing arts center, whose specific peaks would occur outside the normal area-wide traffic peaks studied in the 2000 GUP EIR, event-related time periods would also be addressed.

2. The assessment of traffic impacts at GUP intersections will use the same assumptions concerning changes in non-GUP background growth as used in the GUP EIR, unless new information shows a substantial increase or decrease in background traffic levels relative to those assumed for 2010 in the 2000 GUP EIR.

3. Once any changes in background assumptions necessitated under Step 2 have been taken into consideration, the amount of project-specific traffic at any 2000 GUP EIR intersection will be added. The resulting traffic will only represent a new significant impact if, when added to traffic from other already-approved GUP projects, the cumulative running-total GUP impact exceeds the threshold of significance stated in 2000 GUP EIR.

4. Mitigation required for any new significant impact would first look to the ability of mitigations already identified in the 2000 GUP EIR to mitigate the impact to less-than-significant, including both EIR-listed intersection modifications and "no net new commute trip" accomplishment.

5. Any mitigation required beyond measures already identified in the GUP EIR would include two alternative approaches: further intersection modification and further reduction in commute-trip generation.

Stanford will also meet with County as necessary to discuss and refine the proposed scope of work and will obtain County approval before proceeding with the study.

This criteria should specify how new information should be considered. The City requests that traffic levels anticipated as part of background projects be quantified and existing traffic levels be verified with new traffic counts. At a minimum, critical gateway intersections including El Camino Real/Sand Hill Road and Sand Hill Road/Santa Cruz Avenue should be monitored to determine changes in the vicinity of the campus to the Menlo Park border.

If further reduction in commute-trip generation is allowed, the City requests the County ensure that such programs reduce trips directly in the impacted corridors to mitigate impacts.

Other impacted jurisdictions should also be consulted on the scope.

Summary

Condition G11 specifies which projects will require project-specific traffic studies. Project-specific traffic studies will include 1) localized circulation impacts, and 2) screening analysis of whether there might be additional significant impacts beyond those identified in the 2000 GUP EIR. If screening analysis indicates changes in total GUP trip distribution compared to the EIR, then a re-analysis of impacts will be undertaken at affected intersections, using 2000 GUP EIR methodology, to determine whether significant impacts would result and to identify mitigations.

Stanford will prepare a scope of work for any project-specific traffic study and review it with the County and its consultant prior to beginning work.

The City requests that the relevant approval body be specified. Consistent with the request outlined in the City's comment letter, the City requests that the Board of Supervisors must consider any relocation of development to different districts within the campus.

APPENDIX RA-MV

Comment Letter RA-MV Attachment

City of Mountain View
COMMUNITY DEVELOPMENT DEPARTMENT • PLANNING DIVISION
500 Castro Street • Post Office Box 7540 • Mountain View • California • 94039-7540
650-903-6306 • Fax 650-962-8501

December 12, 2017

David Rader
Santa Clara County Planning Office, County Government Center
701 W. Hedding Street, 7th Floor, East Wing
San Jose, CA 95110

Re: STANFORD UNIVERSITY 2018 GENERAL USE PERMIT - DRAFT ENVIRONMENTAL IMPACT REPORT (SCH#2017012022)

Dear Mr. Rader:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Report (DEIR) for the Stanford University General Use Permit (GUP), including the presentation that was made to the City's Environmental Planning Commission on November 1, 2017. The City of Mountain View has the following comments on the DEIR:

1. Transportation & Traffic
Intersection ID No. 83 Charleston Road/San Antonio Road is under the jurisdiction of the City of Palo Alto (not Mountain View) as shown on the tables.

Table 1 on Page 5.15-86 notes that the planned closure of Castro Street at the train tracks would mitigate the Project impact for the Central Expressway/Moffett Blvd intersection (Intersection ID No. 89) and lists a back-up mitigation of fair-share funding for an intersection improvement should the Castro Street closure project not be implemented. The planned closure of Castro Street and related improvements (bicycle/pedestrian undercrossing of Central Expressway and a new access ramp from Evelyn Avenue to Shoreline Blvd) are part of the Mountain View Transit Center Master Plan approved by the Mountain View City Council on May 23, 2017. These improvements will be primarily, but not fully, funded by VTA's Measure B Sales Tax Program.

The City requests that the fair-share funding allocation planned for the back-up mitigation measure be made available for the Castro Street closure improvements consistent with the DEIR's statement that these improvements will mitigate the Project's significant impact at the Central Expressway/Moffett Blvd intersection. These improvements are also consistent with the priority that the trip fees collected from Stanford be used for transportation improvements that increase safety and mobility for pedestrians, bicyclists and transit users.

2. No Net New Commute Trips
The City supports the proposal to continue the No Net New Commute Trips required condition for development on campus. The City encourages the Draft EIR to study the ability to reduce

commute trips or vehicle miles traveled created by other workers directly or not directly employed by Stanford University (i.e. workforce or contracted staff), instead of trips made only by students, faculty, and staff.

3. Affordable Housing Funding Availability
Affordable housing continues to be a primary concern for the region, and the City requests that Santa Clara County maximize the funding collected for housing supply to be distributed not only among students, faculty and staff housing needs, but also for other workers (temporary, causal, part-time, and etc.) that work or will work within the General Plan Use permit area. The City also asks that the County consider allowing a portion of funds for affordable housing projects to be distributed outside the 6-mile radius of campus to allow a larger portion of neighboring jurisdictions to accommodate increased workforce housing demands.

4. Historic and Cultural Resources
The City is supportive of Stanford University's proven commitment to maintaining historic and cultural resources with the Academic Growth Boundary, and we encourage that commitment to continue with the General Use Permit 2018.

5. Rideshare Technology
How does the DEIR address the commuting trips created by private ride-hailing services (i.e. Uber, Lyft, and etc.)? Are these counted as single occupancy trips?

6. GUP Outreach
The City applauds Stanford University and the County of Santa Clara for their commitment to giving the public multiple opportunities to comment on the various phases of this project review. The City suggests that expanded translation services be offered at future outreach meetings.

If you have any questions, please do not hesitate to contact me at (650) 903-6306 or my staff via email at taryn.toyama@mountainview.gov.

Sincerely,

Randal R. Tsuda, AICP
Community Development Director

CC: Dan Rich, City Manager
City Council
Environmental Planning Commission

APPENDIX RA-PV

Comment Letter RA-PV Attachment

TOWN of PORTOLA VALLEY
Town Hall: 765 Portola Road, Portola Valley, CA 94028 ~ Tel: (650) 851-1700 Fax: (650) 851-4677

December 14, 2017

David Rader
Santa Clara County Planning Office, County Government Center
70 W. Hedding Street, 7th Floor, East Wing,
San Jose, CA 95110
david.rader@pln.sccqov.ors.
Fax: (408) 288-91 98

Re: Comments on DEIR for Stanford University's 2018 GUP

Dear Mr. Rader:

Thank you for the opportunity to respond to the Draft Environmental Impact Report for Stanford University's 2018 General Use Permit (DEIR). In light of the County of Santa Clara's recent extension of the comment period, the full Town Council has had an opportunity to discuss the DEIR and this letter is being sent on behalf of the Town of Portola Valley. The Town's comments focus on the housing issues discussed in the DEIR.

Background

We understand that Stanford University seeks to develop 2,275,000 SF net new academic and academic support space (and build out the remaining square footage in the 2000 GUP)[1] and add 3,150 net new housing units/beds of which up to 550 units would be available for faculty, staff, postdoctoral scholars and medical residents. The application for development is wholly within Academic Growth Boundary (AGB), central campus, located in Santa Clara County. By 2035 full buildout the project is expected to increase the regional population by 9,610 people-this is two times the total population of the Town of Portola Valley.

Carryover of 2000 GUP Housing Strategies

As a preliminary matter, we support the Housing Linkage policy codified as Condition F.8 of the 2000 General Use Permit requiring that Stanford's development of academic and academic support space be linked to the development of its housing units. We think this linkage program has worked well to ensure housing construction keeps pace with academic development and we are pleased to see this program carried forward in the 2017 GUP. We encourage the County to look closely at the existing triggers and update them to reflect the current housing crisis.

Likewise, we support the affordable housing program codified as Condition F.6 of the 2000 General Use Permit requiring that for each 11,763 square feet of academic development constructed, Stanford shall either: 1) provide one affordable housing unit on the Stanford campus, or 2) make an appropriate cash

[1]We assume this 2000 GUP build out will be subject to Conditions F.6 and F.8 regarding housing linkage and affordable housing fund requirements.

payment in-lieu of providing the housing unit. We encourage the County to look closely at the in lieu fee and set it at an initial rate that reflects the current market conditions. Also, as discussed in more detail below, while we acknowledge that some of the funding should be prioritized towards transit proximate development, we also encourage the County to retain the six-mile radius policy in order to fund more projects.

Comments on Population and Housing Section

1. *Jobs/housing imbalance:* While the DEIR recognizes the current job/housing imbalance, its current prominence in Plan Bay Area 2040 and the associated environmental impacts, the DEIR falls short of analyzing the project's impact on this imbalance. Over twenty years ago the Santa Clara County General Plan recognized that employment and economic growth in the County was greatly outpacing the housing supply, and the housing that was being constructed at greater distances from major employment centers in the County.

The DEIR also recognizes that the "principal effects of this imbalance are known to include: increased travel and commute distances; increased traffic congestion; increased automobile dependency; increased housing affordability problems, especially in "job-rich" cities; increased automobile emissions, including greenhouse gas emissions, affecting air quality and contributing to global climate change; increased noise; and overburdened urban services and facilities."

Since 1980 all other Bay Area counties have added more jobs per added housing unit than was their situation in 1980, thus exacerbating this imbalance. This is due to not just robust job growth in these Counties but to a dramatic slowdown in housing production there relative to earlier decades, particularly in San Mateo county, Santa Clara county, and other inner East Bay communities. The existing housing stock is also increasingly housing higher wage earners as the regional economy shifts toward higher wage jobs and actual housing production lags growth in demand.

The Stanford University Medical Center 2012 EIR looked at this imbalance and we think it would be productive to have a similar analysis here.

2. *Population Projections:*

A. Stanford's off-campus housing demand projection throughout the region is a critical component of the population and housing analysis. Given the role of Stanford as a nationally recognized research institution with plans to increase the faculty during the project period, the accuracy of Stanford's projections of graduate student and postdoctoral population cohorts that will affect the demand for off campus housing should be further analyzed and discussed.

B. The population projections in Tables 5.12.7 and 5.12.8 do not appear to include service workers associated with the population increase. As population increases, the demand for services also increases. For instance, it is likely that faculty members moving into single family homes will hire gardeners, housekeepers, nannies and other service workers. As the sharing economy grows, it is also likely that car drivers and delivery people will also increase. This increase in service workers, particularly low income workers, should also be included in the projections.

C. Please include a total population chart for off-site affiliated housing. The DEIR includes a table showing increased population related to graduate students and faculty/staff (i.e. spouses, children and other family members), but the off site housing section does not. Accordingly, the offsite housing population numbers appear to be under-estimated.

3. *Displacement of Existing Residents:* The DEIR states "Existing housing on the campus may be demolished over the course of implementation of the 2018 General Use Permit; however, any demolished housing units would be added to the inventory of new housing units authorized for construction. Therefore, the Project would not displace substantial numbers of existing housing." (P.5.12.14.) Please clarify whether Stanford intends to demolish any existing on or off site housing units and if so clarify where the occupants will be temporarily housed during construction. As we have seen with the devastating fires in Sonoma, Napa and Mendocino Counties, temporary housing demand can have a significant impact on a local community's existing housing stock, especially its affordable rental stock.

4. *Analysis of Faculty Housing Demand:* The DEIR states that there will be a net reduction of 102 faculty households. (P. 5.12.17.) With the DEIR projecting 789 net new faculty members and the project proposing to build 550 faculty/staff/medical student units, please explain how there is a net reduction of needed units.

5. *Methodology for Assuming Off Site Housing Demand Is Met*

A. The DEIR states the estimated distribution of off site housing demand is based on data from Stanford's 2016 Commute Survey (p. 5.12.17). Given the current housing crisis in the Bay area, it is unreasonable to assume that all population sectors, particularly low income wage earners, will continue to live in nearby communities where housing prices have shot up and vacancy rates remain low.

B. The DEIR concludes there is no impact on population and housing because the housing increases within each of these jurisdictions would represent a small fraction of the household growth projected for each jurisdiction by ABAG for the 2015-2040 timeframe. (P.5.12.18). There are two problems with this conclusion. First, the ABAG population projections and the RHNA housing allocations based on those populations, are only directory. ABAG does not mandate the construction of housing and thus the ABAG projections are not an accurate proxy for whether the housing demand will in fact be accommodated. Second, the current housing crisis has made it clear that jobs production has well out paced housing production. The overall area is not only experiencing significant housing deficits right now, but such deficits are projected to continue well into the future. Given this current housing situation, the DEIR should conduct a more thorough analysis to determine whether off-site housing allocated to a particular jurisdiction will in fact be built and be available to Stanford's population demand. Data about existing off-site leases or Stanford owned land that could be developed into housing would be useful to this analysis.

6. *Impact on Town of Portola Valley:* The draft EIR indicates that the 2018 GUP is anticipated to result in only one more unit in Portola Valley (indirect growth) (P. 5.12.19). This appears to significantly underestimate housing demand in Portola Valley which is directly adjacent to Stanford.

Additional Recommendations

1. To more fully address the project's housing impacts, we recommend that the County review the housing linkage triggers to ensure that the amount of on site housing is maximized and constructed prior to academic build out. Likewise, we request the County to examine the amount of the affordable housing linkage to ensure that it adequately accounts for the project's affordable housing demand and that the in lieu fee reflects the current and future housing market.

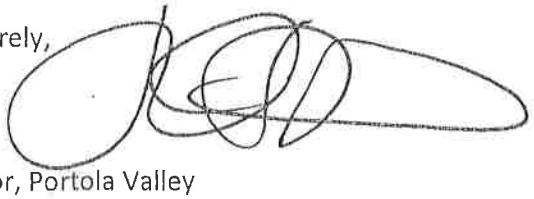
2. We also request the County to consider allocating a portion of its affordable housing fund to jurisdictions that do not meet the mile transit proximate criteria. In addition, we encourage expanded use of these funds to support construction of accessory dwelling units. Stanford students are likely renters of such ADU's. In particular, the Town Council of Portola Valley has recently been discussing strategies for addressing the community's housing challenges. While the cost of land and estate zoning poses challenges, we believe an expanded accessory dwelling unit program is viable as is Town-constructed workforce housing. We look forward to partnering with the County/Stanford on these and other housing programs. Portola Valley's close proximity to the Stanford project would also assist in reducing commute traffic and might even reduce the impacts to the 280 Freeway/Alpine LOS F intersection identified in the DEIR. To this end, we encourage the County and Stanford to examine extending the Marguerite shuttle and/or other commute bus into Portola Valley during commute hours and partnering with Portola Valley on Zipcar and commuter bicycle programs.

3. We encourage Stanford to facilitate Santa Clara County working with San Mateo County in developing and improving current bicycle and pedestrian pathways throughout Stanford lands and adjacent communities. We strongly support the existing pathways Stanford has created throughout campus and urge Stanford to continue its efforts to encourage students, faculty and staff to convert more off-campus vehicle trips to bicycle or pedestrian trips.

4. Finally, as a community which values its open space and rural character, we encourage the County to require a permanent conservation easement over the foothills in return for the development in the flatlands. Clustering development and offsetting the intensity of development with permanent protection ofthe adjacent hills is a planning tool used by most nearby local agencies and the County itself. Stanford's growth at this point is basically unrestricted. As Supervisor Simitian has pointed out, Stanford's ultimate buildout must be known so that every 15 years or so, Stanford does not request another 3 million square feet of development. The 2000 GUP required preparation of a holding capacity analysis intended to set the maximum buildout limits for the Stanford lands, with particular attention to the foothills. This analysis was not completed. It should not only be completed, but also analyzed in the EIR. Furthermore, the holding capacity should be analyzed for each campus area, so that there is assurance that the foothills will remain protected. (Please also see comment letter from Sandy Sloan dated November 21, 2017 which is attached and incorporated.)

Thank you for your consideration of these concerns. We would appreciate any opportunity to discuss these issues with you and would appreciate a response.

Sincerely,



Mayor, Portola Valley

Enclosure

APPENDIX AQR-REV

Stanford 2018 General Use Permit Application: Air Quality Technical Report (Revised)

ESA

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memorandum

date	July 25, 2018
to	Dave Rader, Senior Planner Santa Clara County Department of Planning and Development
from	Brian Boxer, Paul Mitchell, Chris Sanchez, Brian Schuster - ESA
subject	**ESA Peer Review of 2018 General Use Permit Application – Revised Air Quality Technical Report**

Stanford prepared and submitted a revised Air Quality Technical Report in support of, and related to, the proposed 2018 General Use Permit. The Air Quality Technical Report was revised as a result of staff-initiated changes, and in response to comments received on the Draft EIR. The revised Air Quality Technical Report was independently peer reviewed by ESA. The revised Air Quality Technical Report replaces the original Air Quality Technical Report in its entirety.

At the request of the County, ESA conducted an independent peer review of this report to verify the technical accuracy of the information, and identify any apparent deficiencies, errors and omissions affecting the completeness, methodologies, findings and adequacies of the report. The ultimate goal of the peer review is to help ensure that the information contained in the report met accepted professional standards for use in the EIR.

As part of the peer review, ESA advised County staff of any revisions or additions to the report that were necessary. ESA prepared and submitted a technical peer review memoranda to the County documenting its comments. In turn, Stanford prepared a response memoranda indicating how ESA peer review comments were responded to; and updated the report accordingly. The revised Air Quality Technical Report was revised by Stanford in July 2018. In general, revisions to the Air Quality Technical Report made in response to peer review comments and Stanford staff-initiated changes include, but are not limited to minor numerical and editorial adjustments.

These peer review and response memoranda are part of the administrative record for the EIR. Based on the peer review conducted; ESA concludes that this revised Air Quality Technical Report as revised is appropriate for use as reference in the EIR.

Prepared for
Stanford University
Stanford, California

Prepared by
Ramboll Environ US Corporation

San Francisco, California

Project Number
03-38006A

Date
July 24, 2018

STANFORD 2018 GENERAL USE PERMIT: AIR QUALITY TECHNICAL REPORT

STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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ACRONYMS AND ABBREVIATIONS

AB	Assembly Bill
ABAG	Association of Bay Area Governments
ARB	California Air Resources Board
ATCM	Air Toxic Control Measure
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
Bay Area Basin	San Francisco Bay Area Air Basin
BDT	Best Demonstrated Technology
CAAQS	California Ambient Air Quality Standards
CalEEMod®	California Emissions Estimator Model
CAP	criteria air pollutant
CARE	Community Air Risk Evaluation
CCAA	California Clean Air Act of 1988
CEF	Central Energy Facility
CEQA	California Environmental Quality Act
CO	carbon monoxide
CY	Cubic yards
DPM	diesel particulate matter
FCAA	Federal Clean Air Act
GHG	greenhouse gas
GUP	General Use Permit
HAP	hazardous air pollutant
HRA	health risk assessment
MACT	Maximum Achievable Control Technology
MMBTU	million British Thermal Units
MTC	Metropolitan Transportation Commission
MWh	megawatt-hour
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emissions Standards for Hazardous Air Pollutant
NO	nitric oxide
NO_2	nitrogen dioxide

NO_X	nitrogen oxides
NSPS	New Source Performance Standards
NSR	New Source Review
O_3	ozone
OEHHA	Office of Environmental Health Hazard
OPR	Office of Planning and Research
Pb	lead
PGE	Pacific Gas & Electric
PM	particulate matter
PSSI	Peninsula Sanitary Service, Inc.
RLMP	Responsible Laboratory Management Practices
ROG	reactive organic gas
SB	Senate Bill
SESI	Stanford Energy System Innovations
SIP	State Implementation Plan
SMOP	Synthetic Minor Operating Permit
SO_2	sulfur dioxide
SO_X	sulfur oxides
sq ft	square feet
TAC	toxic air contaminant
TBACT	Best Available Control Technology for Toxics
TOG	total organic gas
ug/m^3	microgram per cubic meter
USEPA	United States Environmental Protection Agency
VMT	vehicle miles traveled
VOC	volatile organic compound

1. INTRODUCTION

Please note that this report replaces the Air Quality Technical Report dated August 2, 2017. This updated report incorporates calculations of entrained roadway dust emissions that result in changes to mobile emissions.

1.1 Project Description

Stanford University's contiguous lands occupy over 8,000 acres, with 4,017 of those acres in unincorporated Santa Clara County. The development of the Stanford land in unincorporated Santa Clara County currently is subject to conditions of approval in the 2000 General Use Permit (GUP). The 2000 GUP authorized the development of 2.035 million square feet of net new academic space and 3,018 net new housing units. In March 2016 the Santa Clara County Planning Commission authorized an additional 1,450 housing units. As of December 2015, 769,354 square feet of academic buildings remain to be built under the 2000 GUP allocation. Stanford is proposing a 2018 General Use Permit that would authorize 2.275 million net new academic space and 3,150 net new housing units. Stanford estimates that the new development authorized by the proposed 2018 General Use Permit would occur between 2018 and 2035.

1.2 Emissions Inventory Years

This report evaluates the criteria air pollutant (CAP) and toxic air contaminant (TAC) emissions inventories associated with the buildings and energy sources for existing conditions and the development proposed for the 2018 GUP (the "Project"). Inventories presented here represent the following existing conditions years: 2014, 2015, annualized emissions for Fall 2018, and emissions for the completion of the development proposed for the 2018 GUP, anticipated to occur by 2035.

1.2.1 Study Area Boundaries

Stanford anticipates that the 2018 GUP will continue to cover all of its lands in unincorporated Santa Clara County. However, the GUP does not apply to land uses within those areas that are permitted as of right. The single-family and two-family residences in the faculty/staff subdivision are permitted as of right, and therefore are not included in the study area for this existing conditions report. In addition, Stanford does not propose development under the 2018 General Use Permit in areas zoned for medium-density faculty and staff housing (the Peter Coutts, Pearce Mitchell, and Olmsted Terrace housing areas). Nor does Stanford propose development outside the Academic Growth Boundary, including on the Stanford Golf Course. Therefore, these areas similarly are not included in the study area boundary for this Air Quality Technical Report

The study area boundary includes all of the Academic Campus and Campus Open Space lands, including the Stanford Driving Range, which Stanford proposes to designate as Academic Campus rather than medium-density residential. Thirty-eight faculty and staff housing units are included in the study area in the Searsville and Olmsted staff rental subdivisions. The study area within which the emissions are analyzed is shown on Figure 1-2.

1.2.2 Existing Conditions Analysis Years

This document contains the evaluation of three scenario years to represent existing conditions. A more complete description of the existing condition years and the recent history of Stanford's emissions profile is provided in Section 3.1. The scenario years are:

- 2014, which represents the actual historic campus emissions prior to the implementation of the Stanford Energy System Innovations (SESI), and also includes the operations of the Valero Service Station. This period uses data from 2014. A major feature of SESI was the replacement of the steam-based heating system with a hot-water based heating system, and replacement of the cogeneration plant with a new more efficient Central Energy Facility (CEF). A fuller description of the SESI and a comparison of the old and new CEF is provided in Section 3.1. The 2014 information is provided to aid in understanding the degree to which historic emissions have been reduced.
- 2015, which represents the current campus emissions after implementation of SESI. This period uses data from 2015. Natural gas and electricity usage is based on July – December 2015, after SESI is implemented. This scenario also reflects year 2015 emission factors.
- Fall 2018, which represents the annualized campus emissions that are expected to exist immediately prior to commencement of operations under the proposed 2018 GUP. This includes buildings that would be expected to be permitted and occupied during implementation of the 2000 GUP, and also reflects emission factors consistent with 2018. The Fall 2018 scenario assumes that the Escondido Village Graduate Residences Project is under construction, but not yet occupied and operational.

1.2.3 Project Analysis

This document evaluates the emissions inventory for complete buildout of the 2018 GUP. This scenario is called "Fall 2035" because it consists of the full Project operations. However, the mobile source emissions are conservatively calculated using 2030 emission factors.[1] If 2035 mobile source emission factors were used instead of 2030, the total CAP emissions would be lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions.

[1] 2030 mobile source emission factors are used to be consistent in comparison with the 2030 GHG emissions threshold.

2. AIR QUALITY ENVIRONMENTAL AND REGULATORY OVERVIEW

2.1 Existing Air Quality

Air quality depends upon both the rate and location of pollutant emissions. Atmospheric conditions such as wind speed, wind direction, and air temperatures interact with features of the landscape to determine the movement and dispersal of air pollutants and consequently affect air quality. This section describes the physical setting for Stanford through a discussion of regional and local information related to climate, meteorology, and air pollution conditions.

2.1.1 Air Quality Background

Stanford is located in Santa Clara County, as part of the nine-county San Francisco Bay Area. It is located within the San Francisco Bay Area Air Basin (Bay Area Basin) under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD). The Bay Area Basin includes all of Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, and Santa Clara Counties, the southern portion of Sonoma County, and the southwest portion of Solano County. The Bay Area Basin covers approximately 5,540 square miles of terrain consisting of coastal mountain ranges, inland valleys, and the San Francisco Bay. The Bay Area Basin is generally bounded on the west by the Pacific Ocean, on the north by the Coast Ranges, and on the east and south by the Diablo Range.

In the Bay Area Basin, marine air traveling through the Golden Gate, as well as across San Francisco and through the San Bruno Gap, is a dominant weather factor.

Two surface meteorological stations are in the vicinity of Stanford: one is an onsite station maintained by Stanford located approximately 650 feet south of the intersection of Stock Farm Road and Sand Hill Road. The other station is a National Climate Data Center station located at the Palo Alto airport (WMO ID 724937) approximately 5 kilometers northeast from the Stanford campus.

2.1.2 Topography, Meteorology, and Climate

The Bay Area Basin climate is dominated by a strong, semi-permanent, subtropical high-pressure cell over the northeastern Pacific Ocean. Climate is also affected by the moderating effects of the adjacent oceanic heat reservoir. Mild summers and winters, moderate rainfall and humidity, and daytime onshore breezes characterize regional climatic conditions in the San Francisco Bay Area (Bay Area). In summer, when the high-pressure cell is strongest and farthest north, fog forms in the morning and temperatures are mild. In winter, when the high-pressure cell is weakest and farthest south, occasional rainstorms occur.

Ambient concentrations of air pollutant emissions are determined by the amount of emissions released by pollutant sources and the atmosphere’s ability to transport and dilute such emissions. Natural factors that affect transport and dilution include terrain, wind, atmospheric stability, and the presence of sunlight. Existing air quality conditions in the Stanford area are determined by such natural factors as topography, meteorology, and climate in addition to the amount of emissions that the existing sources of air pollutants release. The environmental factors that affect ambient air pollutant concentrations are discussed separately.

2.1.2.1 Temperature Inversions

Temperature inversions, also called thermal inversions, describe areas where the normal decrease in air temperature with increasing altitude is reversed, and air at higher altitudes is warmer than the air below it. Inversion layers can range from less than 100 feet to over thousands of feet in thickness. Thermal inversions limit the vertical dispersion of air pollutants, and can trap pollutants close to the ground. These inversions occur most often when a warmer, less dense air mass flows over a colder, denser air mass close to the ground. The highest air pollutant concentrations in the Bay Area generally occur during such inversions, of which there are two types: 1) subsidence inversions – a regional phenomenon that is most common in the Bay Area during summer and fall, when descending warmer air from the subtropical high pressure cell centered over the Pacific Ocean caps the cooler marine air layer closer to the surface; and 2) radiation inversions – which are more localized and more typical of winter nights in interior parts of the Bay Area where air in contact with the ground cools more rapidly than the air layer above it.

2.1.2.2 Topography and Its Effect on Wind Speeds and Patterns

Low wind speed conditions limit horizontal air dispersion, and can result in the buildup of air pollutant concentrations. Poor air quality under low wind speed conditions can be especially pronounced in interior valleys, where the topography also contributes to the restriction of air movement and pollutant dispersion.

2.1.2.3 Solar Radiation and Its Impact on Photochemical Pollutants

The higher intensity and longer duration of solar radiation during the Bay Area's summer months provide ultraviolet light and warm temperatures that promote the formation of secondary photochemical pollutants (e.g., ozone [O_3]). Because sunlight intensity and summer temperatures are much higher in many of the Bay Area's inland valleys than near the coast, these inland areas are especially prone to photochemical air pollution.

As a consequence of these factors, the parts of the Bay Area with the highest air pollution potential tend to be the inland areas, which experience higher temperatures in the summer and lower temperatures in the winter, and which are sheltered from the higher winds and more frequent fog episodes that affect the coastal areas. Also, because air pollutant levels depend on the amount of pollutants emitted locally or from upwind sources, ambient levels in inland areas are higher because they are subject to emissions transported by the prevailing winds from populous upwind areas.

2.1.2.4 Climate Subregion for Stanford

The peninsula region extends from northwest of San Jose to the Golden Gate. The Santa Cruz Mountains run up the center of the peninsula, with elevations exceeding 2,000 feet at the southern end and decreasing to 500 feet in South San Francisco. Coastal towns experience a high incidence of cool, foggy weather in the summer. Cities in the southeastern peninsula experience warmer temperatures and fewer foggy days because the marine layer is blocked by the ridgeline to the west. San Francisco lies at the northern end of the peninsula. Because most of San Francisco's topography is below 200 feet, marine air is able to flow easily across most of the city, making its climate cool and windy.

The blocking effect of the Santa Cruz Mountains results in variations in maximum summertime temperatures in different parts of the peninsula. For example, in coastal areas and San Francisco, the mean maximum summer temperatures are in the mid-60's, while in Palo Alto the mean maximum summer temperatures are in the high 70's and low-80's. Mean

minimum temperatures during the winter months in Palo Alto are in the high-30's to low-40's, whereas on the coast, minimum temperatures are in the low 40's.

Two important gaps in the Santa Cruz Mountains occur on the peninsula. The larger of the two is the San Bruno Gap, extending from Fort Funston on the ocean to the San Francisco Airport. Because the gap is oriented in the same northwest to southeast direction as the prevailing winds, and because the elevations along the gap are less than 200 feet, marine air is easily able to penetrate into the Bay. The other gap is the Crystal Springs Gap, between Half Moon Bay and San Carlos. As the sea breeze strengthens on summer afternoons, the gap permits maritime air to pass across the mountains, and its cooling effect is commonly seen from San Mateo to Redwood City.

Annual average wind speeds range from 5 to 10 mph throughout the peninsula, with higher wind speeds usually found along the coast. Winds on the eastern side of the peninsula are often high in certain areas, such as near the San Bruno Gap and the Crystal Springs Gap.

The prevailing winds along the peninsula's coast are from the west, although individual sites can show significant differences. For example, Fort Funston in western San Francisco shows a southwest wind pattern while Pillar Point in San Mateo County shows a northwest wind pattern. On the east side of the mountains, winds are generally from the west, although wind patterns in this area are often influenced greatly by local topographic features.

Air pollution potential is highest along the southeastern portion of the peninsula. This is the area most protected from the high winds and fog of the marine layer. Pollutant transport from upwind sites is common. In the southeastern portion of the peninsula, air pollutant emissions are relatively high due to motor vehicle traffic as well as stationary sources. At the northern end of the peninsula in San Francisco, pollutant emissions are high, especially from motor vehicle congestion. Localized pollutants, such as carbon monoxide, can build up in "urban canyons." Winds are generally fast enough to carry the pollutants away before they can accumulate.

2.1.3 Existing Regional and Local Air Quality

Regional air quality is tracked for purposes of monitoring and either maintaining or achieving compliance with applicable air quality laws and regulations.

The legal framework for regulating air emissions is divided into two general categories of pollutants, and then further divided based on the nature of the activity or "source" of air pollution. The first category of pollutants is "criteria air pollutants" (CAPs), for which ambient air quality standards based on the protection of public health have been established under State and federal law. The criteria air pollutant standards, the types of sources that emit criteria air pollutants, and the region's status in complying with these standards are described in the next section.

The second category of pollutants is "toxic air contaminants" (TACs), which comprise a wide variety of compounds determined to pose an actual or potential risk to public health, either by increasing cancer risks or increasing other health risks such as respiratory diseases like asthma.

2.1.3.1 Criteria Air Pollutants

Federal and State air quality laws identify CAPs as particulate matter (PM), ground-level O_3, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_X), and lead (Pb). Additional details regarding the federal and State regulations pertaining to CAPs is in Section 2.2.

Bay Area Criteria Air Pollutant Attainment Status

Attainment of ambient air quality standards is demonstrated with mandatory monitoring of regional air quality. BAAQMD operates a regional monitoring network that measures the ambient concentrations of six criteria air pollutants. The major pollutants of concern in the San Francisco Bay Area are O_3, PM less than 10 µm in diameter (PM_{10}), PM less than 2.5 µm in diameter ($PM_{2.5}$), CO, NO_X, and sulfur oxide (SO_X). Within Santa Clara County, the BAAQMD operates or receives criteria air pollutant data from a number of local monitoring stations. The monitoring stations and the pollutants measured are described in **Table 2-1-1** below.

Based on this monitoring data, the Bay Area Basin is currently designated as an air quality attainment area under federal National Ambient Air Quality Standards (NAAQS) for all pollutants except for O_3 (for which the region is designated as a marginal nonattainment area) and CO (for which the region is designated as a moderate maintenance area).[2,3] Under the California State standards, the region is a nonattainment area for O_3, PM_{10}, and $PM_{2.5}$; and as an attainment area for all other pollutants.

Table 2-1-1 BAAQMD Criteria Pollutant Monitoring Stations Operating in Santa Clara County

Santa Clara County Monitoring Station	Criteria Pollutants Monitored	Operation Schedule
Gilroy	O_3, $PM_{2.5}$	Continuous
Los Gatos	O_3	Continuous
Redwood City	O_3, $PM_{2.5}$, CO, NO_X	Continuous
Reid-Hillview Airport	Lead	1 in 6 days
Palo Alto Airport	Lead	Closed December 19, 2014
San Jose – Knox (near road)	$PM_{2.5}$, CO, NO_X	Continuous
San Martin	O_3	Continuous
San Jose – Jackson	O_3, $PM_{2.5}$, PM_{10}, CO, NO_X, SO_2, Lead	O_3, $PM_{2.5}$, CO, NO_2, SO_2: Continuous, PM_{10}: 1 in 3 days, Lead: 1 in 6 days

Note:
Operating schedule based on 2015 Air Monitoring Network Plan information.

Source:
BAAQMD. 2015.[4]

Of the six criteria air pollutants, O_3 is the only one that is not emitted directly to the air from emission sources. Instead, ground-level O_3 is formed from a chemical reaction between NO_X

[2] USEPA. 2016. Green Book Nonattainment Areas. Criteria Pollutant Nonattainment Summary Report. June. 2016. Available online at: https://www3.epa.gov/airquality/greenbook/ancl3.html#Notes

[3] As of September 27, 2010 all carbon monoxide nonattainment areas have been redesignated as "maintenance" areas.

[4] BAAQMD. 2016. 2015 Air Monitoring Network Plan. July. 2016. Available online at: http://www.baaqmd.gov/~/media/files/technical-services/2015_network_plan-pdf.pdf?la=en

and volatile organic compounds (VOCs), often referred to as precursors, in the presence of sunlight. NO_X collectively refers to two oxides of nitrogen, namely nitric oxide (NO) and nitrogen dioxide (NO_2). VOCs refer to a general class of carbon-containing compounds that exhibit photochemical reactivity (i.e., can undergo a chemical reaction in air and in the presence of sunlight). Different regulatory agencies (i.e., United States Environmental Protection Agency [USEPA], California Air Resources Board [ARB] and BAAQMD) have established different nomenclature and definitions for photochemically reactive organic compounds (i.e., VOCs, reactive organic compounds [ROGs], and precursor organic compounds). However, these definitions are very similar and generally include the same organic compounds, with only minor differences in specific chemicals that are excluded (i.e., exhibit negligible photoreactivity, as determined by the specific regulatory agency). Although not defined by photoreactivity, total hydrocarbons is another term that is used by the USEPA to denote airborne organic compounds.

2.1.3.2 Monitoring Data

As mentioned above, ambient concentrations of pollutants are determined by regional pollutant emissions, pollutant emissions in a given area, and wind patterns and meteorological conditions for that area. As a result, ambient concentrations can vary among different locations within an area. The closest and most representative monitoring station locations to Stanford are the Redwood City and San Jose – Jackson monitors. The Redwood City monitor is sited closer to the Project, but does not gather data for all CAPs. The San Jose monitor has data for all CAPs and can be used to supplement the Redwood City data.

Table 2-1-2 shows a 5-year (2011-2015) summary of maximum concentration monitoring data collected from the Redwood City (O_3, $PM_{2.5}$, CO, NO_2) and San Jose - Jackson (PM_{10}, SO_2) stations, along with the number of exceedances of state and national Ambient Air Quality Standards (AAQS). The monitoring data show that O_3, PM_{10}, and $PM_{2.5}$ periodically exceeded the AAQS during this period.

Table 2-1-2 Summary of Ambient Air Quality in the Project Vicinity

Air Pollutants Monitored at San Mateo County Monitoring Station – Redwood City and Santa Clara County Monitoring Station – San Jose - Jackson	Year				
	2011	2012	2013	2014	2015
Ozone (Redwood City)					
Maximum 1-hour concentration measured	0.076 ppm	0.063 ppm	0.083 ppm	0.086 ppm	0.086 ppm
Days exceeding State 0.09 ppm 1-hour standard	0	0	0	0	0
Maximum 8-hour concentration measured	0.061 ppm	0.054 ppm	0.075 ppm	0.065 ppm	0.071 ppm
Days exceeding national 0.075 ppm 8-hour standard	0	0	0	0	1[a]
Days exceeding State 0.07 ppm 8-hour standard	0	0	1	0	1
Fine Particulate Matter ($PM_{2.5}$) (Redwood City)					

Table 2-1-2 Summary of Ambient Air Quality in the Project Vicinity

Air Pollutants Monitored at San Mateo County Monitoring Station – Redwood City and Santa Clara County Monitoring Station – San Jose - Jackson	Year				
	2011	2012	2013	2014	2015
Maximum 24-hour concentration measured	39.7 µg/m^3	33.3 µg/m^3	39.0 µg/m^3	35.0 µg/m^3	34.6 µg/m^3
No. of days exceeding national 35 µg/m^3 24-hour standard	1	0	3	0	0
Annual average concentration	8.7 µg/m^3	8.5 µg/m^3	10.7 µg/m^3	7.1 µg/m^3	5.7 µg/m^3
Exceeds State 12 µg/m^3 annual standard?	No	No	No	No	No
Carbon Monoxide (CO) (Redwood City)					
Maximum 8-hour concentration measured	1.7 ppm	1.8 ppm	1.6 ppm	1.6 ppm	1.6 ppm
Number of days exceeding national and State 9.0 ppm 8-hour standard	0	0	0	0	0
Nitrogen Dioxide (NO_2) (Redwood City)					
Maximum 1-hour concentration measured	0.056 ppm	0.060 ppm	0.054 ppm	0.055 ppm	0.048 ppm
Days exceeding State 0.18 ppm 1-hour standard	0	0	0	0	0
Respirable Particulate Matter (PM_{10}) (San Jose)					
Maximum 24-hour concentration measured (national)[b]	44 µg/m^3	60 µg/m^3	58 µg/m^3	55 µg/m^3	58 µg/m^3
No. of days exceeding national 150 µg/m^3 24-hour standard [b]	0	0	0	0	0
Days exceeding State 50 µg/m^3 24-hour standard [b]	0	1	5	1	1
Annual average concentration	19.2 µg/m^3	18.8 µg/m^3	22.3 µg/m^3	19.9 µg/m^3	22.0 µg/m^3
Exceeds State 20 µg/m^3 annual standard?	No	No	Yes	No	Yes
Sulfur Dioxide (SO_2) (San Jose)					
Maximum 1-hour concentration measured [b]	0.0072 ppm	0.0079 ppm	0.0025 ppm	0.0030 ppm	0.0031 ppm
Maximum 24-hour concentration measured [b]	0.0024 ppm	0.0028 ppm	0.0014 ppm	0.0009 ppm	0.0011 ppm
Days exceeding national 0.075 ppm 1-hr standard [b]	0	0	0	0	0

Table 2-1-2 Summary of Ambient Air Quality in the Project Vicinity

Air Pollutants Monitored at San Mateo County Monitoring Station – Redwood City and Santa Clara County Monitoring Station – San Jose - Jackson	Year				
	2011	2012	2013	2014	2015
Days exceeding State 0.04 ppm 24-hour standard [b]	0	0	0	0	0

Notes:
[a.] The national 8-hour standard for ozone was lowered from 0.075 ppm to 0.070 ppm on December 28, 2015.
[b.] PM_{10} monitoring was discontinued on June 30, 2008 at Redwood City and is not available. Redwood City does not monitor SO2. PM10 and SO2 summaries were gathered from the San Jose monitoring station.
Abbreviations:
ppm = parts per million of air by volume
$\mu g/m^3$ = micrograms per cubic meter

Source:

BAAQMD annual air quality summaries, http://www.baaqmd.gov/about-air-quality/air-quality-summaries, 2016.

Criteria Pollutant Emissions—Santa Clara County

Table 2-1-3 summarizes the emissions inventory for CAPs within Santa Clara County and within the entire Bay Area Basin for various source categories. According to Santa Clara County's 2015 emissions inventory, total mobile sources (on-road and off-road) are the largest contributor to the estimated annual average air pollutant levels of ROG, CO, and NO_X, accounting for approximately 49%, 87%, and 74%, respectively, of the total inventory.

Area-wide sources (e.g., solvent evaporation from equipment cleaning operations; on-site fuel combustion for space and water heating (e.g., hot water heaters); and landscape maintenance equipment such as lawnmowers and leaf blowers) account for approximately 81% of Santa Clara County's PM_{10} emissions and 73% of the County's $PM_{2.5}$ emissions.[5]

Although mobile source emissions constitute the majority of the 2015 criteria air pollutant inventory both statewide and in Santa Clara County, emissions from this source category have decreased greatly since the 1970s due to more stringent federal and state emission controls on mobile sources and fuels. Examples of vehicle emissions standards include ARB's low-emission vehicle standards, ARB's heavy-duty engine standards, and USEPA's corporate average fuel economy standards for passenger cars and light duty trucks. Examples of cleaner fuel standards include the elimination of lead from gasoline, and lowering of sulfur content in fuels.[6]

[5] ARB. 2013. Almanac Emission Projection Data. Accessed June 30, 2016. Available online at: http://www.arb.ca.gov/app/emsinv/2013/emssumcat.php

[6] USEPA. 2016. Gasoline Standards. Accessed June 30, 2016. https://www.epa.gov/gasoline-standards.

Table 2-1-3 2015 Estimated Criteria Pollutant Emissions Inventories by Source (County and Air Basin) (Tons/Day Based on Annual Average)

Source	ROG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$
Santa Clara County [tons/day]						
Mobile	28.2	247.6	43.0	0.3	3.6	2.0
Stationary	12.9	8.7	11.3	2.7	1.4	0.6
Area	17.5	27.3	3.8	0.1	21.0	6.9
Total	**58.6**	**283.6**	**58.1**	**3.1**	**26.0**	**9.5**
San Francisco Bay Area Air Basin [tons/day]						
Mobile	103.3	946.6	215.6	2.3	16.0	9.4
Stationary	61.1	32.6	39.6	20.8	6.3	2.9
Area	71.6	128.4	16.4	0.5	96.5	31.7
Total	**236.0**	**1107.6**	**271.6**	**23.6**	**118.8**	**44.0**

Notes:
ROG = reactive organic gases; CO = carbon monoxide; NO_X = oxides of nitrogen; SO_X = oxides of sulfur; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter.
Totals in table may not add exactly because of rounding.

Source:
ARB. 2013.

Criteria pollutant emissions from mobile sources are projected to continue decreasing with vehicle fleet turnover to newer, cleaner models. However, while emissions from gasoline- and diesel-fueled mobile sources are both decreasing, a greater reduction in emissions from gasoline-fueled vehicles relative to diesel-fueled vehicles has resulted in an increase in the relative contribution of diesel sources to CAP from mobile sources. As a result, current regulatory development is focusing on reducing emissions from diesel vehicles.

Criteria Pollutant Emissions Sources in Palo Alto and Surrounding Areas

Local CAP sources (in Menlo Park, Palo Alto, and Mountain View) include industrial activity, a landfill and a water treatment plant in the vicinity of Stanford, as well as vehicle emissions from nearby roadways, including US Route 101 and Interstate 280. **Table 2-1-4** below summarizes estimated 2011 emissions from point sources at major facilities surrounding Stanford. This year represents information that is readily available to the public. None of these facilities are within 1,000 feet of the study area and would not be expected to be included in a cumulative emissions assessment.

Table 2-1-4 Summary of 2011 Criteria Air Pollutant Emissions for Major Facilities Emitting 0.01 Tons/Day or More of Criteria Air Pollutants (CAPs) in Project Vicinity (Tons/Year)

Plant Number	Plant Name	PM_{10}	$PM_{2.5}$	ROG	NO_X	SO_2	CO
11668	Gas Recovery Systems, Inc.	--	--	--	32.85	--	7.3
3011	IPT SRI Cogeneration Inc.	--	--	7.3	18.25	--	25.55
2740	City of Mountain View (Shoreline Landfill)	3.65	3.65	18.25	18.25	3.65	47.45
15982	Google Inc.	--	--	3.65	7.3	--	25.55
617	Palo Alto Regional Water Quality	--	--	3.65	21.9	--	--

Note:
BAAQMD facilities emissions data was presented in tons/day. Conversion assumed 365 days in a year.

Source:
Bay Area Emissions Inventory Summary Report: Criteria Air Pollutants, 2011

2.1.3.3 Toxic Air Contaminants

This section presents ambient air toxics monitoring data for the Stanford vicinity, as well as information regarding regional, local, and Facility emissions.

TAC Chemicals and Their Sources

Table 2-1-5 presents source and health effect information for the ten TACs posing the greatest known health risks in California, based on ambient air quality data.

Ambient air monitoring data for TACs near Stanford are measured at multiple locations throughout Northern California and the Bay Area. The closest monitoring stations are located at San Francisco-Arkansas Street, San Jose-4th Street, and San Jose-Jackson Street, approximately 35 miles north (San Francisco station) and 20 miles southeast of Stanford (San Jose stations). The facilities monitor approximately 30 volatile organic compounds and 35 metals, including the ten TACs listed below in **Table 2-1-5**.

TAC Emission Sources in Stanford Vicinity

Major local TAC sources include industrial activity in the vicinity of Stanford, landfills, technology companies in Silicon Valley, and emissions from cars, trucks and trains using the area's highway, parkway, and rail transportation network. Similar to CAP emissions, TAC emissions result from the operation of factories and other "stationary" facilities, as well as "mobile sources" such as passenger automobiles and light-duty trucks; other mobile equipment such as portable diesel generators; ships and harbor craft such as tugboats; cargo handling equipment, heavy duty trucks, and other construction equipment; and rail locomotives.

Table 2-1-5 Summary of Sources and Health Effects of 10 TACs That Pose Highest Cancer Risk and Diesel PM in California

TAC	Sources	Example Non-Cancer Chronic and Acute Effects
Acetaldehyde	Mobile engine exhaust Agricultural burning and wildfires Stationary source fuel combustion	Eye, skin, respiratory tract irritation
Benzene	Fugitive emissions from gasoline Gasoline engine exhaust Crude oil and natural gas mining Petroleum refining Industrial sources Residential fuel combustion Natural petroleum seeps	Reduced blood cell production Central nervous system effects Headache, dizziness, nausea
1,3-Butadiene	Mobile engine exhaust (incomplete combustion) Boilers, heaters, and internal combustion engines exhaust Agricultural waste burning Residential wood burning Oil/gas extraction Petroleum refining, synthetic material manufacturing	Neurological effects Eye, mucous membrane irritation
Carbon Tetrachloride	Chemical product manufacturing Petroleum refining Pesticide and grain fumigant usage	Central nervous system effects Liver and kidney damage
Hexavalent Chromium	Industrial uses: corrosion inhibitor in cooling towers, chrome plating, glass furnace firebrick lining Gasoline motor vehicles Oil and coal combustion	Gastrointestinal hemorrhaging Respiratory irritation and skin reactions
Ethylbenzene	Manufacture of styrene Cleaning products, paints, and other chemicals produced using Ethylbenzene	Respiratory effects Irritation of the eyes Neurological effects
Formaldehyde	Motor vehicle exhaust (complete combustion) Oil refineries emissions	Respiratory symptoms Eye, nose, throat irritation
Methylene Chloride	Plastic product and synthetics manufacturing Aircraft and parts manufacturing	Bone marrow, liver, kidney effects Central nervous system effects

Table 2-1-5 Summary of Sources and Health Effects of 10 TACs That Pose Highest Cancer Risk and Diesel PM in California

TAC	Sources	Example Non-Cancer Chronic and Acute Effects
	Paint stripping operations	
Chloroform	Manufacture of refrigerants and pharmaceuticals Chemical production Chlorination of water	Nervous system effects Liver and kidney damage
Perchloroethylene	Dry cleaning operations Fabricated metal product manufacturing Consumer products (e.g. brake cleaners, tire sealants)	Liver toxicity Kidney dysfunction Neurological effects Skin and eye irritation
Diesel Particulate Matter	Diesel fuel combustion	Reduced lung function Cardio and respiratory disease

Note:
All compounds in this list have been identified as carcinogens by the State of California.

Sources:
Toxic Air Contaminant Identification Reports, CARB, 2010

Facilities in the Stanford vicinity (Palo Alto, Mountain View, Atherton and Menlo Park) emit TACs in addition to those emitted at Stanford. Typical emitters of TACs in the region include large office buildings with emergency generators, data farms with emergency generators, research companies and institutions, water quality plants, gasoline fuel stations, and small manufacturing operations.

2.1.3.4 Sensitive Receptors

For the purposes of air quality, public health, and noise analyses, sensitive receptors are generally defined as land uses with population concentrations that would be particularly susceptible to disturbance from dust, noise, vibration, air pollutant concentrations, or other disruptions associated with project construction and/or operation. These location types generally include schools, day care centers, libraries, hospitals, residential care centers, parks, churches, and residents. Some receptors are considered more sensitive than others to air pollutants. The reasons for greater than average sensitivity include pre-existing health problems, proximity to emissions sources, or duration of exposure to air pollutants. Schools, hospitals, and convalescent homes are considered to be relatively sensitive to poor air quality because children, elderly people, and the infirm are more susceptible to respiratory distress and other air quality-related health problems than the general public. Residential areas are considered sensitive to poor air quality because people usually stay home for extended periods of time, which is associated with longer exposure to ambient air. Recreational uses are also considered sensitive due to the greater exposure to ambient air because vigorous exercise places a high demand on the human respiratory system. There are a number of different types of sensitive receptors located within one mile of Stanford, including community clinics, elementary schools, and assisted living centers, as shown in

Figure 2-1. Residential areas where children may live are also in the vicinity of Stanford and constitute additional sensitive receptors.

2.2 Regulatory Overview

2.2.1 Regulation of Criteria Air Pollutants

2.2.1.1 Federal and State Ambient Air Quality Standards

The Federal Clean Air Act (FCAA) required the USEPA to establish NAAQS, which set limits on pollutants in ambient air to protect public health and welfare. In response, the USEPA established both primary and secondary standards for six pollutants (called "criteria" pollutants), which come from numerous and diverse sources. These six criteria pollutants are: O_3; CO; NO_2; SO_2; Pb; and PM—including PM_{10} and $PM_{2.5}$. Primary standards are designed to protect human health including the health of "sensitive" populations, such as those with asthma, children and the elderly. Secondary standards are designed to protect property and public welfare, including protection against visibility impairment and damage to animals, crops, vegetation, and buildings, from air pollutants in the atmosphere. **Table 2-2-1**, includes a summary of the sources and health effects of the various criteria pollutants.

The FCAA allows states to adopt ambient air quality standards and other regulations, provided that they are at least as stringent as federal standards. ARB has established the more stringent California Ambient Air Quality Standards (CAAQS) for the six criteria pollutants through the California Clean Air Act of 1988 (CCAA), and also has established CAAQS for additional pollutants, including sulfates, hydrogen sulfide, vinyl chloride and visibility-reducing particles.

Table 2-2-1 Criteria Pollutants, Their Precursors, Sources, and Related Health Effects

Pollutant	Sources and Health Effects
$PM_{2.5}$ and PM_{10}	PM_{10} and $PM_{2.5}$ pose a serious health hazard, individually or in combination with other pollutants. More than half of the smallest particles inhaled get deposited in the lungs and can cause permanent lung damage. Respirable particles have been found to increase morbidity and mortality via the following adverse health effects: decreased lung function, aggravated asthma, exacerbation of lung and heart disease symptoms, chronic bronchitis and irregular heartbeat. In addition, respirable particles can act as a carrier of absorbed toxic substances. Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, fuel combustion, and atmospheric photochemical reactions. Some sources of PM, such as demolition and construction activities, are local in nature, while others, such as vehicular traffic, have a more regional effect. Very small particles of certain substances (e.g., sulfates and nitrates) can cause lung damage directly, or can contain adsorbed gases (e.g., chlorides or ammonium) that may be injurious to health. Particulates also can damage materials and reduce visibility. In addition to directly emitted particulates, NO_X and SO_X are precursors of $PM_{2.5}$ and PM_{10}.

Table 2-2-1 Criteria Pollutants, Their Precursors, Sources, and Related Health Effects

Pollutant	Sources and Health Effects
Ozone (O_3)	Ozone is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving VOCs and NO_X. Because VOC and NO_X in the atmosphere can cause O_3, these chemicals are known as precursor compounds for O_3. Significant O_3 production generally requires O_3 precursors to be present in a stable atmosphere with strong sunlight for approximately 3 hours. Ozone concentrations tend to be higher in the late spring, summer, and fall, when the long sunny days combine with regional subsidence inversions to create conditions favorable to the formation and accumulation of secondary photochemical compounds, like O_3. Elevated O_3 concentrations have been shown to induce airway irritation and inflammation, result in wheezing and difficulty breathing, aggravate pre-existing respiratory conditions such as asthma, and may lead to permanent lung damage after repeated exposure to elevated concentrations.
Carbon Monoxide (CO)	Carbon monoxide is a colorless and odorless gas that is known to cause aggravation of various aspects of coronary heart disease, dizziness, fatigue, impairment to central nervous system functions, and possible increased risk to fetuses. CO is a non-reactive pollutant that is a product of incomplete combustion, and is mostly associated with motor vehicle traffic. High CO concentrations develop primarily during the winter when periods of light winds combine with the formation of ground level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates in cold weather.
Sulfur Dioxide (SO_2)	Sulfur dioxide is known to cause irritation of the respiratory tract, shortness of breath, and can injure lung tissue when combined with fine PM. SO_2 is a combustion product of sulfur or sulfur-containing fuels such as coal, which are restricted in the Bay Area. SO_2 is also a precursor to the formation of atmospheric sulfate and PM (PM_{10} and $PM_{2.5}$), and contributes to potential atmospheric sulfuric acid formation that could become acid rain downwind.
Lead (Pb)	Lead has a range of adverse neurotoxin health effects, and was formerly widely released into the atmosphere primarily via leaded gasoline. Other sources of lead include Pb smelters, and Pb battery manufacturing. The phase-out of leaded gasoline in California resulted in decreasing levels of atmospheric lead.

Table 2-2-1 Criteria Pollutants, Their Precursors, Sources, and Related Health Effects

Pollutant	Sources and Health Effects
Nitrogen Dioxide (NO_2)	Nitrogen dioxide is a reddish-brown gas that is a by-product of combustion processes. Automobiles and industrial operations are the main sources of NO_2. NO_2 may be visible as a coloring component of a brown cloud on high pollution days, especially in conjunction with high O_3 levels. Long-term exposure to NO_2 has the potential to decrease lung function, and worsen chronic respiratory symptoms and diseases in sensitive populations. It has also been associated with cardiopulmonary mortality and emergency room asthma visits.

Abbreviations:
NO_x = oxides of nitrogen
SO_x = oxides of sulfur
VOC = volatile organic compound
Sources:
USEPA. Criteria Air Pollutants, 2016, 2015a

ARB and USEPA designate an area's attainment status with respect to the CAAQS and NAAQS, respectively. The purpose of these designations is to identify areas with air quality problems and thereby initiate planning efforts for improvement. The three basic designation categories are "nonattainment," "attainment," and "unclassified." The "unclassified" designation is used in an area that cannot be classified on the basis of available information as meeting or not meeting the standards.

Table 2-2-2 includes the NAAQS and CAAQS currently in effect for each of the criteria pollutants, and the most recent attainment designations with respect to the Bay Area Basin.

Table 2-2-2 Ambient Air Quality Standards

Pollutant	Avg. Period	California Standard	Federal Standard	Bay Area Basin Attainment Status Under California Standard	Bay Area Basin Attainment Status Under Federal Standard
Ozone (O_3)	1-hour	0.09 ppm (180 µg/m^3)	Revoked	Nonattainment	--
	8-hour[a]	0.070 ppm (137 µg/m^3)	0.070 ppm (137 µg/m^3)	Nonattainment	Marginal Nonattainment
Respirable Particulate Matter (PM_{10})	24-hour	50 µg/m^3	150 µg/m^3	Nonattainment	Unclassified
	Annual	20 µg/m^3	Revoked	Nonattainment	--
Fine Particulate	24-hour	--	35 µg/m^3	--	Nonattainment

Table 2-2-2 Ambient Air Quality Standards

Pollutant	Avg. Period	California Standard	Federal Standard	Bay Area Basin Attainment Status Under California Standard	Bay Area Basin Attainment Status Under Federal Standard
Matter ($PM_{2.5}$)	Annual[b]	12 µg/m^3	12 µg/m^3	Nonattainment	Unclassifiable/ attainment
Carbon Monoxide (CO)	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	Attainment	Attainment
	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	Attainment	Attainment
Nitrogen Dioxide (NO_2)	1-hour[c]	0.18 ppm (339 µg/m^3)	0.100 ppm (188 µg/m^3)	Attainment	Unclassified
	Annual	0.030 ppm (57 µg/m^3)	0.053 ppm (101 µg/m^3)	--	Attainment
Lead	Rolling 3-Mo. Average	--	0.15 µg/m^3	--	Attainment
	Calendar Quarter	--	1.5 µg/m^3	--	Attainment
	30-Day Average	1.5 µg/m^3		Attainment	--
Sulfur Dioxide (SO_2)[e]	1-hour	0.25 ppm (655 µg/m^3)	0.075 ppm (196 µg/m^3)	Attainment	Attainment
	3-hour[f]	--	0.5 ppm (1310 µg/m^3)	--	Attainment
	24-hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3)	Attainment	Attainment
	Annual Arithmetic Mean	--	0.030 ppm (80 µg/m^3)	--	Attainment
Hydrogen Sulfide (H_2S)	1-hour	0.03 ppm (42 µg/m^3)	--	Unclassified	--
Vinyl Chloride	24-hour	0.01 ppm (26 µg/m^3)	--	--	--
Sulfates	24-hour	25 µg/m^3	--	Attainment	--

Table 2-2-2 Ambient Air Quality Standards

Pollutant	Avg. Period	California Standard	Federal Standard	Bay Area Basin Attainment Status Under California Standard	Bay Area Basin Attainment Status Under Federal Standard
Visibility-Reducing Particles	8-hour	Extinction coefficient of 0.23 per kilometer (visibility of less than10 miles due to particles when relative humidity is less than 70%)	--	Unclassified	--

Notes:
[a] On October 1, 2015, the 8-hour national O_3 standard was lowered from 0.075 ppm to 0.07 ppm. This standard is expressed as the annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
[b] The USEPA revised the primary standard on December 14, 2012 from 15 µg/m^3 to 12 µg/m^3. States are required to submit their area designation recommendations under the revised standard by December 13, 2013. The secondary standard is 15 µg/m^3.
[c] The 1-hour national standard for NO_2 was promulgated on January 22, 2010. To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.100 ppm.
[d] The national standard for Pb was revised on October 15, 2008 to a rolling 3-month average. The 1978 Pb standard (1.5 µg/m^3 as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
[e] On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 0.075 ppm. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved.
[f] This is a secondary standard.
Abbreviations:
ppm = parts per million
µg/m^3 = micrograms per square meter
Sources:
BAAQMD. Air Quality Standards and Attainment Status. 2015

The following sections summarize criteria pollutant-related plans, programs and regulations at the federal, state, regional and local levels that are relevant to the Facility.

2.2.1.2 Air Quality Plans

The FCAA and the CCAA require State Implementation Plans (SIPs) to be developed for areas designated as nonattainment (with the exception of areas designated as nonattainment for the State PM_{10} standard). The SIP must integrate federal, state, and local actions and regulations to identify specific control measures to reduce pollution to attain the NAAQS by the required compliance date. Plans are also required under federal law for areas designated as "maintenance" for national standards. The FCAA Amendments of 1990 added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. Air quality plans usually define control strategies to reduce air pollutant emissions from industrial facilities, commercial processes, motor vehicles, and other sources. Control strategies are typically implemented through a combination of regulations adopted and enforced by the air district, grant and incentive programs, public education and outreach, and partnerships with other agencies and stakeholders.

The responsibility for developing plans and programs for each air basin has been delegated to the regional air district responsible for attaining and maintaining air quality standards in that air basin. ARB is the agency responsible for developing the SIP in California. The SIP is periodically modified to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their regional air districts. The USEPA has responsibility to review all state SIPs to determine conformation to the mandates of the FCAA Amendments, and to determine if implementation will achieve air quality goals. If the USEPA determines a SIP to be inadequate, a Federal Implementation Plan may be prepared for the nonattainment area that imposes additional control measures. Failure to submit an approvable SIP or to implement the plan within the mandated timeframe may result in sanctions being applied to transportation funding and stationary air pollution sources in the air basin.

Currently, there are three plans for the Bay Area:

- Ozone Attainment Plan for the 1-Hour National Ozone Standard (2001), which was developed to meet federal O_3 air quality planning requirements.[7] BAAQMD prepares O_3 attainment plans for the national O_3 standard, and clean air plans for the California standard, both in coordination with the Metropolitan Transportation Commission (MTC) and Association of Bay Area Governments (ABAG). The most recent O_3 attainment plan was submitted in 2001 and was approved by the USEPA in 2004. The USEPA determined that the Bay Area Basin had attained the national 1-hour O_3 standard; this standard has since been replaced by an 8-hour standard.
- Bay Area 2005 Ozone Strategy, adopted by the BAAQMD in cooperation with the MTC and ABAG, reviews the region's progress over the years in reducing O_3 levels; describes current conditions and charts a course for future actions to further reduce O_3 and O_3 precursor levels in

[7] Association of Bay Area Governments (ABAG), 2001. Revised San Francisco Bay Area 2001 Ozone Attainment Plan Staff Report. Accessed July 20, 2016. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Plans/2001%20Ozone%20Attainment%20Plan/staff_report_2001.ashx

the Bay Area and achieve compliance with the State 1-hour O_3 Standard.[8] The control strategy includes stationary source measures, mobile source measures and transportation control measures.

- Clean Air Plan (2010), which serves to update the 2005 Bay Area Ozone Strategy and also provides an integrated, multi-pollutant strategy to improve air quality, protect public health, and protect the climate.[9]

With respect to applicable air quality plans, BAAQMD prepared the 2010 Clean Air Plan to address nonattainment of the national 8-hour O_3 standard and nonattainment of the CAAQS in the Bay Area Basin. The purpose of the 2010 Clean Air Plan is to:

- Update the Bay Area 2005 Ozone Strategy in accordance with the requirements of the CCAA to implement all feasible measures to reduce O_3;
- Consider the impacts of O_3 control measures on PM, air toxics, and greenhouse gases (GHGs) in a single, integrated plan;
- Review progress in improving air quality in recent years; and
- Establish emission control measures to be adopted or implemented in the 2009-2012 timeframe.

The Clean Air Plan describes current conditions, reviews the progress in reducing Bay Area Basin O_3 levels to attain State 1-hour and 8-hour O_3 standards, and describes how the proposed control strategy for the Bay Area Basin will fulfill the CCAA planning requirements for the State 1-hour O_3 standard and mitigation requirements for transport of O_3 and O_3 precursors to neighboring air basins. The control strategies include stationary source control measures to be implemented through BAAQMD regulations; mobile source control measures to be implemented through incentive programs and other activities; and transportation control measures to be implemented through programs in cooperation with the MTC, local governments, transit agencies, and others.

The 2010 Clean Air Plan is currently being updated by the BAAQMD. In partnership with the ABAG, MTC, and the Bay Conservation and Development Commission, the BAAQMD is preparing the 2016 Clean Air Plan/Regional Climate Protection Strategy. Drafts of the 2016 Plan and Environmental Impact Report were released in July 2016, and a proposed final draft of the 2016 Plan and Environmental Impact Report are scheduled to be released in November 2016. The 2016 Plan is an integrated multi-pollutant plan that aims to reduce air pollution from a variety of stationary and mobile sources located in the Bay Area Basin. The 2016 Plan is required by the CCAA to identify control measures and strategies for the BAAQMD to implement in order to meet state ambient air quality standards for O_3. Furthermore, the 2016 Plan will encompass measures and programs to reduce particulate matter and toxic air contaminant emissions, as well as include the Bay Area's first Regional

[8] BAAQMD. 2006. Bay Area 2005 Ozone Strategy. Accessed July 20, 2016.
www.baaqmd.gov/~/media/.../2005%20Ozone%20Strategy/adoptedfinal_vol1.ashx
www.baaqmd.gov/~/media/files/communications-and.../adoptedfinal_vol2.pdf

[9] BAAQMD. 2010. Bay Area Clean Air Plan, Volumes I and II. Accessed July 20, 2016.
http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2010-clean-air-plan/cap-volume-i-appendices.pdf?la=en
http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/Plans/2010%20Clean%20Air%20Plan/CAP%20Volume%20II_Sections%20A-F.ashx

Climate Protection Strategy, which will identify control measures and strategies for the Air District to reduce GHG emissions in the Bay Area.

The draft control measures proposed to be included in the 2016 Plan are aimed at protecting public health, fulfilling state air quality attainment requirements, and serving as a regional climate protection strategy through reducing emissions of O_3 precursors, particulate matter, toxic air contaminants, and GHGs. Analyses of the different pollutants will be conducted via an integrated control strategy that will identify co-benefits and disbenefits of the control strategy used for each individual pollutant. There are nine proposed control measures in the 2016 Plan that will supplement existing federal, state, regional, and local regulation, spanning the areas of agriculture, buildings, energy, Natural Working Lands, short-lived climate pollutants, stationary sources, transportation, waste control, and water control.

Title V Operating Permit (40 CFR Part 70)/Synthetic Minor Operating Permit

Title V of the 1990 FCAA Amendments requires all major sources and some minor sources of air pollution to obtain an operating permit. A Title V permit grants a source permission to operate, and includes all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. It also requires that the source report its compliance status with respect to permit conditions to the permitting authority. The applicability threshold for a major source is dependent on whether the area is in attainment or nonattainment, and is based on the potential to emit criteria pollutants. Title V permits are typically issued by state or local agencies, although a small number of permits are issued by the USEPA.[10]

Title V permits in the Bay Area are issued by the BAAQMD. In the Bay Area, Title V requirements are implemented by Regulation 2 Rule 6 of the BAAQMD Rules and Regulations. In the BAAQMD, any source that emits or has the potential to emit 100 tons per year (tons/yr) or more of any CAP, 100,000 tons/yr of GHGs, 10 tons/yr of a single hazardous air pollutant (HAP), or 25 tons/yr of all HAPs combined is a major source and must obtain a Title V operating permit.

A facility that has a potential to emit that exceeds the above applicability thresholds may apply to accept federally enforceable limitations to keep emissions below such levels. Such facilities are called synthetic minor sources. Synthetic minor operating permits (SMOP) are issued by the BAAQMD and are implemented by Regulation 2 Rule 6 of the BAAQMD Rules and Regulations. Stanford applied for a SMOP in 2014 and it is expected to be issued in the near future.

New Source Performance Standards (40 CFR Part 60)

The USEPA promulgated New Source Performance Standards (NSPS) for major and minor sources on a category-by-category basis. NSPS are national emission standards that are progressively tightened over time to achieve a steady rate of air quality improvement without unreasonable economic disruption. The NSPS imposes uniform requirements on new and modified sources based on the best demonstrated technology (BDT). BDT refers to the best system of continuous emissions reduction that has been demonstrated to work in a given industry, considering economic costs and other factors, such as energy use. In other words, any new source of air pollution must install the best control system currently in use

[10] EPA. 2013. Operating Permits Issued under Title V of the Clean Air Act. Accessed July 22, 2016. https://www.epa.gov/title-v-operating-permits

within that industry. The NSPS program is implemented by the BAAQMD. **Table 2-2-3** summarizes NSPS regulations that are applicable to Stanford.

Table 2-2-3 Summary of Subparts under 40 CFR Part 60 (New Source Performance Standards) Listed in the Facility's Title V Operating Permit

40 CFR Part 60 Subpart	Description	Summary
A	General Provisions	Generally applies to any stationary source for which construction or modification is commenced after applicable date. Includes requirements for performance testing; compliance with standards and maintenance; monitoring; modification and reconstruction; general control device and work practice; and notification, recordkeeping and reporting.
Dc	Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units	Generally applies to steam generating units for which construction, modification, or reconstruction commenced after June 9, 1989, and that has a maximum design heat input capacity greater than or equal to 10 MMBTU/hour but less than or equal to 100 MMBTU/hour. Includes SO_2 and PM emission limits, but does not have limits for units fired exclusively on natural gas. Also covers compliance and performance test methods and procedures for SO_2 and PM; emission monitoring requirements for SO_x and PM; and reporting and recordkeeping requirements.
IIII	Standards of Performance for Stationary Compression Ignition Internal Compression Engines	Applies to stationary compression ignition internal compression engines for which construction, modification, or reconstruction commenced after July 11, 2005. Includes emission standards based on model year, maximum engine power, and emergency or non-emergency engine status; fuel requirements; monitoring requirements; compliance requirements; testing requirements; notification, reporting, and recordkeeping requirements; and emission standards for special fuels.

Abbreviations:
MMBTU = million British Thermal Units
VOC = volatile organic compound
gr/dscf = grains per dry standard cubic foot

2.2.1.3 State Programs and Regulations

ARB is the State agency responsible for coordination and oversight of state and local air pollution control programs in California and for implementing the CCAA. The CCAA, which was adopted in 1988, requires that all air districts in the State endeavor to achieve and maintain the CAAQS by the earliest practical date. The CCAA specifies that districts should

focus particular attention on reducing the emissions from transportation and area-wide emission sources, and provides districts with the authority to regulate indirect sources.

ARB is primarily responsible for developing and implementing air pollution control plans to achieve and maintain the NAAQS and produces a major part of the SIP. In addition, ARB is primarily responsible for statewide pollution sources, although local air districts are still relied upon to provide additional strategies for sources under their jurisdiction.

Control of Particulate Matter—Senate Bill 656

ARB and regional air districts are responsible for implementing the provisions of Senate Bill (SB) 656, which seeks to reduce PM_{10} and $PM_{2.5}$ air pollution.[11] As a first step, ARB developed and approved a list of readily available, feasible, and cost-effective control measures based on existing California rules, regulations, and programs for stationary, area-wide, and mobile sources. The regional air districts then identified schedules for implementation of selected measures, prioritizing measures based on the extent of the PM problem in their jurisdiction, as well as based on the cost-effectiveness of the selected measures. Currently, air districts are working on evaluating and adopting rules in their specific implementation schedules. These schedules, along with ARB's other programs, are designed to continue progressing towards reducing the public's exposure to PM and towards attaining the state and federal ambient air quality standards.

CARB Air Toxic Control Measure for Stationary Compression Ignition Engines (17 CCR 93115)

The ARB Air Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines was adopted in 2004 and amended in May 2011, with the goal of reducing criteria pollutant and DPM emissions from diesel-fueled stationary compression ignition engines. The ATCM outlines emission standards, fuel use requirements, and operational hour limitations for prime and emergency back-up engines. The 2011 amendments harmonized many of the ATCM requirements with the 2006 USEPA Standards of Performance for Stationary Compression-Ignition Internal Combustion Engines (NSPS Subpart IIII); however, some ATCM emission standards and other requirements are more stringent than the NSPS.

Regulation of Other Stationary Sources

Other diesel-fueled stationary combustion sources such as boilers are regulated in the state of California through regional air district rules. For Stanford, the regulating air district is the BAAQMD. The BAAQMD rules applicable to stationary diesel combustion sources are discussed in this section.

State Mobile Source Regulations

Similar to the USEPA, California has adopted an array of regulations aimed to reduce emissions from mobile fuel combustion sources, including both fuel and source-specific emissions standards such as emissions control technologies. State regulations demonstrating both types of emissions reduction strategies are detailed below.

Diesel Fuel Regulations (Title 13, CCR, Section 2281, 2282, 2284, 2299; Title 17, CCR, Section 93114)

In 1988, ARB proposed an initial diesel fuel regulation limiting the sulfur content and aromatic hydrocarbon content of diesel fuel for motor vehicles. In 1998, ARB identified

[11] State of California. Senate Bill No. 656. 2003, ch. 738.

particulate emissions from diesel-fueled engines (DPM) as a TAC. ARB developed the Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles and the Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines and approved these documents in September 2000. These documents proposed to reduce diesel particulate emissions and the associated health risk by 75% in 2010 and by 85% in 2020, and to require the use of catalyzed diesel particulate filters and ultra-low sulfur diesel fuel. The 1988 initial diesel fuel regulation was subsequently amended, and additional regulations were passed. The Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines was also amended. The current standards for diesel fuel in California are listed below.

- Sulfur Content of Diesel Fuel – This standard prohibited the sale of vehicular diesel fuel with a sulfur content exceeding 500 ppm by weight after 1993. Starting in 2006, the sulfur limit was reduced to 15 ppm to be phased in over June through September 2006.
- Aromatic Hydrocarbon Content of Diesel Fuel – This standard prohibited the sale or supply of any diesel fuel after 1993 if the aromatic hydrocarbon content exceeds 10% by volume. Starting in December 2004, section 93114 of the CCR required that air quality management districts apply the same standards to encompass non-vehicular diesel fuel.
- Lubricity of Diesel Fuel– This standard prohibits the sale or supply of any diesel fuel after January 1, 2005 unless the fuel meets minimum lubricity level.

These California regulations establish the same fuel sulfur content limits as the federal diesel fuel regulations described in Section 2.2.1.1 above (15 ppm (0.0015%) for all non-ocean going vessel diesel-fueled engines); however, the California fuel regulations accelerate the effective dates of the requirements for non-highway applications within California by 3 to 5 years.

ARB Statewide Truck and Bus Regulation

ARB adopted the Statewide Truck and Bus Regulation in December 2008 and amended it in December 2011 and December 2014. The regulation requires heavy-duty vehicles to be retrofitted with PM filters beginning January 1, 2012, and requires older vehicles to be replaced starting January 1, 2015. By January 1, 2023, nearly all trucks and buses must have 2010 model year engines or equivalent. The 2014 amendment extended concessions for the timeline of retrofitting PM filters to small fleets, owners that were financially unable to comply with PM filter requirements in 2014, and other groups with special circumstances, in addition to making other minor changes to the regulation.

ARB Off-Road Emissions Regulation for Compression-Ignition Engines and Equipment

Engines designated as nonroad engines by USEPA are known as off-road engines in California state regulations implemented by ARB. Similar to the USEPA Nonroad Diesel Rule, the Off-Road Emissions Regulation for New Compression-Ignition Engines and Equipment applies to diesel engines such as those found in construction, general industrial, and terminal equipment. Initially adopted in 2000 and amended in 2004, the regulation establishes Tier emission standards, test procedures, and warranty and certification requirements. For some model years and engine size, the ARB Tier emission standards are more stringent than the USEPA standards.

ARB In-Use Off-Road Diesel Vehicle Regulation

In July 2007 ARB adopted the In-Use Off-Road Diesel Vehicle Regulation and amended it in December 2011. The regulation requires owners of off-road mobile equipment powered by diesel engines 25 HP or larger to meet the fleet average or best available control technology (BACT) requirements for NO_X and PM emissions by January 1 of each year. The regulation also establishes idling restrictions, limitations on buying and selling older off-road diesel vehicles (Tier 0), reporting requirements, and retrofit and replacement requirements. The requirements and compliance dates vary by fleet size, with performance requirements for large fleets beginning in 2014, medium fleets in 2017, and small fleets in 2019. Requirements regarding idling, disclosure, reporting, and labeling took effect in 2008 and 2009. The Diesel Off-road On-line Reporting System is an online tool designed to help fleet owners report their off-road diesel vehicle inventories and actions taken to reduce vehicle emissions to the ARB, as required by the In-Use Off-Road Diesel Vehicle Regulation.

2.2.1.4 Regional (BAAQMD) and Local Plans, Programs, and Regulations

The BAAQMD attains and maintains air quality conditions in the Bay Area Basin. The BAAQMD's jurisdiction encompasses all of seven counties – Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara and Napa, and portions of two others – southwestern Solano and southern Sonoma.

The BAAQMD regulates air quality through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the public's understanding of air quality issues. The clean air strategy of BAAQMD includes the preparation of plans for the attainment of ambient air quality standards, adoption and enforcement of rules and regulations concerning sources of air pollution, and issuance of permits for stationary sources of air pollution. BAAQMD is the agency with permit, regulatory, and enforcement authority over most types of stationary emission sources in the Bay Area.

Regulation 9-7 (Boilers)

Regulation 9-7 provides standards for the control of NOx and CO from industrial, institutional, and commercial boilers, steam generators, and process heaters greater than 2 million British thermal unit [MMBTU]/hr. It has standards for NO_X and CO concentrations, depending on the rate heat limit. The regulation also has requirements for insulation, stack gas temperature, testing, monitoring, and recordkeeping. Stanford's hot water generators of the new CEF and the boilers of the Replacement Process Steam Plant are subject to Regulation 9-7.

Regulation 9-8 (Internal Combustion Engines)

Regulation 9-8 provides standards for the control of NO_X and CO from internal combustion engines. Emissions standards of the regulation do not apply to emergency generators. However, emergency generators are limited to up to 50 hours of reliability-related activities within a calendar year. The regulation also requires recordkeeping.

2.2.2 Regulation of Toxic Air Contaminants

Air quality regulations also focus on TACs (or in federal terminology, HAPs). In California, TACs are defined by the ARB as those air pollutants that "may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health". There are currently over 200 substances that have been identified by the ARB as TACs. While most TACs originate from human sources such as fossil fuel combustion

or dry cleaning facilities, natural sources such as forest fires and volcanic eruptions also contribute TACs to ambient air.

The nature and magnitude of the potential health effects of TACs depends on the substance, concentration, and period of exposure. Some TACs cause effects in response to short-term (acute) exposure; others cause effects only after sustained exposures over weeks, months, or years. The effects of acute exposure may be minor, such as watery eyes or respiratory irritation, or they may be extensive, such as damage to the reproductive system or nervous system. If exposure to a sufficient concentration occurs for a sufficient period, individuals may have an increased risk of developing cancer, or a greater likelihood of experiencing non-carcinogenic chronic adverse effects. These chronic non-carcinogenic health effects may be minor, such as nasal rhinitis or respiratory irritation; or they may involve long-term damage to the immune, neurological, reproductive, respiratory, or other systems.

While some natural sources such as forest fires and volcanic eruptions contribute TACs to ambient air, most TACs originate from anthropogenic sources. Industrial facilities and mobile sources are significant sources of TACs. Various common urban facilities also produce TAC emissions, such as gasoline stations (benzene), hospitals (ethylene oxide), and dry cleaners (perchloroethylene). Automobile exhaust also contains TACs such as benzene and 1,3-butadiene. Most recently, DPM was identified as a TAC by ARB. DPM is a complex mixture of hydrocarbons, particulates, gases, and other compounds. DPM is emitted by diesel-fueled internal combustion engines, and the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emission control system is present. Both California's Office of Environmental Health Hazard (OEHHA) and the USEPA consider DPM to be a carcinogen. Both agencies also recognize that exposure to DPM may cause non-cancer effects such as change(s) in lung function and airway inflammation. DPM is a component of PM, and recent scientific data have linked prolonged exposure to PM to premature mortality, respiratory effects, and cardiovascular disease.

For TACs that do not cause cancer, threshold levels of chemicals are established by OEHHA, which are thought to be safe. However, in general, for those TACs that may cause cancer, even the smallest concentrations of chemicals may present some risk of cancer. In other words, from a regulatory point of view, there is no threshold level below which adverse health risks, although potentially small, may not be estimated to occur for carcinogenic chemicals. This is in contrast with the CAPs, for which acceptable levels of exposure can be determined and for which ambient standards have been established (refer to **Table 2-1-1**). The USEPA and ARB regulate TACs through statutes and regulations that generally require the use of the maximum or best available control technology for toxics (Maximum Achievable Control Technology [MACT] and Best Available Control Technology for Toxics [TBACT], respectively) to limit emissions. These, in conjunction with additional rules set forth by BAAQMD, establish the regulatory framework for TACs.

An example of a chronic, non-carcinogenic disorder exacerbated by air pollutants is asthma, which has been the focus of a number of recent studies. While there is only limited evidence that air pollution is the causative factor in asthma onset, there are considerable data that link air pollution to worsening of the disease. For example, living near traffic sources has been associated with both asthma occurrence and aggravation of the disease,[12] and others

[12] Salam, M., T. Islam, and F. Gilliland. 2008. Recent Evidence for Adverse Effects of Residential Proximity to Traffic Sources on Asthma. Current Opinion in Pulmonary Medicine, 14:3–8.

reported a significant increase in hospital visits as exposure to traffic increased.[13] Proximity to heavy traffic has also been linked to impaired lung development in children.[14]

Unlike criteria pollutants, TACs do not have region-wide ambient concentration limits such as NAAQS or CAAQS; there is no equivalent to "attainment status" for TACs. Concentrations of TACs may be regulated indirectly based on results from a health risk assessment (HRA). An HRA is a scientifically based tool used to determine if exposure to chemicals(s) pose a significant risk (cancer risk or non-cancer hazards) to human health. The effects of air toxic emissions are relatively localized, with concentrations tending to decrease markedly with distance from the source due to dilution and/or degradation. Due to this localized nature, HRAs tend to focus on receptors in the immediate vicinity of the point of release.

2.2.2.1 Federal Regulations

National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61 and 40 CFR Part 63)

The FCAA Amendments of 1970 required the USEPA to identify and list all air pollutants (not already identified as criteria pollutants) that "may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible or incapacitating reversible illness." The standards for TACs were considerably strengthened under the FCAA Amendments with the listing of 189 HAPs. For each HAP identified, the USEPA was to then promulgate National Emissions Standards for Hazardous Air Pollutants (NESHAPs) at levels that would ensure the protection of the public health with an ample margin of safety and to prevent any significant and adverse environmental effects, which may reasonably be anticipated, on wildlife, aquatic life, or other natural resources. The NESHAPS can set different requirements for major and area sources. Major sources are defined as stationary sources with potential to emit more than 10 tons/yr of any HAP or more than 25 tons/yr of any combination of HAPs; all other sources regulated under Title III of the FCAA Amendments are considered area sources. Issuance of the emission standards occurs in two phases. The first phase consists of technology-based emission standards designed to produce a high level of emission reductions for major sources of HAPs, which are referred to as MACT standards. For area sources, the standards may be different, based on generally available control technology. In the second phase, the USEPA must issue health risk-based emissions standards where such standards are deemed necessary to address risks remaining after implementation of the technology-based NESHAPs. These second-phase standards are generally referred to as "residual MACT" standards.

The FCAA Amendments also required the USEPA to issue vehicle or fuel standards containing reasonable requirements to control HAP emissions, applying at a minimum to benzene and formaldehyde. Performance criteria were established to limit mobile source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 of the FCAA Amendments also required the use of reformulated gasoline in selected U.S. cities (those with the most severe O_3 nonattainment conditions) to further reduce mobile-source emissions, including air toxics.

[13] Chang, J., R. Delfino, D. Gillen, T. Tioa, B. Nickerson, and D. Cooper. 2009. Repeated Respiratory Hospital Encounters Among Children with Asthma and Residential Proximity to Traffic. Occup. Environ. Med 66(2):90-98.

[14] Gauderman, W. J., H. Vora, R. McConnell, K. Berhane, F. Gilliland, D. Thomas, F. Lurmann, E. Avol, N. Kunzli, M. Jerrett, and J. Peters. 2007. Effect of Exposure to Traffic on Lung Development from 10 to18 Years of Age: A Cohort Study. Lancet. 369. pp. 571-577.

The federal hazardous air pollutant regulations that are applicable to Stanford are described in **Table 2-2-4**.

Table 2-2-4 Summary of Federal HAPs Regulations Applicable to Stanford

CFR Part	Subpart	Description	Details
40 CFR Part 63	A	General Provisions	Establishes applicability determination for stationary sources; prohibits circumvention and fragmentation of sources; includes definitions and requirements for preconstruction review and notification, performance testing, monitoring, recordkeeping and reporting, to which subparts can incorporate by reference or override.
40 CFR Part 63	ZZZZ	National Emission Standards for Hazardous Air Pollutants For Stationary Reciprocating Internal Combustion Engines	Start-up requirements for Reciprocating Internal Combustion Engines (RICE) at area sources; management practices (air/filter replacement schedule, inspection schedule) listed in this regulation (or in conjunction with an alternative management program administered by State permitting authorities), for stationary emergency RICE; and recordkeeping requirements.

Notes:
RICE = Reciprocating Internal Combustion Engines

2.2.2.2 State Regulations

Tanner Air Toxics Act

TACs in California are primarily regulated through the Tanner Air Toxics Act (Assembly Bill [AB] 1807) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588, or the Hot Spots Act). AB 1807 sets forth a formal procedure for ARB to designate substances as TACs. Research, public participation, and scientific peer review are necessary before ARB can designate a substance as a TAC. To date, ARB has adopted the USEPA's list of HAPs as TACs and has identified more than 20 additional TACs.

Once a TAC is identified, ARB then adopts an ATCM for sources that emit that particular TAC. If there is a safe threshold at which there is no toxic effect from a substance, the control measure must reduce exposure below that threshold. If there is no safe threshold, the measure must incorporate BACT to minimize emissions.

Proposition 65

The Safe Drinking Water and Toxic Enforcement Act of 1986, Proposition 65, was passed as a ballot initiative in 1986 and is intended to protect citizens and the State's drinking water from chemicals known to cause cancer or reproductive toxicity (including birth defects), as well as to notify citizens about their exposure to such chemicals.

Diesel Risk Reduction Plan

In August 1998, the ARB identified DPM (i.e., PM from diesel-fueled engines) as a TAC. Following this, ARB adopted a comprehensive Risk Reduction Plan in 2000. Pursuant to this Plan, ARB adopted diesel-exhaust control measures and stringent emission standards for various on-road mobile sources of emissions, including transit buses and off-road diesel equipment (e.g., tractors, generators). In 2001, ARB adopted the Public Transit Bus Fleet Rule and Emissions Standards for New Urban Buses, which established emissions limits on 1985 and subsequent model year heavy-duty bus engines and vehicles for NO_X, CO, nonmethane hydrocarbons, PM, and formaldehyde. The emissions standards apply to all heavy-duty urban buses, including diesel-fueled buses. Therefore, the rule limits the emissions of two TACs identified by ARB: DPM and formaldehyde. In 2007, a low-sulfur diesel fuel requirement and tighter emission standards for heavy-duty diesel trucks was put into effect, followed in 2011 by the same standards being applied to off-road diesel equipment.

Over time, the replacement of older vehicles will result in a fleet that produces substantially lower levels of TACs than the replaced vehicles. Mobile-source emissions of TACs (e.g., benzene, 1,3-butadiene, DPM) decreased significantly over the last decade and will be reduced further in California through a progression of regulatory measures (e.g., Low-Emission Vehicle/Clean Fuels and Phase II reformulated gasoline regulations) and control technologies.

With implementation of ARB's Risk Reduction Plan, DPM concentrations are expected to be reduced by 75% in 2010 and 85% in 2020 from the estimated year-2000 level. As emissions are reduced, it is expected that risks associated with exposure to these emissions will also be reduced. Emissions from heavy-duty diesel equipment associated with Stanford would be required to comply with the rules outlined above. Details regarding the regulations adopted pursuant to the ARB's Risk Reduction Plan are also discussed in Section 2.2.1.3.

Air Quality and Land Use Handbook

The ARB provides guidance concerning land-use compatibility with TAC sources. Although not a law or adopted policy, the handbook offers recommendations for the siting of sensitive receptors (e.g., proposed residential units) near uses associated with TACs to help limit the exposure of children and other sensitive populations to TACs.

2.2.2.3 Regional (BAAQMD) and Local Plans, Programs, and Regulations

BAAQMD CARE Program

Under the Community Air Risk Evaluation (CARE) program, BAAQMD aims to identify areas (referred to in this context as "priority" or "impacted" communities) with high TAC emissions and sensitive populations that could be affected by them, and to use this information to establish policies and programs to reduce TAC emissions and exposures.[15] The impacted communities are located in Concord, Richmond/San Pablo, San Jose, eastern San Francisco, western Alameda County, Vallejo, San Rafael, and Pittsburg/Antioch.

The main objectives of the program are to:

[15] Bay Area Air Quality Management District (BAAQMD). 2016. CARE Program. Accessed July 1, 2016. http://www.baaqmd.gov/plans-and-climate/community-air-risk-evaluation-care-program.
BAAQMD. 2014. Identifying Areas with Cumulative Impacts from Air Pollution in the San Francisco Bay Area. Accessed July 1, 2016. http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CARE%20Program/Documents/ImpactCommunities_2_Methodology.ashx?la=en

- Evaluate potential health risks associated with exposure to TACs from both stationary and mobile sources;
- Assess potential exposures to sensitive receptors and identify impacted communities;
- Prioritize TAC reduction measures for significant TAC sources in impacted communities; and
- Develop and implement mitigation measures - such as grants, guidelines, or regulations - to improve air quality, focusing initially on priority communities.

BAAQMD Planning Healthy Places

The purpose of the Planning Healthy Places guidelines is to promote efficient and sustainable land use development while ensuring clean and healthy air for residents. Planning Healthy Places was developed on the premise that regional ambient air emissions and health risk control programs do not account for localized impacts to communities located in close proximity to busy roadways, factories, airports, and other sources of air pollution.

BAAQMD prepared these guidelines outside the California Environmental Quality Act (CEQA) context to assist developers and land use planners with addressing potential land use compatibility issues associated with locating people close to localized sources of air pollution, specifically PM and TACs. The BAAQMD identifies a list of "best practices" to reduce emissions or exposure to sensitive receptors who are in close proximity to development projects. Through Planning Healthy Places, the BAAQMD denotes regions in the Bay Area located close to highways and busy roadways where "best practices" are recommended to reduce exposure and emissions, as well as regions situated close to large and complex emissions sources (such as ports, refineries, and gas stations) where further study is required to assess air pollution levels. There are a number of further study areas located in the vicinity of Stanford, which correspond to gas stations, dry cleaners, and back-up generators.

BAAQMD Rules and Regulations

BAAQMD has implemented specific rules and regulations that limit emissions from various sources, and that identify specific pollution reduction measures. Some emissions sources are further subject to legal requirements imposed through BAAQMD's permitting process.

Under BAAQMD Rule 2-1 (General Permit Requirements), Rule 2-2 (New Source Review [NSR]), and Rule 2-5 (NSR of TACs), all sources that have the potential to emit TACs are required to obtain permits from BAAQMD. Permits may be granted if the sources are constructed and operated in accordance with applicable regulations, including NSR standards and ATCMs. BAAQMD prioritizes TAC-emitting stationary sources based on the quantity and toxicity of the TAC emissions, and on the proximity of the facilities to sensitive receptors. BAAQMD analyzes sources that require a permit (e.g., performs health risk assessments) based on their potential to emit TACs. If it is determined that a project's emissions would exceed BAAQMD's threshold of significance for TACs, as identified below, the source has to implement BACT for TACs (TBACT) to reduce emissions. BAAQMD's TBACT measures apply to individual facility sources, such as storage tanks, boilers, and emergency generators. If a source cannot reduce the risk below the threshold of significance even after implementing TBACT, then BAAQMD will deny the permit. BAAQMD permit requirements help to reduce emissions and related health impacts from new emissions sources, as well as from existing emissions sources by requiring them to apply new technology when retrofitting.

A number of laboratory sources and operations are exempt from the "authority to construct" and "permit to operate" authorizations detailed in BAAQMD Rule 2-1, provided that Responsible Laboratory Management Practices (RLMP) are followed. RLMP include the incorporation of information about the emissions of volatile TACs into training for laboratory personnel, avoidance of open container storage of volatile TACs and hazardous chemical waste, the periodic monitoring of fume hoods, and proper disposal of hazardous chemical waste containing TACs. If Responsible Laboratory Management Practices are followed, then the following laboratory sources are exempt from permitting requirements:

- Teaching laboratories used exclusively for classroom experimentation and/or demonstration;
- Laboratories located in a building where the total laboratory floor space is less than 25,000 square feet or the total number of fume hoods is less than 50. In addition, laboratory units for which the owner or operator can demonstrate that there will not be any TAC emissions (except under accidental conditions) are not included in the floor space or fume hood calculations;
- Bench scale laboratory equipment or processes (excluding pilot plants) used exclusively for experimentation, quality control testing, or research and development;
- Vacuum producing devices in laboratory operations which are used exclusively with other equipment that are also exempt from permitting, and which do not remove or transfer air contaminants from another source;

BAAQMD's permitting process applies to stationary sources. Properties that are exposed to elevated levels of TACs from nonstationary sources, and the nonstationary sources themselves (e.g., on-road vehicles), are not subject to air quality permits. Emissions controls on mobile sources are subject to regulations implemented at the federal and State levels by USEPA and ARB, respectively.

3. CRITERIA POLLUTANT EMISSIONS INVENTORIES

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions and project conditions criteria air pollutant emission inventories, which include both construction and operational emissions. Sub-categories of criteria air pollutant operational emissions include: natural gas combustion, mobile sources, emergency generators, laboratories, and the fuel stations. Full details on the calculation methodology for the existing conditions and Project inventories are provided in **Appendix A**.

3.1 Existing Conditions Inventories Description

There are three scenario years presented in this Air Quality Technical Report to evaluate existing conditions:

- 2014
- 2015
- Fall 2018

The Fall 2018 scenario year presented in this technical report represents the annualized emissions expected to exist immediately prior to commencement of operations under Stanford's proposed 2018 General Use Permit. This includes additional buildings that would be expected to be permitted during implementation of the 2000 General Use Permit but does not include occupancy of the new Escondido Village Graduate Residences. This scenario also takes into account changes in the motor vehicle fleet anticipated in 2018. For example, mobile sources are expected to have lower emissions in 2018 based on existing regulatory standards. Also importantly, the Fall 2018 scenario reflects Stanford's existing commitment to acquire electricity from a solar farm in Kern County and to build new solar systems on Stanford's campus. The Kern County solar farm will be a 68-megawatt peak solar plant generating 159,000 megawatt-hours per year (MWh/year). In addition, several Stanford building complexes feature solar panels, including the Science and Engineering Quad and the Knight Management Center. Installation began in May 2016 on rooftop panels for an additional 16 campus buildings to provide an additional 5 megawatts (MW), which will generate up to 7,300 MWh/year. These two solar systems are expected to provide up to 53 percent of Stanford's total electricity use. While these projects do not impact CAP or TAC emissions at Stanford, this does impact GHG emissions, and is therefore an important aspect to consider in presenting scenario years.

The 2014 and 2015 scenarios demonstrate the effects of the recently completed changes at Stanford that have significantly changed its CAP and TAC emissions profile. Previously, in 2014, Stanford produced electricity, steam and chilled water at its on-campus Cardinal cogeneration plant and its prior Central Energy Facility (old CEF). These facilities employed what was previously considered a state-of-the-art process of generating electricity through a gas-fired plant, and using the steam (a by-product of electricity generation) to heat campus buildings. Stanford used onsite chillers to create cold water to cool the buildings. In addition, the old CEF provided process steam for use in kitchens and laboratories. Excess electricity produced by the old CEF that was not used by Stanford was sold back to Pacific Gas & Electric Company (PG&E). Emitting equipment for the old CEF was comprised of four boilers, a gas turbine, duct burners, and three emergency generators. The old CEF (including the Cardinal Cogeneration plant) was decommissioned in April 2015.

In 2015, Stanford completed a groundbreaking overhaul of its campus heating and cooling system. This overhaul is called the Stanford Energy System Innovations-- or SESI. SESI relies on a heat-recovery process that is 70 percent more efficient than the prior cogeneration process for heating and cooling. The new system will meet more than 90 percent of the campus heating demands by capturing almost two-thirds of the waste heat generated by the campus cooling system. To make that exchange possible, Stanford replaced 22 miles of underground pipes and retrofitted 155 buildings to convert the campus from a steam- to hot water- based system. In addition, Stanford now purchases its electricity through a Direct Access program that enables purchase from Electric Service Providers that include renewable resources within their portfolios.

The new CEF includes the following equipment:

- three hot water generators,
- two emergency generators,
- electric-powered chillers (non-emitting), and
- thermal energy storage tanks (non-emitting).

The hot water generators supply hot water for building heating and primarily run on natural gas, with the additional capability to run on diesel fuel in emergencies. The emergency generators run on diesel fuel.

In addition to the change in emissions profiles due to the SESI, there were also changes in 2015 due to two other types of emissions sources:

- Stanford installed a steam processing plant that provides process steam for sterilization purposes (e.g., for kitchens and laboratory autoclaves). This is referred to as "Replacement Process Steam."
- Stanford installed individual boilers at a few campus locations to provide steam for heating and hot water services at campus buildings that will not be converted from steam to hot water within a reasonably foreseeable timeframe. This category of sources is referred to as the "Individual Replacement Boilers."

Both pre-SESI (2014) and post-SESI (2015) inventories are provided here to provide context for the Fall 2018 inventory. 2014 represents the historic actual campus emissions prior to implementation of the SESI, and also includes the operations of the Valero Service Station. 2015 represents the current campus emissions after implementation of SESI and still includes operation of the Valero Service Station. The 2015 emissions inventory was then used to develop the Fall 2018 inventory by incorporating assumptions on growth in certain categories, such as an increase in academic square footage and residential beds, and the removal of the Valero Service Station. A comparison of the 2014, 2015, and Fall 2018 inventories is provided in **Table 3-1-1**, illustrating the effect of SESI (between 2014 and 2015), the impact of removing the Valero Service Station, and the remaining growth of the campus under the 2000 General Use Permit (Fall 2018).

3.2 Project Inventory Description

This document evaluates the emissions inventory for complete buildout of the 2018 GUP. The Fall 2018 emissions inventory was used to develop the Project inventory by incorporating assumptions on growth in certain categories, such as an increase in academic square footage and residential beds. This scenario is called "Fall 2035" because it consists of the full Project

operations, which are anticipated to occur in 2035. However, the mobile emissions are conservatively calculated using 2030 emission factors. If 2035 emission factors were used instead of 2030, the total CAP emissions would be lower than reported here. Therefore, this comparison is a conservative estimate of the anticipated 2035 Project emissions. **Table 3-1-1** summarizes the Project inventory.

3.3 Construction Emissions: Existing Conditions and 2035 Project

This section describes the estimation of CAP and TAC emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual emissions from construction and demolition for all existing conditions and Project inventory years. Detailed information on the construction emissions calculations are provided in **Appendix A**, and detailed emission inventory from the California Emissions Estimator Model (CalEEMod®) output files are included in **Appendix B**. The major construction phases included in this analysis are:

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

CAP and TAC emissions from these construction activities are largely attributable to fuel use from off-road construction equipment and vendor vehicles. VOCs can be emitted from architectural coating activities. CAP and TAC emissions from construction worker, vendor, and hauling vehicles are already included as separate line items in the mobile emissions section. All PM_{10} is assumed to be DPM for purposes of health risk calculations.

Ramboll Environ used CalEEMod® version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists, and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 square feet (sq ft), demolition of 50,306 sq ft of buildings per year, and excavation of 62,062 cubic yards (CY) of soil, with the default start and end dates of the phases moved such that all construction occurs within one year while maintaining total default number of equipment-hours. This is intended to mirror the average construction year that occurred during the 2000 GUP. Ramboll Environ understands based on communications with Stanford's construction project managers that the majority of construction equipment used by contractors building projects at Stanford meets final Tier 4 emissions standards. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment. Emissions are shown in **Table 3-1-1** and detailed mobile source tables.

3.4 Operational Emissions- Existing Conditions and 2035 Project

3.4.1 Natural Gas

CAP emissions from natural gas combustion are generated from residential and commercial usage (e.g., cooking and heating) and industrial usage (i.e., powering the old CEF for the 2014 inventory and powering the new CEF and Replacement Process Steam Plant for the 2015 and Fall 2018 inventories).

For the 2014 and 2015 inventories, student residential and university commercial natural gas usage is provided through PGE consumption data. Natural gas usage for private faculty/staff housing is estimated based on averages for the climate zone. Natural gas usage of the old CEF (2014 inventory) and the new CEF and Replacement Process Steam Plant (2015 inventory) are provided by Stanford.

The Fall 2018 inventory is based on the 2015 inventory for the above subcategories (except for private faculty/staff housing), scaled up for the remainder of the development of the existing 2000 GUP by 2018. Private faculty/staff housing natural gas usage for the Fall 2018 inventory is assumed to remain constant from the 2015 inventory.

The Fall 2035 inventory is based on the Fall 2018 inventory for the above subcategories, scaled up for the development of the proposed 2018 GUP by 2035 and with the addition of the new Escondido Village Graduate Residences. New private faculty/staff housing natural gas usage is based on averages for the climate zone assuming compliance with the 2016 Building Energy Efficiency Standards. Natural gas consumption, emission factors, and emissions for all scenario years are summarized in **Tables 3-4-1, 3-4-2, 3-4-3, 3-4-4**, and **3-4-5.**

3.4.2 Mobile Sources

CAP emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford. Mobile source emissions include running exhaust emissions, idle exhaust emissions, start exhaust tailpipe emissions, diurnal evaporative hydrocarbon emissions, resting evaporative losses, hot soak evaporative hydrocarbon emissions, running loss evaporative hydrocarbon emissions, tire and brake wear PM emissions, and entrained roadway PM emissions. Running exhaust, tire and brake wear PM, and entrained roadway PM emissions are dependent on VMT. Starting exhaust, hot soak evaporative, and running loss evaporative emissions are dependent on the number of starts or trips that a vehicle makes. Idle exhaust, resting evaporative, and diurnal evaporative emissions are dependent on the number vehicles. Assumptions and calculations used to determine emissions are described in detail in **Appendix C**.

For 2014 and 2015, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers with the exception of the on-campus fleet. The on-road Campus Fleet can be categorized into the Bonair Fueling Station Fleet, the Peninsula Sanitary Service, Inc (PSSI) Fleet, the Marguerite Bus/Shuttle Fleet, and the Public Safety Fleet. Stanford provided activity data in the form of fuel totals for the Bonair Fueling Station Fleet and PSSI Fleet, and VMT for the Marguerite Bus/Shuttle Fleet, portions of the PSSI Fleet, and the Public Safety Fleet. Activity data (fuel consumption) for the off-road

Campus Fleet and golf course fleets (Siebel Varsity Golf Training Complex and Red Barn)[16] was provided by Stanford. Activity data (number of trips and VMT) for visitors and childcare facilities was calculated by Ramboll Environ based on Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

For Fall 2018, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, visitors, and vendors corresponding to 2015 were scaled up based on additional academic square footage, and additional number of residents housed on campus. Activity data for the Public Safety Fleet is assumed to be the same as for 2015. The 10 oldest vehicles from the Marguerite fleet will be replaced with electric vehicles by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%.

For 2035, activity data (number of trips and/or VMT) for off-campus trips, on-campus trips, and vendors were provided by Fehr & Peers. On-road Campus Fleet emissions incorporate the Stanford commitments that all Marguerite buses will be electric vehicles by 2035 and 70% of Bonair vehicles will be electric vehicles by 2035. Activity data (number of trips and VMT) for campus visitors and travel associated with the childcare facilities was calculated by Ramboll Environ based on Stanford-specific information and assumptions and provided to Fehr & Peers for their traffic analysis. Activity data (number of trips) for vendors was estimated by Fehr & Peers. Data from Fehr & Peers is provided in **SB 743 VMT Analysis Appendices A, B, and C**.

The mobile source criteria pollutant emission factors were generated with the most recent approved version of ARB's EMission FACtor model (EMFAC2014), approved by the USEPA on December 14, 2015. Mobile emissions were estimated for the following pollutants: ROG, CO, NO_X, PM_{10}, $PM_{2.5}$, SO_X. Full calculation details can be found in **Appendix A**.

Emissions for all scenario years are summarized in **Tables 3-4-6, 3-4-7, 3-4-8, 3-4-9,** and **3-4-9b.**

3.4.3 Emergency Generators

Stanford currently has 90 emergency generators installed on campus. CAP emissions are from diesel combustion in their operation for both testing and maintenance and for emergency operation. Activity data (hours of operation) for the emergency generators is provided by Stanford for 2014 and 2015. Activity data was scaled up from the 2015 inventory based on increased academic square footage to develop the Fall 2018 inventory. For 2035, activity data from Fall 2018 was scaled up based on the increase in academic square footage from Fall 2018 to full buildout of the 2018 GUP. Full calculation details are provided in **Appendix A**.

[16] Although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary.

Emissions for all scenario years are summarized in **Tables 3-4-10** and **3-4-11.**

3.4.4 Laboratories

Laboratory emissions are estimated for 93 chemicals, the list of which was approved in BAAQMD protocols as described in **Appendix A**.[17] Chemicals include those regulated by BAAQMD TAC Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments. For the 2014 inventory, Ramboll Environ first estimated chemical usage for the 93 chemicals based on the total number of fume hoods on campus and Stanford-provided inventory data for 2001 for the ChemBio building usage quantities or 2015 chemical inventories of the Lokey Laboratory Building (ChemBio), the Shriram Center (BioE/ChemE), Mudd (Seeley G) Chemistry, and the Environment and Energy building. Then, ROG emissions are calculated based on the chemical type and volatility. The 2015 inventory is assumed to be the same as 2014, as laboratory activities are assumed to be the same. The Fall 2018 inventory is based on the 2015 inventory but including 8% growth to account for an expected increase in academic square footage. The Fall 2035 inventory is based on the Fall 2018 inventory but including 22% growth to account for an expected increase in academic square footage. Full calculation details are provided in **Appendix A**.

Emissions for all scenario years are summarized in **Tables 3-4-12, 3-4-13, 3-4-14, and 3-4-15.**

3.4.5 Fuel Stations

In 2014, the Valero and Bonair fuel stations were in operation. The Valero fuel station was accessible to the public prior to its closure in 2016. The Bonair fuel station is still operational and is used to fuel campus vehicles. For the 2014 inventory, annual gasoline throughput for 2014 or 2015 for all stations was provided by Stanford and was used to estimate evaporative VOC emissions from gasoline. For the 2015 inventory the same throughput as in 2014 was used for the Bonairi and Valero fuel stations. For the Fall 2018 inventory, the 2015 inventory throughput for Bonair was used, and decreased by 5% to represent the switch to a hub-based system that will reduce VMT and therefore fuel consumption. The Valero fuel station, which ceased operations in 2016, was not included in the Fall 2018 inventory.

For 2035, Project emissions from the Bonair fuel station was based on the Fall 2018 inventory and subsequently decreased (by 50%) by the growing number of electric vehicles that will be part of the Stanford on-campus fleet.

In all scenario years, a controlled VOC emission factor from the source specific guidance for gasoline dispensing facilities from BAAQMD Permit Handbook was used.[18]

Emissions for all scenario years are summarized in **Tables 3-4-16, 3-4-17, 3-4-18,** and **3-4-19.**

3.5 Criteria Pollutant Inventories in Context

A category-by-category comparison of emissions between the three existing conditions inventories and the Project inventory is shown in **Table 3-1-1**. Even with growth in

[17] ARB. Bay Area Air Quality Management District Regulation 2. Accessed July 22, 2016. http://www.arb.ca.gov/drdb/ba/suphtml/r2-1.htm

[18] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

population and building square footage, total mass emissions of CAPs decrease significantly from 2014 to 2015 to Fall 2018 and to Fall 2035.

The decrease from 2014 to 2015 is due to the decommissioning of the Cardinal Cogen plant, and conversion to the SESI, which uses heat recovery for building heating and cooling.

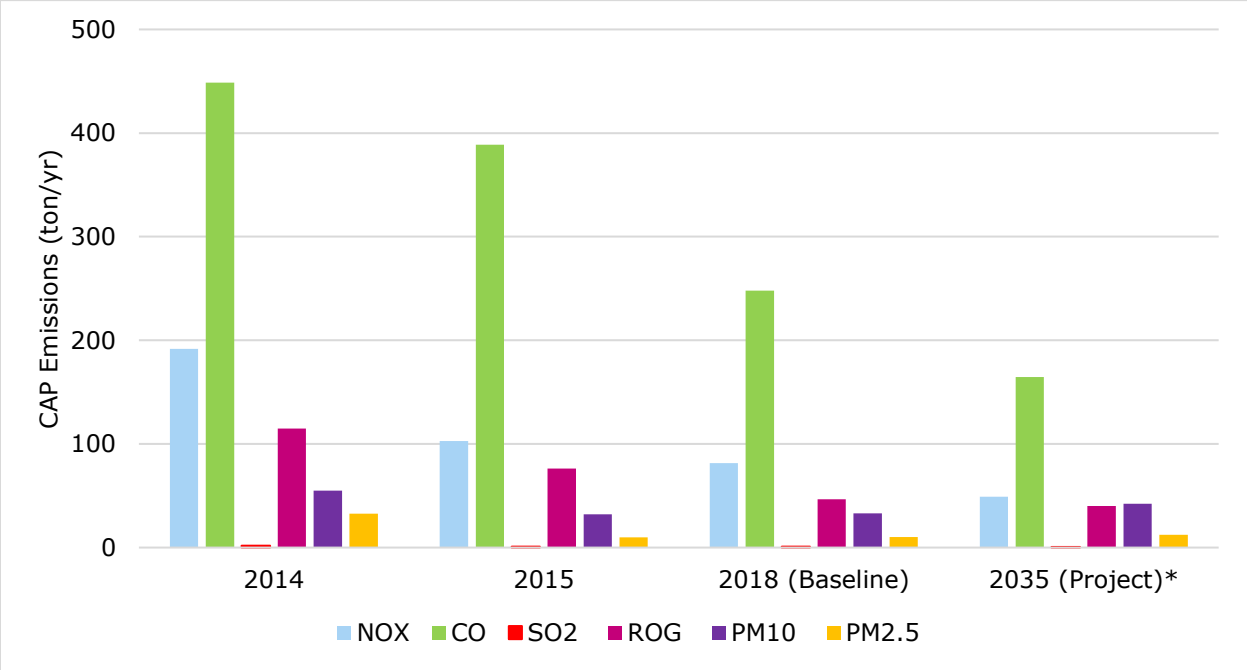
The continued decreases through Fall 2018 and Fall 2035 are due to lower emissions from mobile sources subject to a progression of regulatory measures. As described in Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030. A summary of total emissions over time is shown in **Table 3-5-1** and **Figure 3-5**.

Table 3-5-1. Stanford CAP Emissions

	CAP Emissions (ton/yr)					
Inventory Year	NO_X	CO	SO_2	ROG	PM_{10}	$PM_{2.5}$*
2014	192	449	1.7	115	55	33
2015	103	389	0.79	76	32	9.8
2018 (Baseline)	82	248	0.75	47	33	10
2035 (Project)	49	165	0.69	40	42	12

* $PM_{2.5}$ is conservatively assumed to equal PM_{10} for non-mobile sources, even though only a fraction of PM_{10} is $PM_{2.5}$.

Figure 3-5. Stanford CAP Emissions



*As described in Section 1.2.3, the 2035 Project inventory is based on 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030.

4. TOXIC AIR CONTAMINANT EMISSIONS INVENTORIES

This section describes the methodology that Ramboll Environ used to develop the existing conditions and project conditions TAC emission inventories, which include operational emissions. Construction activities also result in the emissions of DPM, a recognized TAC in California. Since DPM is assumed to be all PM_{10}, and PM_{10} is discussed and calculated in the CAP section, the methodology for calculating construction emissions is not further discussed here. Sub-categories of TAC operational emissions include: natural gas combustion, mobile sources, emergency generators, laboratories, and fuel stations. Full details on the calculation methodology for inventory development are provided in **Appendix A**.

Section 3.1 describes the context for the three existing conditions inventory years and Project inventory year presented in this technical report.

4.1 Operational Emissions – Existing Conditions and 2035 Project

4.1.1 Natural Gas

TAC emissions from natural gas combustion are generated from residential and commercial usage (e.g., cooking and heating), and also from powering the old CEF (for the 2014 inventory) or the new CEF and Replacement Process Steam Plant (for the 2015, Fall 2018, and Fall 2035 inventories). The same activity data (natural gas usage) used for estimating CAP emissions, as described in Section 3.4.1, are also used for calculating TAC emissions.

Benzene, formaldehyde, and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion. TAC emissions from natural gas sources are summarized in **Tables 4-1-1, 4-1-2, 4-1-3, 4-1-4,** and **4-1-5**.

4.1.2 Mobile Sources

TAC emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford.

DPM, benzene, and 1,3-butadiene emissions were estimated from fuel combustion of mobile sources. BAAQMD CEQA Guidelines indicate that these three pollutants represent a substantial portion of the ambient background risk from TACs in the Bay Area Basin.[19] DPM emissions were assumed to be equivalent to PM_{10} emissions from diesel-powered mobile sources. The methodology for calculating PM_{10} emissions are presented in Section 3.4.2 and in **Appendix A**. Benzene and 1,3-butadiene are components of ROG and total organic gas (TOG) emissions (presented in Section 3.4.2), so emissions from total ROG (for diesel mobile sources) or TOG emissions (for gasoline mobile sources) were speciated to determine the benzene and 1,3-butadiene emissions. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 of the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011). Therefore, only those two compounds are included for gasoline TAC calculations.

The same activity data (i.e., VMT, vehicle trips, brake horsepower per hour) used to calculate CAP emissions, as described in Section 3.4.2, are used to calculate TAC emissions.

[19] BAAQMD California Environmental Quality Act: Air Quality Guidelines (Updated May 2012). http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/baaqmd-ceqa-guidelines_final_may-2012.pdf?la=en

TAC emissions from mobile sources are summarized in **Tables 4-1-6, 4-1-7, 4-1-8, and 4-1-9**.

4.1.3 Emergency Generators

DPM emissions were conservatively assumed to be equivalent to PM_{10} emissions from emergency generators. Methodology for calculating PM_{10} emissions are presented in Section 3.4.3 above, and described in detail in **Appendix A**.

Emissions estimates for DPM from emergency generators are shown in **Tables 3-3-10** and **3-3-11**, under PM_{10} emissions.

4.1.4 Laboratories

The methodology for the calculation of TAC emissions from laboratories is described in Section 3.4.4 above, and described in detail in **Appendix A**.

Emissions estimates are shown in **Tables 3-4-12, 3-4-13, 3-4-14,** and **3-4-15**.

4.1.5 Fuel Stations

ROG emissions estimated in Section 3.4.5 were speciated to assume that 0.3% of total emissions are benzene.[20] The calculation methodology is described in detail in **Appendix A.**

Emissions estimates are shown in **Table 4-2.**

4.2 Toxic Air Contaminant Inventories in Context

A category-by-category comparison of TAC emissions between the three existing conditions inventories and the Project inventory is shown in **Table 4-2**. The TACs shown in this summary table are those evaluated by the BAAQMD for natural gas combustion and fuel combustion for mobile sources, which represent a substantial portion of ambient background risk from TACs in the Bay Area. Therefore, this report focuses on these five TACs. The other 89 laboratory chemicals for which emissions were calculated are shown in **Tables 3-4-12, 3-4-13, 3-4-14,** and **3-4-15**. Even with growth in population and building square footage, total mass emissions of four out of the five TACs that are tracked in the emissions inventory decrease from 2014 to Fall 2035. A summary of TAC emissions over time is shown in **Table 4-2-2** and **Figure 4-2**.

The decrease from 2014 to 2015 is due to the decommissioning of the Cardinal Cogen plant, and conversion to the SESI for heating and cooling.

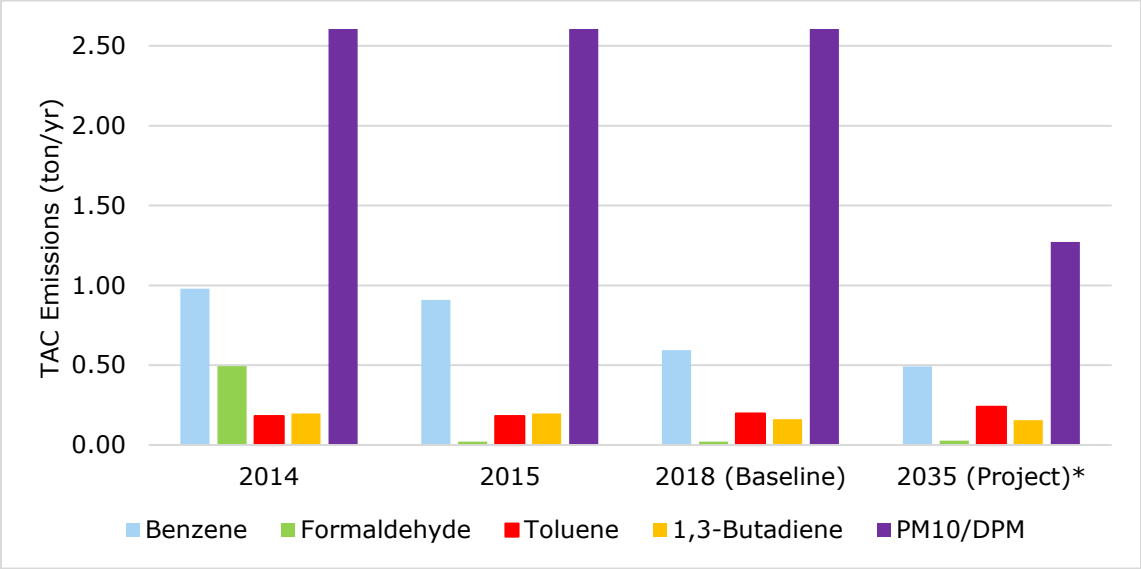
Continued decreases through Fall 2018 and Fall 2035 are due to lower emissions from mobile sources subject to a progression of regulatory measures. As described in Section 1.2.3, the 2035 Project inventory is the developed using 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030.

[20] Speciation from Table 1 in CAPCOA Air Toxics "Hot Spots" Program: Gasoline Service Station Industrywide Risk Assessment Guidelines. http://www.arb.ca.gov/ab2588/rrap-iwra/gasiwra.pdf.

Table 4-2-2. Stanford TAC Emissions

	TAC Emissions (ton/yr)				
Inventory Year	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM
2014	0.99	0.50	0.18	0.20	2.8
2015	0.92	0.020	0.18	0.20	2.8
2018 (Baseline)	0.60	0.022	0.20	0.16	2.7
2035 (Project)*	0.49	0.027	0.24	0.16	1.3

Figure 4-2. Stanford TAC Emissions



* As described in Section 1.2.3, the 2035 Project inventory is based on 2030 emission factors. This is conservative, as the mobile emission factors are expected to continue to decrease after 2030.

5. IMPACT ASSESSMENT AND MITIGATION MEASURES

5.1 Standards of Significance

This section discusses the criteria and general methods used to evaluate the Project's significance with respect to air quality impacts under CEQA. It also discusses the BAAQMD 2010 thresholds of significance, which are used to evaluate the Project. Methodology for the calculation of emissions is discussed in more detail in Section 3 above.

5.1.1 CEQA Guidelines Appendix G Thresholds

Appendix G of the State CEQA Guidelines requires evaluating whether the project under consideration would:

- Conflict with or obstruct implementation of an applicable air quality plan;
- Violate any air quality standard, or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any CAP for which the project region is non-attainment under an applicable federal or State ambient air quality standard (including increasing emissions which exceed quantitative thresholds for O_3 precursors);
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

Lead agencies may rely on the CEQA significance criteria established by the local air pollution control agency (for the Bay Area, BAAQMD) to determine the significance of a project's air emissions under the Appendix G thresholds.

5.1.2 BAAQMD Significance Thresholds

The BAAQMD presents its thresholds of significance along with methods for evaluating compliance in its guidance document entitled California Environmental Quality Act Air Quality Guidelines (updated May 2011).[21] The BAAQMD significance thresholds are summarized in **Table 5-1-1**. The BAAQMD significance thresholds are divided between CAPs and TACs, and

[21] On March 5, 2012 the Alameda County Superior Court issued a judgment, in California Building Industry Association v. Bay Area Air Quality Management District, finding that the BAAQMD had failed to comply with CEQA when it adopted its significance thresholds in 2010. The Court ruled that the adoption of the significance thresholds (including new significance thresholds for TACs and fine particulate matter or $PM_{2.5}$) is considered a "project" under CEQA, and, thus, the BAAQMD should have prepared the required CEQA review and documentation. The court issued a writ of mandate ordering the BAAQMD to set aside the 2010 significance thresholds and cease dissemination of them until the BAAQMD had complied with CEQA. On August 13, 2013, the California First District Court of Appeal reversed the Superior Court's decision, ruling that adoption of CEQA significance thresholds does not constitute a "project" under CEQA. The CBIA then sought review of this decision in the California Supreme Court, which narrowed the scope of review to the question: under what circumstances does CEQA require an analysis of how existing environmental conditions will impact future residents or receptors of a proposed project? On December 17, 2015, the California Supreme Court held that CEQA does not generally require an agency to consider the effects of existing environmental conditions on a proposed project's future users or residents. On August 16, 2016, the California First District Court of Appeal concluded that a local agency might permissibly apply the thresholds for existing environmental conditions to an environmental review of the agency's own project conducted under CEQA, even though the thresholds cannot be used to require an environmental impact report or the implementation of mitigating measures for a privately initiated project based solely on the impact the existing environment will have on future users or occupants of a project.
Because the vacation of the proposed significance thresholds did not affect their validity from a scientific perspective and the BAAQMD's thresholds are supported by substantial evidence, and because the County of Santa Clara does not have alternative numeric thresholds for evaluating air quality impacts under CEQA, the thresholds from the BAAQMD CEQA Guidelines will be used in this analysis.

are set for evaluating a project's short-term construction emissions, long-term operational emissions, and contributions to cumulative impacts to determine whether such contributions are cumulatively considerable. Generally, the BAAQMD significance thresholds for CAPs address the first three Appendix G air quality CEQA thresholds and the TAC thresholds address the fourth Appendix G threshold. Finally, BAAQMD has established a threshold for odors, consistent with the fifth Appendix G threshold.

The 2011 BAAQMD CEQA Guidelines explain that criteria pollutant thresholds based on mass emission rates (e.g., NO_X, ROGs, PM_{10} exhaust, $PM_{2.5}$ exhaust) or ambient air concentrations (e.g., CO) are designed to maintain ambient air concentrations of criteria air pollutants below State and federal standards, or to prevent a "cumulatively considerable contribution" to regional nonattainment with ambient air quality standards.

Table 5-1-1 BAAQMD CEQA Air Quality Thresholds of Significance

Air Pollutants (and Precursors)	Construction-Related Average Daily Emissions (lbs/day)	Operational-Related	
		Average Daily Emissions (lbs/day)	Maximum Annual Emissions (tons/year)
ROGs	54	54	10
NO_X	54	54	10
PM_{10} [a]	82 (exhaust only)	82	15
$PM_{2.5}$ [a]	54 (exhaust only)	54	10
$PM_{10}/PM_{2.5}$ (fugitive dust)	Best Management Practices	None	
CO (local concentration)	None	9.0 ppm (8-hour average) 20.0 ppm (1-hour average)	
Risks and Hazards for New Sources and Receptors (Individual Project)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >10.0 in a million Increased non-cancer risk of > 1.0 HI (chronic or acute) Ambient $PM_{2.5}$ increase: > 0.3 µg/m^3 annual average, a concentration that would not result in significant health impacts. Zone of Influence: 1,000-foot radius from fence line of source or receptor	

Table 5-1-1 BAAQMD CEQA Air Quality Thresholds of Significance

Air Pollutants (and Precursors)	Construction-Related Average Daily Emissions (lbs/day)	Operational-Related	
		Average Daily Emissions (lbs/day)	Maximum Annual Emissions (tons/year)
Risks and Hazards for New Sources and Receptors (Cumulative Threshold)	Same as Operational Thresholds	Compliance with Qualified Community Risk Reduction Plan OR Increased cancer risk of >100 in a million (from all local sources) Increased non-cancer risk of >10 HI (from all local sources) (chronic) Ambient $PM_{2.5}$ increase: > 0.8 µg/m^3 annual average (from all local sources) Zone of Influence: 1,000-foot radius from fence line of source or receptor	
Odors	None	Complaint History – five confirmed complaints per year averaged over 3 years	

Note:
a. Upon consultation with BAAQMD, BAAQMD clarified that roadway dust should be included in the emissions to compare to the operational thresholds.

Abbreviations:
BMP = best management practices
MT of CO_2e/yr = metric tons of carbon dioxide equivalent per year
MT CO_2e/SP/yr = metric tons carbon dioxide equivalent per service population per year
HI = hazard index; µg/m^3 = micrograms per cubic meter.

To assist the lead agency in evaluating air quality impacts at the community scale, thresholds of significance have been established for local community risks and hazards associated with TACs and $PM_{2.5}$ with respect to siting a new source and/or receptor, as well as for assessing both individual source and cumulative multiple source impacts. These thresholds of significance focus on $PM_{2.5}$ and TACs because these more so than other emission types may pose significant adverse health impacts at the local level as discussed separately below.

TACs and $PM_{2.5}$ are evaluated based on the health impacts that may result from the emissions of TACs and $PM_{2.5}$. The health impacts associated with TACs are quite diverse and generally are assessed locally, rather than regionally. TACs (and $PM_{2.5}$) can cause, depending on the specific TAC, long-term health impacts such as cancer, birth defects, neurological damage, asthma, bronchitis, or genetic damage; or short-term acute affects such as eye watering, respiratory irritation (a cough), running nose, throat pain, and headaches.

For evaluation purposes, TACs are separated into carcinogens and non-carcinogens based on the nature of the physiological impacts associated with exposure to the pollutant.

Carcinogens are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per one million exposed individuals, typically over a lifetime of exposure. Non-carcinogenic substances differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis. Acute and chronic exposure to non-carcinogens is expressed as a hazard index (HI), which is the ratio of expected exposure levels to an acceptable reference exposure levels.

The thresholds of significance for local community risk and hazard impacts are identified below. Local community risk and hazard impacts are associated with TACs and $PM_{2.5}$ because emissions of these pollutants can have significant adverse health impacts at the local level. If Project-related emissions of TACs or $PM_{2.5}$ exceed any of the following thresholds, the Project would result in a significant adverse impact:

- An excess cancer risk level of more than 10-in-1 million, or a non-cancer (i.e., chronic or acute) hazard index greater than 1.0 would be a significant cumulatively considerable contribution;
- An incremental increase of greater than 0.3 microgram per cubic meter ($\mu g/m^3$) annual average $PM_{2.5}$ from a single source would be a significant cumulatively considerable contribution.

Cancer risks, and acute and chronic hazard indices, are calculated from the estimated concentrations of pollutants in the air and the potential for exposure of people to these pollutants. That process is known as risk assessment. Concentrations in the air are calculated from TAC emissions using air dispersion modeling. Air dispersion modeling is the mathematical estimation of pollutant impacts from emissions sources within a study area. Information on factors that affect the fate and transport of pollutants in the atmosphere, including meteorological conditions, site configuration, emission release characteristics, and surrounding terrain, is used in the dispersion model. Once concentrations are calculated using air dispersion modeling, the risks are calculated using information on how much air people breathe and the toxicity of the chemical considered. The resulting cancer risks and chronic and acute hazard index, as described above, are compared to the BAAQMD significance thresholds to assess significance.

With respect to odors, the significance threshold used is the odor nuisance complaint approach in BAAQMD Regulation 7. The 2010 BAAQMD CEQA Guidelines also provide guidance in the form of screening distances, to help evaluate potential odor impacts.

5.2 Environmental Analysis

5.2.1 Construction Impacts

Impact AQ-1-: Project Construction Would Not Result in Emissions of NOx, PM, and ROGs above BAAQMD Significance Thresholds.

The proposed project would generate construction emissions from a variety of sources, including the following: off-road construction equipment; and on-road worker, vendor, and hauling vehicles. Because construction can fluctuate from year to year, emissions from construction activity are shown for both an average construction year scenario and a "peak"

construction scenario.[22] A summary of emissions and comparison to thresholds is shown in **Table 5-2-1.** Note that construction emissions under the 2000 GUP also occurred during the baseline year as discussed in Section 3.3 and as presented in the baseline emissions inventory (such average annual emissions are estimated to be equivalent to those presented here for the 2018 GUP). Under the 2000 General Use Permit, peak construction emissions are estimated to exceed the peak levels presented here for the 2018 GUP. To be conservative, construction emissions associated with the 2018 GUP are evaluated as new emissions here, without subtracting the baseline emissions. Details on CAP emission calculations for the annual average construction scenario are shown in Appendix A. Peak construction emissions are calculated consistent with the assumptions used in the health risk analysis in terms of the scope and size of the largest construction project built at Stanford under the 2000 GUP. CalEEMod® 2013.2.2 output files for all construction runs are included in Appendix B.[23]

Table 5-2-1: Average Daily Construction Emissions

	Average Daily Emissions (pounds/day)[1]			
	ROG	**NOx**	**Exhaust PM_{10}[2]**	**Exhaust $PM_{2.5}$[2]**
Project Average Construction Scenario - Off-Road Equipment + On-Road Trips (Worker + Vendor + Hauling)	14.9	22.0	2.8	1.3
Significance Threshold	54	54	82	54
Above Threshold?	No	No	No	No
Project Peak Construction Scenario - Off-Road Equipment + On-Road Trips (Worker + Vendor + Hauling)	51.3	41.8	1.1	1.0
Significance Threshold	54	54	82	54
Above Threshold?	No	No	No	No

[22] The "peak" construction scenario for the proposed project was identified to begin in year 2023, five years after commencement of the 2018 GUP. Given the time that it will take to complete the ongoing Escondido Village Graduate Residences and to permit another large project, this year is assumed to be the earliest year construction of a peak project might begin.

[23] On-road worker, vendor, and hauling emissions for the annual average scenarios are calculated using EMFAC2014 and are shown as line items within operational Tables 3-4-6 through 3-4-9. All other emissions for the annual average and peak scenarios were quantified using CalEEMod®, as these emissions did not rely on Fehr & Peers data and were not otherwise quantified for operational inventories.

[1] Construction emissions in lbs/day were calculated by dividing the total CAP emissions by the number of working days. For the annual average scenario, this was the annual emissions divided by 260 days. For the peak construction scenario, this was the total emissions divided by 780 days, since the peak construction project is modeled over three years.

[2] Exhaust PM for the annual average scenario includes tire wear and brake wear PM for on-road vehicles. The BAAQMD Thresholds do not include these sources so the comparison is conservative.

Table 5-2-1 indicates that construction activity associated with the proposed Project would result in emissions of criteria pollutants and precursors that would be below thresholds of significance for all pollutants. Therefore, impacts from emissions of NOx, PM, and or ROGs from construction activities are **less than significant**.

Impact AQ-2: With Inclusion of BAAQMD-Recommended Basic Construction Mitigation Measures, Project Construction Would Result in Less-Than-Significant, Localized Dust-related Air Quality Impacts.

In addition to exhaust emissions from construction equipment, Project-related demolition, excavation, soil stockpiling and handling, and other construction activities may generate wind-blown dust (including PM_{10} and $PM_{2.5}$). Construction-related dust emissions would vary from day to day, depending on the level and type of activity, silt content of the soil, and the weather. In the absence of mitigation, dust generated from construction activities may result in significant adverse impacts on a temporary and intermittent basis during the construction period.

According to BAAQMD significance thresholds, a project would not have a significant adverse air quality impact associated with construction dust if applicable BAAQMD-recommended construction best management practices are required as mitigation measures and implemented during construction activities.

BAAQMD notes that individual best management practices have been shown to reduce fugitive dust by anywhere from 30% to more than 90%, and conclude that projects that implement construction best management practices will reduce fugitive dust emissions to a less-than-significant level.[24]

The Project would implement best management practices (BMPs) to ensure that fugitive dust for Project construction would result in less-than-significant impacts. This mitigation also contains measures that would reduce emissions from construction equipment engine exhaust.

Mitigation Measure AQ-2: All construction activities for the Project shall comply with the following BAAQMD basic construction mitigation measures:

- All exposed surfaces (e.g. parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand or other loose material off-site shall be covered.

[24] BAAQMD. 2010. California Environmental Quality Act Guidelines Update. Proposed Thresholds of Significance. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/draft_baaqmd_ceqa_guidelines_may_2010_final.pdf?la=en Accessed October 2016.

- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweepers is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes. Clear signage shall be provided for construction workers at all access points.
- All construction equipment shall be maintained and properly tuned in accordance with manufacturers' specifications. All equipment shall be checked by a certified visible emissions evaluator.
- Post a publicly visible sign with the telephone number and person to be contacted regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

Implementation of the BMPs above would reduce the impact to a less-than-significant level.

Impact AQ-3: Project Construction Would Not Generate Emissions of TAC and $PM_{2.5}$ At Levels That Would Result in Health Risks above BAAQMD Significance Thresholds.

According to BAAQMD significance thresholds, Project construction would have a significant adverse air quality impact if construction-related emissions of toxic air contaminants would cause an excess cancer risk level exceeding 10 in 1 million, or an acute or chronic HI greater than 1.0, as measured by an HRA model that takes into consideration topography, wind patterns, and other facts in identifying the maximum exposed sensitive receptor. Sensitive receptors include residences, schools, hospitals and convalescent facilities, parks, and churches.

Additionally, BAAQMD has a concentration-based threshold for annual $PM_{2.5}$ concentrations that exceed 0.3 µg/m3.

Off-road equipment (which includes construction-related equipment) is a large contributor to diesel particulate matter (DPM) emissions in California, although since 2007, ARB has found the emissions to be substantially lower than previously expected.[25] Newer and more refined emission inventories have lowered the estimates of DPM emissions from off-road equipment such that off-road equipment is now considered the sixth largest source of DPM emissions in California.[26] For example, ARB's revised estimates of particulate matter (PM) emissions (of

[25] ARB, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* p.1 and p. 13

(Figure 4), October 2010.

[26] ARB, *Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* October 2010.

which DPM is a major component) for the San Francisco Bay Area Air Basin for the year 2010 have decreased by 83 percent from previous 2010 emissions estimates.[27] Approximately half of the reduction in emissions can be attributed to the economic recession and half to updated methodologies used to better assess construction emissions.[28]

Additionally, a number of federal and state regulations are requiring cleaner off-road equipment. Specifically, both the USEPA and California have set emissions standards for new off-road equipment engines, ranging from Tier 1 to Tier 4. Tier 1 emission standards were phased in from 1996 to 2000, and Tier 4 interim and final emission standards for all new engines will be phased in between 2008 and 2015. To meet the Tier 4 emission standards, engine manufacturers will be required to produce new engines with advanced emission-control technologies. Although the full benefits of these regulations will not be realized for several years, the USEPA estimates that by implementing the federal Tier 4 standards, NOx and PM emissions will be reduced by more than 90 percent.[29] Stanford voluntarily has committed to require its construction contractors to use engines meeting Tier 4 standards, with the exception of chainsaws and paving phase equipment. Furthermore, California regulations limit maximum idling times to five minutes, which further reduces public exposure to NOx and PM emissions.[30]

Construction activities do not lend themselves to analysis of long-term health risks because of the location of each individual construction project in relation to a sensitive receptor is temporary and variable. As explained in the BAAQMD's CEQA *Air Quality Guidelines*:

> "Due to the variable nature of construction activity, the generation of TAC emissions in most cases would be temporary, especially considering the short amount of time such equipment is typically within an influential distance that would result in the exposure of sensitive receptors to substantial concentrations. Concentrations of mobile-source diesel PM emissions are typically reduced by 70 percent at a distance of approximately 500 feet (CARB 2005). In addition, current models and methodologies for conducting health risk assessments are associated with longer-term exposure periods of 9, 40, and 70 years, which do not correlate well with the temporary and highly variable nature of construction activities. This results in difficulties with producing accurate estimates of health risk."[31]

Therefore, project-level health risk analyses of construction activities have a tendency to overestimate assessments of long-term health risks.

Although total emissions from construction activities were estimated based on the amount of square footage to be developed between full buildout of the 2000 GUP and full buildout of the 2018 GUP, it is not possible to conduct a health risk assessment (HRA) for each discrete project that will occur through 2035. Accordingly, a screening tool was developed to ensure future construction activities would not result in emissions of toxic air contaminants

[27] ARB, "In-Use Off-Road Equipment, 2011 Inventory Model," http://www.arb.ca.gov/msei/categories.htm#inuse_or_category.

[28] ARB*, Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Proposed Amendments to the Regulation for In-Use Off-Road Diesel-Fueled Fleets and the Off-Road Large Spark-Ignition Fleet Requirements,* October 2010*.*

[29] USEPA, "Clean Air Nonroad Diesel Rule: Fact Sheet," May 2004.

[30] California Code of Regulations, Title 13, Division 3, § 2485.

[31] BAAQMD, *CEQA Air Quality Guidelines,* May 2011, page 8-6.

exceeding BAAQMD health risk significance thresholds. All particulate matter less than 10 µm in diameter (PM_{10}) is assumed to be diesel particulate matter (DPM) for purposes of health risk calculations.

The tool is based on a health risk assessment described in **Appendix D**, which reflects the largest quantity of earth moving and the largest amount of above and below ground construction that Stanford has undertaken for a single project under the 2000 General Use Permit. It is likely to be larger than any single project that would be constructed under the 2018 General Use Permit. This analysis has been adapted to evaluate a variety of potential project sizes and distances from sensitive receptors. The resulting analysis demonstrates that:

- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 3,270,000 square feet of combined building and/or parking structure area) and with up to 900,000 cubic yards of debris/soil exported, as long as:
  - The nearest childcare facility is farther than 140 meters from the project construction boundary
  - The nearest residence housing children is farther than 50 meters from the project construction boundary
  - The nearest adult resident is farther than 10 meters from the project construction boundary.[32]

If project construction will be closer than these distances from a sensitive receptor, the following additional screens should be employed:

- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 540,000 square feet of combined building and/or parking structure area and with up to 150,000 cubic yards of debris/soil exported, as long as:
  - The nearest childcare facility is farther than 50 meters from the project construction boundary
  - The nearest resident is farther than 10 meters from the project construction boundary.
- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 180,000 square feet of combined building and/or parking structure area and with up to 50,000 cubic yards of debris/soil exported, as long as:
  - The nearest childcare facility is farther than 30 meters from the project construction boundary
  - The nearest resident is farther than 10 meters from the project construction boundary.

[32] Ramboll Environ conducted a conservative quantitative analysis of $PM_{2.5}$ concentrations for the largest project size confirming that $PM_{2.5}$ concentrations are below thresholds in all locations, including locations close to the theoretical project where cancer risk is above thresholds.

- Health risk standards will not be exceeded, and a project-specific health risk analysis is not required, for any single construction project that is up to 45,000 square feet of combined building and/or parking structure area and with up to 12,500 cubic yards of debris/soil exported, as long as:
  - The nearest resident or childcare is farther than 10 meters from the project construction boundary.

The distances stated above are summarized in **Table 5-2-2**.

Table 5-2-2: Construction Health Risk Screening Distances

Maximum Project Size	Minimum Distance (m) to Nearest Receptor Type		
	Childcare Facility	Child Resident	Adult Resident
3,270,000 square feet; 900,000 CY debris/soil export	140	50	10
540,000 square feet; 150,000 CY debris/soil export	50	10*	10*
180,000 square feet; 50,000 CY debris/soil export	30	10*	10*
45,000 square feet; 12,500 CY debris/soil export	10*	10*	10*

*The screening tool also stipulates that a 10-meter buffer must exist around the project fence line where no sensitive receptor can reside. If Stanford wishes to construct a small project (within the limits set forth by the final screen listed above that does not include distance criteria) inside the 10-meter buffer, directly adjacent to a childcare facility, the project must both comply with the screening limits presented above and construction activities using diesel-powered equipment must not occur when children are present (meaning work must occur during off-hours[33] and/or on the weekends) in order to screen out of conducting a health risk analysis. See **Appendix D** for additional information regarding the screening tool.

If a construction project does not fit within the screening tool parameters, then the following mitigation measure should be implemented:

> Mitigation Measure AQ-3: If a construction project does not fit within the Health Risk Assessment screening parameters, Stanford shall submit to the County Planning Office a project-specific health risk analysis demonstrating that project construction activities will not result in a significant acute, chronic non-cancer or cancer-related health risk to sensitive receptors.

[33] "Off-hours" refer to the periods of time when childcares are not in session.

This mitigation measure would ensure **less-than-significant impacts** on health risk from construction activities.

5.2.2 Operational Impacts

Impact AQ-4: Project Operations Would Not Result in Emissions of NOx, PM, and ROGs above BAAQMD Significance Thresholds.

The proposed project would generate operational emissions from a variety of sources, including the following: new vehicle trips and offroad area sources; maintenance operation of diesel emergency generators and boilers; new laboratories; and fueling stations. Because construction activity is on-going and construction emissions occur throughout the life of the General Use Permit, emissions from off-road construction equipment have been included in the operational emissions. Details on CAP emission calculations are shown in Appendix A.

USEPA emission factors were used for the emergency generators and boilers. Vehicle trip emissions were calculated using EMFAC2014 emissions factors from ARB, based on vehicle trip generation rates developed for this project.

The results of the project operational criteria air pollutant emissions calculations are presented in **Table 5-2-3**. Details on calculations and methodology are provided in the technical appendix A. For purpose of this comparison, $PM_{2.5}$ is conservatively assumed to equal PM_{10} for non-mobile sources, though in reality only a fraction of total PM_{10} is $PM_{2.5}$. Table 5-2-3 indicates that operational criteria air pollutant emissions of the proposed project would result in emissions of criteria pollutants and precursors that would be below thresholds of significance for all pollutants. Therefore, impacts from emissions of NOx, PM, and or ROGs from operational activities are **less than significant**.

Table 5-2-3: Average Daily And Maximum Annual Operational Emissions (Change from Fall 2018 to Fall 2035)

	Average Daily Emissions (pounds/day)			
	ROG	**NOx**	**PM_{10}**	**$PM_{2.5*}$**
Emission Source				
Mobile Sources (including construction off-road equipment)	-57	-214	48	10
Hot Water Generators	0.4	0.7	0.5	0.5
Replacement Process Steam Plant	0.3	1.0	0.4	0.4
Other Natural Gas (e.g., PGE boilers)	1.4	26	2.0	2.0
Emergency Generators	0.5	8.9	0.3	0.3
Laboratories	18.6	-	-	-

Table 5-2-3: Average Daily And Maximum Annual Operational Emissions (Change from Fall 2018 to Fall 2035)

	Average Daily Emissions (pounds/day)			
	ROG	**NOx**	**PM_{10}**	**$PM_{2.5}$***
Fuel Stations	-0.2	-	-	-
Total	-36	-178	52	13
Significance Threshold	54	54	82	54
Above Threshold?	No	No	No	No
	Maximum Annual Emissions (short tons/year)			
	ROG	**NOx**	**PM_{10}**	**$PM_{2.5}$**
Emission Source				
Mobile Sources (including construction off-road equipment)	-10	-39	8.8	1.8
Hot Water Generators	0.1	0.1	0.1	0.1
Replacement Process Steam Plant	0.1	0.2	0.1	0.1
Other Natural Gas (e.g., PGE boilers)	0.3	4.7	0.4	0.4
Emergency Generators	0.01	1.6	0.05	0.05
Laboratories	3.4	-	-	-
Fuel Stations	-0.04	-	-	-
Total	-6.5	-32	9.4	2.3
Significance Threshold	10	10	15	10
Above Threshold?	No	No	No	No

* For purpose of this comparison, $PM_{2.5}$ from non-mobile sources is conservatively assumed to equal PM_{10}, though in reality only a fraction of total PM_{10} is $PM_{2.5}$.

Impact AQ-5: Project Operations Would Not Generate Emissions of TAC and $PM_{2.5}$ That Would Result in Health Risks above BAAQMD Significance Thresholds.

The sources of TAC emissions that would occur during the operational phase of the project include emissions from mobile sources (passenger vehicles and delivery vehicles), and stationary sources (diesel generators and laboratory fume hood stacks).

Mobile source air toxics are compounds emitted from highway vehicles, which are known or suspected to cause cancer or other serious health and environmental effects. Examples of mobile source air toxics include benzene, 1,3-butadiene, formaldehyde, acetaldehyde, acrolein, polycyclic organic matter (POM), naphthalene, and diesel particulate matter.

Under the Project, new diesel emergency back-up generators may be installed during development under the 2018 GUP. To install new diesel generators, if larger than 50 horsepower, Stanford must obtain a permit from the BAAQMD and comply with the Air Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines. As a practical matter, the BAAQMD will not issue a permit for a new generator that results in an operational cancer risk greater than 10 in one million. Accordingly, the following mitigation measure would ensure new generators would not result in a significant health risk:

> Mitigation Measure AQ-5(a): Any new diesel-fired emergency generator with a rated power of 50 horsepower is required to have a permit with the BAAQMD. In accordance with BAAQMD Regulations 2-1 and 2-5, new sources of emissions must implement Best Available Control Technology for Toxics (T-BACT) if individual source risks exceed 1.0 in a million for cancer and/or chronic hazard index is greater than 0.20. Additionally, a permit will be denied if project cancer risk exceeds 10.0 in a million or if chronic or acute hazard index exceeds 1.0. Compliance with BAAQMD rules will ensure that new emergency generators will not result in a significant impact.

Under the proposed 2018 General Use Permit, chemical usage in laboratories could increase. The Project inventory assumes that chemical usage would increase proportionate to the increase in new academic and support square footage. Chemical usage across all laboratories from full buildout of the proposed Project was compared to baseline emissions at commencement of project operations. The resulting incremental difference in emissions was used to calculate potential cancer risk, and non-cancer acute and chronic health risks. This risk estimation conservatively assumed all receptors were sensitive populations being maximally exposed (as a resident). Additionally, the Project's incremental increase for all laboratory chemicals were assumed to be emitted from one stack instead of various stacks spread across campus, which overestimates concentrations at the nearest receptor. TAC emissions dispersion was estimated in a model accounting for local meteorological conditions. Further details on the methods for risk estimation for laboratories can be found in Appendix E. Under these highly conservative conditions, the incremental increase in cancer risk is calculated to be 4.5 in one million, which is well below the BAAQMD significance threshold of 10 in a million. Acute and chronic hazard indices (HIs) would increase by 0.03 and 0.01, respectively, which are also well below the BAAQMD significance threshold of 1.0. Therefore, impacts on health risks from laboratory TAC emissions from full build out of the proposed Project would be less than significant.

Additionally, under the Project, the following mitigation measure would ensure new laboratory space would not result in a significant health risk:

> Mitigation Measure AQ-5(b): For any proposed building project that contains more than 25,000 square feet of emissions generating laboratory space within a building **and** 50 fume foods, Stanford shall conduct a risk screening analysis and obtain a

permit from the BAAQMD for the proposed building project; this permit may be required either prior to or as a condition of approval of the proposed building project. In accordance with BAAQMD Regulations 2-1 and 2-5, new sources of emissions must implement Best Available Control Technology for Toxics (T-BACT) if individual source risks exceed 1.0 in a million for cancer and/or chronic hazard index is greater than 0.20. Additionally, a permit will be denied if project cancer risk exceeds 10.0 in a million or if chronic or acute hazard index exceeds 1.0. Compliance with BAAQMD rules will ensure that new laboratory operations will not result in a significant impact.

TAC and $PM_{2.5}$ emissions from mobile sources will be reduced under the Project compared to baseline conditions, resulting in a reduction of health risks from mobile sources. Consequently, the Project is considered to have a less than significant impact with regard to health risks from mobile sources and risks from mobile sources were not further evaluated.

As described in Section 4.1.1, natural gas combustion results in emissions of benzene, formaldehyde, and toluene. Under the Project, there would be an increase in these TAC emissions due to an increase in natural gas combustion associated with residential and non-residential growth, as shown in **Table 4-2**. However, these increases would be minimal and any newly permitted sources would meet BAAQMD standards. Therefore, impacts on health risks from natural gas combustion would be less than significant.

Therefore, impacts to health risk from emissions of TACs and $PM_{2.5}$ from operational activities would be **less than significant**.

Impact AQ-6: Project Operations Would Not Result in Local Concentrations of CO above BAAQMD Significance Thresholds.

BAAQMD provides a screening methodology based on peak hourly traffic volumes to evaluate potential impacts of CO emissions from mobile sources. The screening methodology focuses on intersections with vehicle traffic exceeding 44,000 vehicles per hour after Project buildout (or 24,000 vehicles per hour in locations with limited vertical or horizontal air mixing) that could violate or contribute to a violation of ambient air quality standards for CO. Based on the estimated Project-related traffic and existing traffic in the area, it is not expected that any of the intersections near the Project would experience more than 24,000 vehicles per hour at full buildout. Thus, the Project would not be expected to contribute to a violation of CO air quality standards.

Therefore, impacts to local concentrations of CO from operational activities are **less than significant**.

5.2.3 General Impacts

Impact AQ-7: The Project Would Not Result in Objectionable Odors.

The BAAQMD CEQA Guidelines identify wastewater treatment plants, oil refineries, asphalt plants, chemical manufacturing, painting/coating operations, coffee roasters, food processing facilities, recycling operations and metal smelters as odor sources of particular concern, and recommends buffer zones of one to two miles around them to avoid potential odor conflicts. The potential for the Project to result in objectionable odors is **less than significant**.

Impact AQ-8: The Project Would Not Conflict with Existing Air Quality Plans.

The most recently adopted air quality plan for the Bay Area is the 2010 Clean Air Plan (CleanAir Plan), which is an update to the BAAQMD's 2005 Ozone Strategy to comply with

State air quality planning requirements. The Clean Air Plan also serves as a multi-pollutant air quality plan to protect public health and the climate. The Clean Air Plan control strategy includes revised, updated, and new measures in the three traditional control measure categories: stationary sources measures, mobile source measures, and transportation control measures. In addition, the Clean Air Plan identifies two new categories of control measures, including land use and local impact measures and energy and climate measures.

The 2010 BAAQMD CEQA Guidelines recommend that consistency with the Clean Air Plan be used to evaluate plan-level projects.[34] This recommendation is applicable to long range plans (e.g., general plan, redevelopment plans, specific plans, area plans, community plans, regional plans, congestion management plans, etc.). Even though the proposed 2018 General Use Permit is not a plan-level project, this Air Quality Technical Report conservatively applies the BAAQMD CEQA Guidelines for plan-level approvals.

The 2010 BAAQMD CEQA Guidelines recommend the consideration of three questions:

- Does the project support the primary goals of the air quality plan;
- Does the project include applicable control measures from the air quality plan; and
- Does the project disrupt or hinder implementation of any Clean Air Plan control measures?

With regard to the first question, the BAAQMD CEQA Guidelines provide a basis for assessing support of the primary goals. The primary goals of the 2010 Bay Area Clean Air Plan are to:

- Attain air quality standards;
- Reduce population exposure and protect public health in the Bay Area; and
- Reduce GHG emissions and protect the climate.

Any project (i.e., project or plan) that would not support these goals would not be considered consistent with the 2010 Clean Air Plan. If approval of a project would not result in significant and unavoidable air quality impacts, after the application of all feasible mitigation, the project may be considered consistent with the 2010 Clean Air Plan.

The second question recommended in the 2010 BAAQMD CEQA Guidelines for evaluating consistency with the Clean Air Plan is whether the project includes applicable control measures from the air quality plan. The Clean Air Plan includes 55 control measures to reduce emissions of PM, PM precursors, and other air pollutants from a wide variety of emission sources. The control measures can be classified into six main categories: Stationary Source Measures, Mobile Source Measures, Transportation Control Measures, Land Use and Local Impact Measures, Energy and Climate Measures, and Further Study Measures.

The following attributes of the proposed Project and Stanford's ongoing programs will further the goals of the Clean Air Plan:

- MSM A-2: Zero Emission Vehicles and Plug-in Hybrids. Stanford will continue to convert its campus fleets to electric vehicles. The Bonair fleet will be 70% electric by 2035.
- MSM B-1: HDV Fleet Modernization. Stanford will replace all of its Marguerite bus fleet with electric buses by 2035.

[34] BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. May.

- MSM C-1: Construction and Farming Equipment. The Project will use Tier 4 Final construction equipment and will comply with BAAQMD BMPs for construction, except for chainsaws and paving phase equipment.
- TCM A-1: Improve Local and Areawide Bus Service. Stanford provides local bus service with its Marguerite campus fleet.
- TCM D-1: Improve Bicycle Access and Facilities. Stanford provides bike paths, lanes, secure storage, and shower facilities.
- ECM 1: Energy Efficiency. Stanford has improved energy efficiency campus-wide through its SESI project.
- ECM 2: Renewable Energy. Stanford is installing solar panels on campus buildings, and will source electricity from the Stanford Solar Generation plant by 2017.

The final basis for evaluation consistency with the Clean Air Plan is whether the Project would disrupt or hinder implementation of any Clean Air Plan control measure. The Project would not affect any Mobile Source Measures, Stationary Source Measures, Transportation Control Measures, Land Use and Local Impact Measures, Energy and Climate Measures, or Further Study Measures and is consistent with applicable Transportation Control Measures. The Project therefore would not conflict with or obstruct implementation of the Clean Air Plan. The Project's impacts relative to the goals of the Clean Air Plan would be **less than significant**.

5.2.4 Cumulative Impacts

Impact AQ-9: The Project Would Not Result in Operational Emissions of NOx, PM, or ROGs that are Cumulatively Considerable.

BAAQMD developed thresholds of significance with consideration of individual project emission levels that would be cumulatively considerable. If a project exceeds the identified project significance levels, then its emissions would be cumulatively considerable. Table 5-2-3 shows that Project operational and construction emissions do not exceed emission thresholds for NOx, PM, or ROGs. Therefore emissions of NOx, PM, or ROGs from the Project does not result in a cumulatively considerable contribution to a cumulative air quality impact.

TABLES

Table 3-1-1
2014, 2015, Fall 2018, and Fall 2035 CAP Emissions - Summary
Stanford University
Stanford, CA

Sources	Criteria Pollutant Emissions																							
	2014 Inventory						2015 Inventory						Fall 2018 (Baseline) Inventory						Fall 2035 (Project) Inventory[1]					
	NO_X	CO	SO_2	ROG	PM_{10}	$PM_{2.5}$[2]	NO_X	CO	SO_2	ROG	PM_{10}	$PM_{2.5}$[2]	NO_X	CO	SO_2	ROG	PM_{10}	$PM_{2.5}$[2]	NO_X	CO	SO_2	ROG	PM_{10}	$PM_{2.5}$[2]
	[ton/yr]						[ton/yr]						[ton/yr]						[ton/yr]					
Stationary Sources																								
Cardinal Cogen	101	83	1.1	40	24	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water Generators	-	-	-	-	-	-	0.56	1.9	0.030	0.30	0.35	0.35	0.61	2.1	0.032	0.33	0.38	0.38	0.74	2.5	0.039	0.40	0.47	0.47
Replacement Process Steam	-	-	-	-	-	-	0.76	12	0.024	0.22	0.31	0.31	0.82	13	0.026	0.24	0.33	0.33	1.0	16	0.032	0.29	0.40	0.40
Other Natural Gas (e.g., PGE boilers)	7.2	6.0	0.043	0.39	0.54	0.54	17	15	0.10	1.0	1.3	1.3	19	16	0.11	1.0	1.4	1.4	23	20	0.14	1.3	1.8	1.8
Emergency Generators	5.9	1.3	0.0036	0.28	0.15	0.15	6.8	1.7	0.0051	0.35	0.20	0.20	7.3	1.9	0.01	0.3827	0.21	0.21	9.0	2.3	0.01	0.4674	0.26	0.26
Laboratories	-	-	-	14	-	-	-	-	-	14	-	-	-	-	-	15	-	-	-	-	-	19	-	-
Valero Fuel Station	-	-	-	0.54	-	-	-	-	-	0.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bonair Fuel Station	-	-	-	0.078	-	-	-	-	-	0.078	-	-	-	-	-	0.074	-	-	-	-	-	0.037	-	-
Subtotal [ton/yr]	**114**	**90**	**1.1**	**55**	**25**	**25**	**25**	**31**	**0.16**	**17**	**2.2**	**2.2**	**27**	**33**	**0.18**	**17**	**2.3**	**2.3**	**34**	**41**	**0.22**	**21**	**2.9**	**2.9**
Mobile Sources																								
Worker Trips	13	128	0.24	18	3.2	1.3	13	128	0.24	18	3.2	1.3	7.2	74	0.22	7.6	3.2	1.4	2.7	36.3	0.2	3.8	3.8	1.5
Resident Trips	10	105	0.15	19	1.9	0.8	10	105	0.15	19	1.9	0.8	5.0	54	0.14	7	1.9	0.8	2.6	36.8	0.2	5.4	3.3	1.4
Campus Vehicles - On Road	27	15	0.062	2.4	1.9	0.9	27	15	0.062	2.4	1.9	0.9	22	15	0.057	1.9	1.8	0.9	1.8	3.1	0.0	0.6	2.1	0.9
Campus Vehicles - Off Road	2.1	18.5	0.0041	4.4	0.19	0.2	2.1	18.5	0.0041	4.4	0.19	0.18	2.1	18.5	0.0041	4.4	0.19	0.18	2.1	18.5	0.0	4.4	0.19	0.18
Other Trips	25	89	0.16	15	2.6	1.2	25	89	0.16	15	2.6	1.2	17	52	0.16	6.8	2.6	1.2	5.6	26.3	0.1	3.6	2.8	1.2
Entrained Roadway Dust	-	-	-	-	19.8	3.0	-	-	-	-	19.8	3.0	-	-	-	-	20.6	3.1	-	-	-	-	27.1	4.1
Construction Off-Road Equipment[3]	0.62	2.7	0.0042	1.3	0.21	0.21	0.60	2.7	0.0042	1.3	0.21	0.21	0.51	2.7	0.0042	1.2	0.20	0.20	0.4	2.7	0.0	1.2	0.19	0.19
Subtotal [ton/yr]	**77**	**358**	**0.62**	**60**	**30**	**7.7**	**77**	**358**	**0.62**	**60**	**30**	**7.7**	**54**	**215**	**0.58**	**29**	**31**	**7.7**	**15**	**124**	**0.47**	**19**	**39**	**9.5**
Total [ton/year]	**192**	**449**	**1.7**	**115**	**55**	**33**	**103**	**389**	**0.79**	**76**	**32**	**9.8**	**82**	**248**	**0.75**	**47**	**33**	**10**	**49**	**165**	**0.69**	**40**	**42**	**12**

Notes:

1. Fall 2035 represents full buildout of the Project. Mobile emission factors are conservatively used from year 2030, to be consistent with the GHG report and comparison to State 2030 targets.
2. $PM_{2.5}$ is conservatively assumed to equal PM_{10} for non-mobile sources, even though only a fraction of PM_{10} is $PM_{2.5}$.
3. Construction emissions are estimated using CalEEMod® 2013.2.2 using the average annual square footage of construction and demolition and estimated excavation from fiscal year 2001 through fiscal year 2015 with default construction schedules and equipment lists. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment.

Abbreviations:

CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns
ROG - reactive organic gas
SO_2 - sulfur dioxide
ton - short tons
yr - year

Table 3-4-1
2014 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		Emission Factors[3]					Emissions				
			NO_x	VOC	CO	SO_2	PM_{10}	NO_x	VOC	CO	SO_2	PM_{10}
	[therms]	[MMBtu]	[lb/MMBtu]					[ton/yr]				
Other Natural Gas												
PGE Residential[1]	632,937	63,294	0.0980	0.0054	0.0824	0.0006	0.0075	3.1	0.17	2.6	0.019	0.24
PGE Commercial[1]	814,953	81,495						4.0	0.22	3.4	0.024	0.30
PGE Searsville/Olmstead[2]	13,408	1,341						0.066	0.0036	0.055	0.00039	0.0050
Total	**1,461,298**	**146,130**						**7.2**	**0.39**	**6.0**	**0.043**	**0.54**

Notes:

1. Annual Natural Gas usage provided by Stanford. Addresses were geocoded, and natural gas use from addresses outside of unincorporated Santa Clara County was removed. Cardinal Cogen emissions are shown separately in Table 3-4-2.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. Criteria pollutant emission factors obtained from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. The emission factors were converted from lb/10^6 scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
lb - pound
MMBTU - million British thermal units
NO_x - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter less than 10 µm in diameter
scf - standard cubic foot
SO_2 - sulfur dioxide
therms - 100,000 British thermal units
ton - short tons
VOC - volatile organic compounds
yr - year

Sources:

CFR. Title 40. Part 98. Mandatory Greenhouse Gas Reporting.

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed March, 2013

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Table 3-4-2
2014 CAP Emissions - Cardinal Cogen
Stanford University
Stanford, CA

Facility	Emissions Sources	Average Daily Emissions [lbs/day]					Annual Emissions [tons/year]				
		NO_X	CO	VOC	SO_2	PM_{10}	NO_X	CO	VOC	SO_2	PM_{10}
Cardinal Cogen	Cogen Total Emissions[1,2]	555	455	218	5.9	134	101	83	40	1.1	24

Notes:

1. BAAQMD 2014 Cardinal Cogen Criteria Air Pollutant Emissions (For 2014 calendar year emissions) presents annual average emissions in lbs/day for criteria pollutants. Ramboll Environ assumed 365 days/year to calculate total annual emissions.
2. Although the Cardinal Cogen exports electricity and steam to outside the study area, all CAP and TAC emissions are assumed to contribute to local air quality and are therefore included here.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CAP - criteria air pollutants
CO - carbon monoxide
GUP - general use permit
lb - pound
NO_X - nitrogen oxides
PM_{10} - particulate matter less than 10 µm in diameter
SO_2 - sulfur dioxide
TAC - toxic air contaminants
VOC - volatile organic compounds

Table 3-4-3
2015 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Annual Natural Gas Usage[1]	Emission Factors[2]					Emissions				
		NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}
	[MMBtu/yr]	[lb/MMBtu]					[ton/yr]				
Hot Water Generators	101,408	0.011	0.038	0.00059	0.0060	0.0070	0.56	1.9	0.030	0.30	0.35
Replacement Process Steam Plant	82,363	0.018	0.3001	5.9E-04	0.0054	0.0075	0.76	12	0.024	0.22	0.31
Other Natural Gas - Total	354,139	0.098	0.08	5.9E-04	0.0054	0.0075	17	15	0.10	0.95	1.3
PGE Residential	56,643						2.8	2.3	0.017	0.15	0.21
PGE Commercial	296,155						15	12	0.087	0.80	1.1
PGE Searsville/Olmstead[3]	1,341						0.066	0.055	0.00039	0.0036	0.0050
Total	**537,910**						**18.7**	**28.8**	**0.16**	**1.48**	**1.98**

Notes:

1. Annual Natural Gas usage provided by Stanford. Natural gas use within Stanford Academic Growth Boundary within unincorporated Santa Clara County in the A1 zoning areas. Natural gas data from the last six months of 2015 was scaled to approximate a full year of post-RCEF operations.
2. Hot Water Generator and Replacement Process Steam Plant boiler emission factors were provided by Stanford; the hot water generator emission factors are from the vendor except for SO_2 from AP-42. The replacement process steam plant NO_X and CO factors are based on BAAQMD Regulation 9-7, with all other emission factors from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. For the remaining boilers, USEPA AP-42 emission factors were used for general natural gas use and exampt small boilers. The emission factors were converted from lb/10^6 scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas. We assume that individual replacement boilers are covered by general natural gas use and that estimates are conservative by doing so. See table below for emission factor comparison.

Source	NO_x [lb/MMBtu]	CO [lb/MMBtu]	SO_2 [lb/MMBtu]	ROG [lb/MMBtu]	PM_{10} [lb/MMBtu]	EF Source
General Natural Gas	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Exempt Small Boilers	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Individual Replacement Boilers	0.037	0.3001	0.000588	0.005392	0.007451	AP42; 30 ppmv for NO_X, 400 ppmv for CO

3. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
EF - emission factor
lb - pound
MMBTU - million British thermal units
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter less than 10 µm in diameter
$PM_{2.5}$ - particulate matter less than 2.5 µm in diameter
ppmv - part per million volume
RCEF - replacement central energy facility

References:

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed July, 2016.

Table 3-4-4
Fall 2018 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Fall 2015 Annual Natural Gas Usage[1]	Scaling for Fall 2018[2]	Fall 2018 Annual Natural Gas Usage	Emission Factors[3]					Emissions				
				NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}
	[MMBtu/yr]	[%]	[MMBtu/yr]	[lb/MMBtu]					[ton/yr]				
Hot Water Generators	101,408	8%	109,605	0.011	0.038	5.9E-04	0.0060	0.0070	0.61	2.1	0.032	0.33	0.38
Replacement Process Steam Plant	82,363	8%	89,021	0.018	0.30	5.9E-04	0.0054	0.0075	0.82	13	0.026	0.24	0.33
Other Natural Gas - Total	354,139		379,172						19	16	0.11	1.0	1.4
PGE Residential	56,643	4%	58,626						2.9	2.4	0.017	0.16	0.22
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007	0.098	0.08	5.9E-04	0.0054	0.0075	0.54	0.45	0.0032	0.030	0.041
PGE Commercial - Remaining[4]	285,148	8%	308,198						15	13	0.091	0.83	1.1
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341						0.066	0.055	3.9E-04	0.0036	0.0050
Total	**537,910**		**577,799**						**20.0**	**31.0**	**0.17**	**1.6**	**2.1**

Notes:

1. 2015 Annual Natural Gas usage details are shown in **Table 3-4-3.**

2. Scaling for Fall 2018 is primarily based on the increase in academic square footage and student beds expected from December 2015 to Fall 2018. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the Hot Water Generators, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings.

3. Hot Water Generator and Replacement Process Steam Plant boiler emission factors were provided by Stanford; the hot water generator emission factors are from the vendor except for SO_2 from AP-42. The replacement process steam plan NOx and CO factors are based on BAAQMD Regulation 9-7, with all other emission factors from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. For the remaining boilers, USEPA AP-42 emission factors were used for general natural gas use and exampt small boilers. The emission factors were converted from lb/106 scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas. We assume that individual replacement boilers are covered by general natural gas use and that estimates are conservative by doing so (except for CO). See table below for emission factor comparison.

Source	NO_X	CO	SO_2	ROG	PM_{10}	EF Source
	[lb/MMBtu]					
General Natural Gas	0.09804	0.08235	0.00059	0.00539	0.00745	AP-42
Exempt Small Boilers	0.09804	0.08235	0.00059	0.00539	0.00745	AP-42
Individual Replacement Boilers	0.037	0.3001	0.00059	0.00539	0.00745	AP42; 30 ppmv for NO_x, 400 ppmv for CO

4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.

5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
BTU - British thermal units
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CEF - Central Energy Facility
CO - carbon monoxide
GUP - general use permit
lb - pound
MMBTU - million British thermal units
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns diameter
ppmv - parts per million by volume
ROG - reactive organic gas
scf - standard cubic foot
SO_2 - sulfur dioxide
ton - short tons
USEPA - United States Environmental Protection Agency
yr - year

References:

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed July, 2016.

Table 3-4-5
Fall 2035 CAP Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Fall 2018 Annual Natural Gas Usage[1]	Scaling for Fall 2035[2]	Fall 2035 Annual Natural Gas Usage	Emission Factors[3]					Emissions				
				NO_X	CO	SO_2	ROG	PM_{10}	NO_X	CO	SO_2	ROG	PM_{10}
	[MMBtu/yr]	[%]	[MMBtu/yr]	[lb/MMBtu]					[ton/yr]				
Hot Water Generators	109,605	22%	133,845	0.011	0.038	5.9E-04	0.0060	0.0070	0.74	2.5	0.039	0.40	0.47
Replacement Process Steam Plant	89,021	22%	108,709	0.018	0.30	5.9E-04	0.0054	0.0075	1.01	16	0.032	0.29	0.40
Other Natural Gas - Total	379,172		475,887						23	20	0.140	1.3	1.8
PGE Residential	58,626	38%	80,651						4.0	3.3	0.024	0.22	0.30
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007	0.098	0.08	5.9E-04	0.0054	0.0075	0.54	0.45	0.0032	0.030	0.041
PGE Commercial - Remaining[4]	308,198	22%	376,358						18	15	0.111	1.01	1.4
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341						0.066	0.055	0.00039	0.0036	0.0050
PGE New Faculty/Staff Housing[6]	0	N/A	6,531						0.320	0.269	0.00192	0.0176	0.0243
Total	**577,799**		**718,441**						**25.1**	**38.4**	**0.21**	**2.0**	**2.6**

Notes:

1. Fall 2018 Annual Natural Gas usage details are shown in **Table 3-4-4.**
2. Scaling for Fall 2035 is primarily based on the increase in academic square footage and student beds expected from Fall 2018 to full buildout of the 2018 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the Hot Water Generators, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. Estimates for new faculty/staff housing are added. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.
3. Hot Water Generator and Replacement Process Steam Plant boiler emission factors were provided by Stanford; the hot water generator emission factors are from the vendor except for SO_2 from AP-42. The replacement process steam plan NOx and CO factors are based on BAAQMD Regulation 9-7, with all other emission factors from Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. For the remaining boilers, USEPA AP-42 emission factors were used for general natural gas use and exampt small boilers. The emission factors were converted from lb/106 scf to lb/MMBtu using BAAQMD default high heating value of 1,020 BTU/scf for natural gas. We assume that individual replacement boilers are covered by general natural gas use and that estimates are conservative by doing so. See table below for emission factor comparison.

Source	NO_X	CO	SO_2	ROG	PM_{10}	EF Source
	[lb/MMBtu]					
General Natural Gas	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Exempt Small Boilers	0.098039	0.082353	0.000588	0.005392	0.007451	AP-42
Individual Replacement Boilers	0.037	0.3001	0.000588	0.005392	0.007451	AP42; 30 ppmv for NO_x, 400 ppmv for CO

4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® version 2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.
6. This represents the natural gas consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. The annual natural gas use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
BAAQMD - Bay Area Air Quality Management District
BTU - British thermal units
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CEF - Central Energy Facility
CO - carbon monoxide
GUP - general use permit
lb - pound
MMBTU - million British thermal units
NO_X - nitrogen oxides
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns diameter
ppmv - parts per million by volume
ROG - reactive organic gas
scf - standard cubic foot
SO_2 - sulfur dioxide
ton - short tons
USEPA - United States Environmental Protection Agency
yr - year

References:

USEPA. 1995. AP 42, Volume I, Fifth Edition. §1.4. Natural Gas Combustion. Available online at: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf. Accessed July, 2016.

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Table 3-4-6
2014 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][11]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	234	2.0	70,286		512,385	0.21	1.2	0.12	0.027	0.011	0.0021
	Graduate	1,259	2.0	523,894		4,793,631	1.6	11	1.0	0.25	0.11	0.019
	Post-doc	555	2.0	246,412		2,335,983	0.74	5.1	0.50	0.12	0.052	0.0092
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160	7.4	57	5.6	1.4	0.61	0.11
	Casual Employees	302	2.0	133,960		1,793,719	0.42	3.5	0.35	0.093	0.039	0.0070
	Contingent Employees	294	2.0	130,354		1,596,836	0.41	3.2	0.32	0.083	0.035	0.0062
	Temporary Employees	604	2.0	268,165		3,421,786	0.84	6.8	0.68	0.18	0.075	0.013
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407	0.23	1.8	0.18	0.046	0.020	0.0035
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239	1.3	10	1.0	0.25	0.11	0.019
	Third Party Contractors	244	2.0	108,178		1,537,214	0.34	2.9	0.30	0.080	0.034	0.0060
	Janitorial Shift Workers	195	2.0	86,543		1,229,771	0.28	2.4	0.24	0.064	0.027	0.0048
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596	2.5	11.9	1.11	0.20	0.084	0.016
	Construction	975	2.0	432,713		6,148,856	1.4	12	1.2	0.32	0.13	0.024
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**	**18**	**128**	**13**	**3.2**	**1.3**	**0.24**
On-Campus (Resident) Trips[3]	Undergraduate	1,582	5.91	1,962,450		7,612,107	5.0	25	2.3	0.40	0.17	0.032
	Graduate	3,648	4.5	5,264,378		27,554,538	13.8	78	7.4	1.45	0.62	0.114
	Post-doc	28	3.7	33,580		168,975	0.089	0.49	0.046	0.0089	0.0038	7.0E-04
	Faculty/Staff	98	3.1	109,500		616,735	0.3	2	0.2	0.03	0.01	0.003
	Sub-Total	**5,356**		**7,369,908**		**35,952,355**	**19**	**105**	**9.9**	**1.9**	**0.81**	**0.15**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	0.83	6.9	0.65	0.17	0.072	0.013
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	0.0037	0.032	0.027	0.0070	0.0041	3.0E-04
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	0.025	0.14	0.62	0.030	0.0013	6.6E-04
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	0.092	0.68	0.064	0.017	0.0072	0.0013
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.56	2.5	11	0.36	0.20	0.016
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.0069	0.061	0.050	0.013	0.0078	0.0010
	Marguerite[10]	66				1,983,931	0.78	4.7	15	1.3	0.63	0.029
	Public Safety	31	2.8	31,879	7.3	232,720	0.058	0.48	0.045	0.012	0.0050	9.1E-04
	Sub-Total	**700**		**614,290**		**8,594,006**	**2.4**	**15**	**27**	**1.9**	**0.93**	**0.062**
Other Trips[3]	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	12	65	6.2	1.3	0.56	0.10
	Worker Non-Commute Trips			301,920		935,952	0.71	3.6	0.33	0.050	0.022	0.0041
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443	0.48	5.1	0.53	0.15	0.064	0.011
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.31	1.7	6.8	0.39	0.24	0.0078
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	1.0	11	1.2	0.34	0.14	0.026
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	0.50	2.3	10	0.31	0.18	0.014
	Construction Vendor Trucks[12]		*2.4*	*8,510*		*62,123*	*0.07*	*0.61*	*0.62*	*0.017*	*0.012*	*0.0012*
	Construction Haul Trucks[12]		*2.4*	*7,987*		*159,740*	*0.11*	*0.97*	*1.6*	*0.034*	*0.022*	*0.0033*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**15**	**89**	**25**	**2.6**	**1.2**	**0.16**
					Total VMT	**143,212,045**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off road equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	0.0015
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
						Total Emissions from Mobile Sources [ton/yr]	**58**	**356**	**77**	**9.7**	**4.5**	**0.62**

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Table 3-4-6
2014 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors for 2015 are used for calculating on-road emissions and are summarized in Mobile Appendix C.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor model
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hr - hour
hp - horsepower
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter less than 10 µm in diameter
$PM_{2.5}$ - particulate matter less than 2.5 µm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - to be determined
ton - short tons
µm - micrometer
USEPA - United States Environmental Protection A
VMT - vehicle miles traveled

Table 3-4-7
2015 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][11]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	234	2.0	70,286		512,385	0.21	1.2	0.12	0.027	0.011	0.0021
	Graduate	1,259	2.0	523,894		4,793,631	1.6	11	1.0	0.25	0.11	0.019
	Post-doc	555	2.0	246,412		2,335,983	0.74	5.1	0.50	0.12	0.052	0.0092
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160	7.4	57	5.6	1.4	0.61	0.11
	Casual Employees	302	2.0	133,960		1,793,719	0.42	3.5	0.35	0.093	0.039	0.0070
	Contingent Employees	294	2.0	130,354		1,596,836	0.41	3.2	0.32	0.083	0.035	0.0062
	Temporary Employees	604	2.0	268,165		3,421,786	0.84	6.8	0.68	0.18	0.075	0.013
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407	0.23	1.8	0.18	0.046	0.020	0.0035
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239	1.3	10	1.0	0.25	0.11	0.019
	Third Party Contractors	244	2.0	108,178		1,537,214	0.34	2.9	0.30	0.080	0.034	0.0060
	Janitorial Shift Workers	195	2.0	86,543		1,229,771	0.28	2.4	0.24	0.064	0.027	0.0048
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596	2.5	11.9	1.11	0.20	0.084	0.016
	Construction	975	2.0	432,713		6,148,856	1.4	12	1.2	0.32	0.13	0.024
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**	**18**	**128**	**13**	**3.2**	**1.3**	**0.24**
On-Campus (Resident) Trips[3]	Undergraduate	1,582	5.91	1,962,450		7,612,107	5.0	25	2.3	0.40	0.17	0.032
	Graduate	3,648	4.5	5,264,378		27,554,538	13.8	78	7.4	1.45	0.62	0.114
	Post-doc	28	3.7	33,580		168,975	0.089	0.49	0.046	0.0089	0.0038	7.0E-04
	Faculty/Staff	98	2.6	94,698		619,941	0.3	2	0.2	0.03	0.01	0.003
	Sub-Total	**5,356**		**7,355,106**		**35,955,561**	**19**	**105**	**9.9**	**1.9**	**0.81**	**0.15**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.7	454,946	7.3	3,321,104	0.83	6.9	0.65	0.17	0.072	0.013
	Bonair on-road - diesel[8]	11	3.2	12,890	7.3	94,099	0.0037	0.032	0.027	0.0070	0.0041	3.0E-04
	Bonair on-road buses - diesel[8]	10	1.1	4,075	7.3	29,749	0.025	0.14	0.62	0.030	0.0013	6.6E-04
	Bonair Unfiltered - on-road - gas[8]	74	1.7	45,317	7.3	330,811	0.092	0.68	0.064	0.017	0.0072	0.0013
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.56	2.5	11	0.36	0.20	0.016
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.0069	0.061	0.050	0.013	0.0078	0.0010
	Marguerite[10]	66				1,983,931	0.78	4.7	15	1.3	0.63	0.029
	Public Safety	31	2.8	31,879	7.3	232,720	0.058	0.48	0.045	0.012	0.0050	9.1E-04
	Sub-Total	**700**		**614,290**		**8,594,006**	**2.4**	**15**	**27**	**1.9**	**0.93**	**0.062**
Other Trips[3]	General Visitors (Vendor)	2,016,204	2.0	4,032,408		25,001,480	12	65	6.2	1.3	0.56	0.10
	Worker Non-Commute Trips			301,920		935,952	0.71	3.6	0.33	0.050	0.022	0.0041
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443	0.48	5.1	0.53	0.15	0.064	0.011
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.31	1.7	6.8	0.39	0.24	0.0078
	Event Visitor Traffic	149,958	2.0	299,917		6,652,357	1.0	11	1.2	0.34	0.14	0.026
	Deliveries - Trucks (total)	168,054	2.0	336,108		2,083,870	0.50	2.3	10	0.31	0.18	0.014
	Construction Vendor Trucks[12]		*2.4*	*8,510*		*62,123*	*0.07*	*0.61*	*0.62*	*0.017*	*0.012*	*0.0012*
	Construction Haul Trucks[12]		*2.4*	*7,987*		*159,740*	*0.11*	*0.97*	*1.6*	*0.034*	*0.022*	*0.0033*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**15**	**89**	**25**	**2.6**	**1.2**	**0.16**
					Total VMT	**143,215,251**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off road equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	0.0015
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
						Total Emissions from Mobile Sources [ton/yr]	**58**	**356**	**77**	**9.7**	**4.5**	**0.62**

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Table 3-4-7
2015 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix A (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor model
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hr - hour
hp - horsepower
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter less than 10 µm in diameter
$PM_{2.5}$ - particulate matter less than 2.5 µm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - to be determined
ton - short tons
µm - micrometer
USEPA - United States Environmental Protection A
VMT - vehicle miles traveled

Table 3-4-8
Fall 2018 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][12]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	185	2.0	55,470		404,378	0.07	0.51	0.049	0.021	0.009	0.0014
	Graduate	1286	2.0	534,884		4,894,189	0.7	5.9	0.57	0.25	0.11	0.017
	Post-doc	589	2.0	261,730		2,481,198	0.33	3.0	0.29	0.13	0.054	0.0088
	Faculty/Staff	5,682	2.0	2,522,720		28,678,561	3.2	33	3.2	1.5	0.62	0.10
	Casual Employees	314	2.0	139,563		1,868,744	0.18	2.1	0.21	0.096	0.040	0.0066
	Contingent Employees	306	2.0	135,808		1,663,642	0.18	1.9	0.19	0.086	0.036	0.0058
	Temporary Employees	629	2.0	279,355		3,564,566	0.37	4.0	0.40	0.18	0.077	0.013
	Non-Employee Affiliates: 20% FTEs	176	2.0	78,281		929,974	0.10	1.1	0.10	0.048	0.020	0.0033
	Non-Employee Affiliates: FTEs	964	2.0	428,097		5,085,797	0.55	5.8	0.57	0.26	0.11	0.018
	Third Party Contractors	263	2.0	116,833		1,660,191	0.16	1.8	0.18	0.085	0.036	0.0058
	Janitorial Shift Workers	210	2.0	93,394		1,327,128	0.13	1.5	0.15	0.068	0.029	0.0047
	First Mile to Transit (all Workers + Students)	2,125	2.0	941,983		3,864,416	1.07	5.9	0.54	0.201	0.085	0.0141
	Construction	975	2.0	432,713		6,148,856	0.58	6.8	0.68	0.32	0.13	0.022
	Sub-Total	**13,705**		**6,020,830**		**62,571,641**	**7.6**	**74**	**7.2**	**3.2**	**1.4**	**0.22**
On-Campus (Resident) Trips[3]	Undergraduate	1,654	5.84	2,028,810		7,869,489	1.87	12.3	1.12	0.41	0.17	0.029
	Graduate	3,829	4.4	5,479,152		28,680,441	5.40	40.2	3.76	1.48	0.63	0.103
	Post-doc	28	3.7	33,580		168,975	0.034	0.24	0.022	0.0088	0.0037	6.1E-04
	Faculty/Staff	98	2.6	94,698		619,941	0.10	0.8	0.08	0.03	0.01	0.002
	Sub-Total	**5,609**		**7,636,240**		**37,338,845**	**7.4**	**54**	**5.0**	**1.9**	**0.82**	**0.14**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	0.59	4.6	0.41	0.16	0.068	0.011
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	0.0023	0.024	0.014	0.0058	0.0029	2.6E-04
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	0.017	0.10	0.47	0.025	0.0010	6.1E-04
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	0.066	3.60	0.041	0.016	0.0068	0.0011
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.497	2.18	7.807	0.334	0.1837	0.0154
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.005	0.047	0.028	0.0115	0.0061	5.3E-04
	Marguerite[10]	66				2,144,233	0.67	4.4	13	1.3	0.58	0.027
	Public Safety	31	2.8	31,879	7.3	232,720	0.042	0.34	0.030	0.012	0.0050	0.0008
	Sub-Total	**700**		**588,428**		**8,565,520**	**1.9**	**15.3**	**22**	**1.8**	**0.86**	**0.057**
Other Trips[3]	General Visitors (Vendor)	2,177,501	2.0	4,355,001		27,001,599	5.1	36	3.4	1.4	0.59	0.10
	Worker Non-Commute Trips			326,074		1,010,828	0.26	1.7	0.16	0.05	0.022	0.004
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985	0.22	3.3	0.33	0.16	0.067	0.011
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	0.23	1.4	5.3	0.34	0.196	0.0073
	Event Visitor Traffic	67,085	2.0	301,862		6,695,507	0.45	7.1	0.71	0.34	0.14	0.023
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	0.48	2.2	7.5	0.32	0.18	0.015
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*	*0.041*	*0.43*	*0.47*	*0.013*	*0.008*	*0.0012*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20.0*	*159,740*	*0.062*	*0.69*	*1.2*	*0.022*	*0.011*	*0.0033*
	Sub-Total	**2,493,169**		**5,504,713**		**40,479,498**	**6.8**	**52**	**17**	**2.6**	**1.2**	**0.16**
					Total VMT	**148,955,504**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off-road Equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	1.5E-03
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
						Total Emissions from Mobile Sources [tons/yr]	**28**	**212**	**54**	**9.8**	**4.4**	**0.57**

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Table 3-4-8
Fall 2018 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B1. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B1 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B1. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2018 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B1.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate CO_2 emissions.
6. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculations are shown in Appendix C.
11. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor
FTE - Full time equivalent
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter under 10 microns
$PM_{2.5}$ - particulate matter under 2.5 microns
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - To be determined
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-4-9
Fall 2035 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Total Emissions [ton/year][11]					
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	ROG	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_X
Off-Campus (Worker) Trips[3]	Undergraduate	185	2.0	55,470		404,378	0.028	0.21	0.015	0.021	0.0085	9.3E-04
	Graduate	764	2.0	317,833		2,908,174	0.17	1.5	0.11	0.15	0.061	0.0066
	Post-doc	828	2.0	367,634		3,485,170	0.19	1.7	0.13	0.18	0.073	0.0079
	Faculty/Staff	7,220	2.0	3,205,524		35,698,523	1.7	17	1.3	1.8	0.75	0.081
	Casual Employees	398	2.0	176,826		2,367,699	0.10	1.1	0.084	0.12	0.050	0.0054
	Contingent Employees	388	2.0	172,068		2,107,835	0.094	1.0	0.076	0.11	0.044	0.0048
	Temporary Employees	797	2.0	353,942		4,516,305	0.19	2.2	0.16	0.23	0.095	0.010
	Non-Employee Affiliates: 20% FTEs	223	2.0	99,182		1,178,277	0.054	0.57	0.042	0.060	0.025	0.0027
	Non-Employee Affiliates: FTEs	1,222	2.0	542,399		6,443,705	0.29	3.1	0.23	0.33	0.13	0.015
	Third Party Contractors	321	2.0	142,671		2,027,352	0.079	1.0	0.072	0.10	0.042	0.0046
	Janitorial Shift Workers	257	2.0	114,049		1,620,630	0.063	0.76	0.057	0.082	0.034	0.0037
	First Mile to Transit (all Workers + Students)	2,654	2.0	1,177,343		4,853,984	0.58	2.9	0.20	0.25	0.103	0.0114
	Construction	975	2.0	432,713		6,148,856	0.24	2.9	0.22	0.31	0.13	0.014
	Sub-Total	**16,231**		**7,157,654**		**73,760,888**	**3.8**	**36**	**2.7**	**3.8**	**1.5**	**0.17**
On-Campus (Resident) Trips[3]	Undergraduate	2,079	5.84	2,550,030		9,891,078	1.0	6.1	0.42	0.51	0.21	0.023
	Graduate	5,974	4.5	8,613,822		45,087,773	3.6	26	1.8	2.3	1.0	0.10
	Post-doc	28	3.7	33,580		168,975	0.015	0.10	0.0068	0.0086	0.0036	3.9E-04
	Faculty/Staff	1,511	2.7	1,463,463		9,574,762	0.69	5.1	0.37	0.49	0.20	0.022
	Sub-Total	**9,592**		**12,660,895**		**64,722,587**	**5.4**	**37**	**2.6**	**3.3**	**1.4**	**0.15**
Campus Vehicles - On-road[4]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049	0.16	1.1	0.080	0.080	0.033	0.0040
	Bonair on-road - diesel	11	3.0	12,246	7.3	89,394	3.0E-04	0.0069	8.1E-04	0.0023	0.0010	9.6E-05
	Bonair on-road buses diesel	10	1.1	3,871	7.3	28,261	0.0029	0.030	0.079	0.0085	3.1E-04	2.6E-04
	Bonair Unfiltered - Assuming on-road - gas	74	1.6	43,051	7.3	314,270	0.017	0.11	0.0079	0.0080	0.0033	4.0E-04
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59	2,424,184	0.36	1.6	1.6	0.29	0.14	0.014
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	0.0012	0.027	0.0032	0.0091	0.0038	3.8E-04
	Marguerite[10]	66				2,618,108	0	0	0	1.7	0.72	0
	Public Safety	31	2.8	31,879	7.3	232,720	0.022	0.17	0.012	0.012	0.0049	5.9E-04
	Sub-Total	**700**		**588,428**		**9,039,395**	**0.56**	**3.1**	**1.8**	**2.1**	**0.90**	**0.020**
Other Trips[3]	General Visitors (Vendor)	2,656,551	2.0	5,313,101		32,968,952	2.7	18	1.3	1.7	0.70	0.076
	Worker Non-Commute Trips			397,810		1,234,221	0.14	0.82	0.056	0.063	0.026	0.0030
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		3,675,599	0.088	1.6	0.13	0.19	0.077	0.0082
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.073	0.79	1.7	0.23	0.11	0.0061
	Event Visitor Traffic	67,085	2.0	299,917		6,980,045	0.18	3.1	0.24	0.35	0.15	0.016
	Deliveries - Trucks	221,428	2.0	442,856		2,747,957	0.44	2.1	2.2	0.33	0.16	0.016
	Construction Vendor Trucks[12]		*3.0*	*8,510*	*7.3*	*62,123*	*0.01*	*0.3*	*0.2*	*0.01*	*0.00*	*0.001*
	Construction Haul Trucks[12]		*4.0*	*7,987*	*20*	*159,740*	*0.03*	*0.5*	*0.4*	*0.02*	*0.01*	*0.003*
	Sub-Total	**3,012,148**		**6,604,231**		**47,996,774**	**3.6**	**26**	**6**	**2.8**	**1.2**	**0.13**
					Total VMT	**195,519,644**						
						[bhp-hr/yr][6]						
Campus Vehicles - Off-road Equip[5,7]	Siebel and Red Barn equip - gas[9]					38,837	3.4	14	0.12	0.040	0.040	0.0015
	Siebel and Red Barn equip - diesel[9]					52,854	0.087	0.37	0.32	0.031	0.029	3.1E-04
	Off-road equip - gas					6,553	0.58	2.4	0.020	0.0068	0.0068	2.5E-04
	Off-road equip - diesel					102,570	0.17	0.72	0.62	0.060	0.055	6.1E-04
	Light Towers - gas					2,925	0.0026	0.0086	0.016	8.3E-04	8.3E-04	2.3E-05
	Light Towers - diesel					186,791	0.16	0.55	1.0	0.053	0.053	0.0014
	Sub-Total					**390,532**	**4.41**	**18.5**	**2.1**	**0.19**	**0.18**	**0.0041**
						Total Emissions from Mobile Sources [tons/yr]	**18**	**121**	**15**	**12.2**	**5.2**	**0.47**

Table 3-4-9
Fall 2035 CAP Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix C. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix C (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix C. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2035 based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix C.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are estimated by scaling assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in 2018. Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Fuel usage for off-road Stanford vehicles was provided by Stanford and is assumed to remain constant from 2015 to 2035. Conversion factors (for gas and diesel) were used to convert gallons of fuel to bhp-hr. CalEEMod® emission factors were then used to estimate emissions.
6. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
7. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption. Emission factors are shown in Mobile Appendix C.
9. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
10. Marguerite buses are assumed to all be electric by 2035. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles; this is kept constant through 2035.
11. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
12. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. However, EMFAC2014 emission factors consistent with worker and vendor CalEEMod fleet breakdowns have been used to calculate CAP emissions for comparison with the BAAQMD construction thresholds of significance.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emissions Estimator Model
CAP - criteria air pollutants
CO - carbon monoxide
CO_2 - carbon dioxide
EMFAC - Emissions Factor
FTE - Full time equivalent
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
NO_X - nitrogen oxides
PM_{10} - particulate matter under 10 microns
$PM_{2.5}$ - particulate matter under 2.5 microns
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
SO_X - sulfur oxide
TBD - To be determined
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 3-4-9b
Entrained Roadway Dust Calculations
Stanford University
Stanford, California

Variable	Units	2014		2015		Fall 2018		Fall 2035	
		PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$	PM_{10}	$PM_{2.5}$
Entrained Roadway Dust Emissions, Santa Clara County[1]	(tons/year)	1,946	291.9	1,946	291.9	1,946	291.9	1,946	291.9
VMT, Santa Clara County[1]	(million VMT per year)	14,041							
Emission Factor	(pounds PM per VMT)	0.00028	0.000042	0.00028	0.000042	0.00028	0.000042	0.00028	0.000042
VMT (Existing, Baseline, and Project)[2]	(VMT per year)	143,215,251		143,215,251		148,955,504		195,519,644	
Entrained Roadway Dust Emissions, Existing, Baseline, and Project	(tons per year)	19.8	3.0	19.8	3.0	20.6	3.1	27.1	4.1
	(pounds per day)	109	16	109	16	113	17	148	22

Notes:

[1] ARB. 2016. Miscellaneous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust. Available at: https://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2016.pdf. Table 5.

[2] VMT from DEIR Appendix AQT, Tables 3-4-6, 3-4-7, 3-4-8 and 3-4-9.

Abbreviations:

ARB - California Air Resources Board
DEIR - Draft Environmental Impact Report
$PM_{2.5}$ - particulate matter under 2.5 microns in diameter
PM_{10} - particulate matter under 10 microns in diameter
VMT - vehicle miles traveled

Table 3-4-10
2014 CAP Emissions - Existing Emergency Diesel Engines
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled Actual Emissions[5]				
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-14	755	8.3	0%	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.0800	0.039	0.003	0.0010	0.000038	0.0006
S-15	1490	8	0%	BAAQMD Spec	5.5	0.67	0.09	0.0055	0.08	0.072	0.009	0.0012	0.000072	0.0011
S-16	73	7.2	0%	BAAQMD Spec	6.3	2.0	0.78	0.0055	0.10	0.004	0.001	0.0005	0.000003	0.0001
S-17	300	20.5	0%	BAAQMD Spec	6.8	0.29	0.16	0.0055	0.07	0.046	0.002	0.0011	0.000037	0.0005
S-18	135	7.2	0%	BAAQMD Spec	11	1.8	0.80	0.0055	0.25	0.012	0.002	0.0009	0.000006	0.0003
S-21	465	21.7	0%	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.106	0.011	0.0028	0.000061	0.0017
S-23	465	11.1	0%	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.054	0.006	0.0014	0.000031	0.0009
S-25	587	0	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.000	0.000	0.0000	0.000000	0.0000
S-28	900	7.1	0%	BAAQMD Spec	13	1.1	0.42	0.0055	0.18	0.094	0.008	0.0030	0.000039	0.0013
S-30	166	7.2	0%	BAAQMD Spec	11	3.3	0.30	0.0055	0.25	0.014	0.004	0.0004	0.000007	0.0003
S-31	166	9.1	0%	BAAQMD Spec	11	3.3	0.30	0.0055	0.25	0.018	0.005	0.0005	0.000009	0.0004
S-32	390	7.6	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.046	0.010	0.0037	0.000018	0.0033
S-33	1008	16.2	0%	BAAQMD Spec	13	1.1	0.42	0.0055	0.18	0.239	0.020	0.0076	0.000099	0.0032
S-34	605	10	0%	Tier Std	6.9	8.5	1.00	0.0055	0.40	0.046	0.057	0.0067	0.000037	0.0027
S-35	170	13.2	0%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.017	0.007	0.0028	0.000014	0.0025
S-37	207	11	0%	Tier Std	6.9	8.5	1.00	0.0055	0.40	0.017	0.021	0.0025	0.000014	0.0010
S-38	380	7.9	0%	BAAQMD Spec	9.3	1.0	0.50	0.0055	0.50	0.031	0.003	0.0017	0.000018	0.0017
S-39	210	6.9	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.022	0.005	0.0018	0.000009	0.0016
S-46	79	8.4	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.010	0.002	0.0008	0.000004	0.0007
S-47	207	6.6	0%	BAAQMD Spec	6.9	11.4	1.30	0.0055	0.40	0.010	0.017	0.0020	0.000008	0.0006
S-52	102	2	0%	BAAQMD Spec	12	1.5	0.40	0.0055	0.25	0.003	0.000	0.0001	0.000001	0.0001
S-56	60	5.6	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.005	0.001	0.0004	0.000002	0.0004
S-57	218	5.1	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.017	0.004	0.0014	0.000007	0.0012
S-58	504	6.1	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.048	0.010	0.0039	0.000019	0.0034
S-59	135	6.1	0%	BAAQMD Spec	8.7	0.30	0.06	0.0055	0.13	0.008	0.000	0.0001	0.000005	0.0001
S-60	317	6	0%	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.014	0.018	0.0021	0.000012	0.0008
S-61	300	70.2	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.146	0.014	0.0116	0.000128	0.0030
S-62	300	6	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.013	0.001	0.0010	0.000011	0.0003
S-63	300	8.7	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.018	0.002	0.0014	0.000016	0.0004
S-65	672	7.4	0%	AP-42	11	2.49	0.32	0.0055	0.32	0.060	0.014	0.0018	0.000030	0.0017
S-67	1008	7.3	25%	BAAQMD Spec	14	1.0	0.30	0.0055	0.15	0.110	0.008	0.0024	0.000045	0.0009
S-68	1848	7.8	25%	BAAQMD Spec	14	2.4	0.08	0.0055	0.20	0.226	0.039	0.0013	0.000087	0.0024
S-71	270	23.8	25%	BAAQMD Spec	7.6	0.67	0.70	0.0055	0.21	0.054	0.005	0.0050	0.000039	0.0011
S-72	380	6.7	25%	BAAQMD Spec	9.3	1.0	0.48	0.0055	0.50	0.026	0.003	0.0013	0.000015	0.0011
S-73	900	7.8	25%	BAAQMD Spec	14	1.0	0.30	0.0055	0.15	0.105	0.008	0.0023	0.000043	0.0009
S-74	102	7.9	0%	BAAQMD Spec	9.2	0.77	0.38	0.0055	0.12	0.008	0.001	0.0003	0.000005	0.0001
S-75	102	6.7	0%	BAAQMD Spec	9.2	0.77	0.38	0.0055	0.12	0.007	0.001	0.0003	0.000004	0.0001
S-76	317	15.3	0%	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.034	0.003	0.0027	0.000029	0.0007
S-77	755	8.8	0%	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.08	0.042	0.003	0.0010	0.000040	0.0006
S-78	2220	5.5	0%	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.093	0.114	0.0135	0.000074	0.0054
S-79	470	6.8	0%	BAAQMD Spec	3.2	0.50	0.17	0.0055	0.09	0.011	0.002	0.0006	0.000019	0.0003
S-80	2220	7.8	0%	BAAQMD Spec	7.8	1.3	0.17	0.0055	0.11	0.149	0.025	0.0032	0.000105	0.0021
S-81	230	10.6	0%	Exec Order	7.6	1.1	0.10	0.0055	0.08	0.020	0.003	0.0003	0.000015	0.0002
S-82	317	6.9	0%	BAAQMD Spec	3.7	0.47	0.14	0.0055	0.14	0.009	0.001	0.0003	0.000013	0.0003
S-83	755	9.3	0%	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.08	0.044	0.003	0.0011	0.000043	0.0006
S-84	317	8.1	0%	BAAQMD Spec	3.7	0.47	0.14	0.0055	0.14	0.010	0.001	0.0004	0.000016	0.0004
S-88	395	6.7	0%	BAAQMD Spec	3.9	0.20	0.20	0.0055	0.06	0.011	0.001	0.0006	0.000016	0.0002
S-89	317	7.2	0%	BAAQMD Spec	3.7	0.47	0.14	0.0055	0.14	0.009	0.001	0.0004	0.000014	0.0004
S-91	395	6.2	0%	Exec Order	6.7	1.3	0.35	0.0055	0.19	0.018	0.004	0.0010	0.000015	0.0005

Table 3-4-10
2014 CAP Emissions - Existing Emergency Diesel Engines
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled Actual Emissions[5]				
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-92	750	8.2	0%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.054	0.005	0.0028	0.000037	0.0009
S-93	325	8.2	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.041	0.009	0.0034	0.000016	0.0029
S-94	277	15.1	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.065	0.014	0.0053	0.000025	0.0046
S-95	750	6.3	0%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.042	0.004	0.0022	0.000029	0.0007
S-96	325	10.1	0%	Exec Order	4.9	4.3	0.26	0.0055	0.21	0.018	0.015	0.0009	0.000020	0.0008
S-97	1175	9.5	0%	Exec Order	7.9	0.93	0.41	0.0055	0.15	0.097	0.011	0.0051	0.000068	0.0018
S-98	1523	8.5	0%	Exec Order	7.9	0.93	0.41	0.0055	0.15	0.112	0.013	0.0059	0.000078	0.0021
S-99	1523	8	0%	Exec Order	7.9	0.93	0.41	0.0055	0.15	0.105	0.013	0.0056	0.000074	0.0020
S-100	2220	15.8	0%	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.299	0.062	0.0157	0.000213	0.0041
S-102	207	8.3	0%	Exec Order	5.7	0.6	0.30	0.0055	0.20	0.011	0.001	0.0006	0.000010	0.0004
S-105	1490	9.3	0%	Exec Order	7.5	0.9	0.39	0.0055	0.16	0.114	0.014	0.0060	0.000084	0.0024
S-106	755	9.2	0%	Exec Order	7.2	0.9	0.38	0.0055	0.17	0.055	0.007	0.0029	0.000042	0.0013
S-110	364	9.4	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.053	0.011	0.0043	0.000021	0.0006
S-111	145	28.3	85%	Exec Order	4.8	1.2	0.25	0.0055	0.17	0.022	0.005	0.0011	0.000025	0.0001
S-112	2220	10.2	85%	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.193	0.040	0.0102	0.000137	0.0004
S-113	398	8.5	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.052	0.011	0.0043	0.000021	0.0037
S-115	130	7.8	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.016	0.003	0.0013	0.000006	0.0002
S-116	364	11	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.062	0.013	0.0050	0.000024	0.0007
S-44	170	6.7	0%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.009	0.004	0.0014	0.000007	0.0013
S-66	166	6.5	85%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.008	0.004	0.0014	0.000007	0.0002
S-70	102	6.8	85%	AP-42	14	3.0	1.14	0.0055	1.00	0.011	0.002	0.0009	0.000004	0.0001
S-107	755	7.8	85%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.052	0.005	0.0027	0.000036	0.0001
S-108	755	7.4	85%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.049	0.005	0.0026	0.000034	0.0001
S-109	755	6.9	85%	Exec Order	8.0	0.80	0.42	0.0055	0.13	0.046	0.005	0.0024	0.000032	0.0001
None	100	5.9	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.009	0.002	0.0007	0.000004	0.0006
S-114	1214	7.2	0%	Exec Order	6.8	1.7	0.36	0.0055	0.19	0.066	0.017	0.0035	0.000053	0.0018
S-11	1807	11	0%	AP-42	11	2.5	0.32	0.0055	0.32	0.239	0.055	0.0070	0.000121	0.0070
S-12	1186	66	0%	AP-42	11	2.5	0.32	0.0055	0.32	0.939	0.215	0.0276	0.000475	0.0274
S-13	1186	11	0%	AP-42	11	2.5	0.32	0.0055	0.32	0.157	0.036	0.0046	0.000079	0.0046
S-53	250	12	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.047	0.010	0.0038	0.000018	0.0033
S-69	1680	12.2	25%	AP-42	11	2.5	0.32	0.0055	0.32	0.246	0.056	0.0072	0.000124	0.0054
S-90	102	7.9	25%	AP-42	14	3.0	1.14	0.0055	1.00	0.012	0.003	0.0010	0.000005	0.0007
S-101	480	12.5	0%	Exec Order	4.3	3.6	0.23	0.0055	0.24	0.028	0.024	0.0015	0.000036	0.0016
S-104	2206	15.7	0%	Exec Order	7.0	1.6	0.37	0.0055	0.19	0.266	0.061	0.0140	0.000210	0.0071
S-117	274	14.4	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.061	0.013	0.0050	0.000024	0.0043
None	50	6.6	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.005	0.001	0.0004	0.000002	0.0004
None	50	9.3	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.007	0.002	0.0006	0.000003	0.0005
None	50	10.3	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.008	0.002	0.0006	0.000003	0.0006
S-112	50	10.2	0%	AP-42	14	3.0	1.14	0.0055	1.00	0.008	0.002	0.0006	0.000003	0.0006
								Total	**[ton/yr]**	**5.9**	**1.3**	**0.28**	**0.0036**	**0.15**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, engine rating, and diesel particulate filter abatement is provided by Stanford. There are four generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.
2. Usage from Stanford.
3. Lists the source for the NOx, CO, POC and PM_{10} emission factor. 'BAAQMD Spec' refers to BAAQMD Specification Sheets for certain generators which was provided by Stanford. 'Exec Order' refers to ARB Executive Order which is available via the ARB Off-road Certification database. 'AP-42' refers to the USEPA compilation of air pollutant emission factors. 'Tier Std' refers to the ARB/USEPA Tier Standards .
4. SO_2 emission factor for all the emergency generators was calculated using 0.0015 weight percent sulfur and the emission factor provided in Table 3.4-1 from AP-42. The % sulfur in fuel oil was assumed to be 15 ppm, based on diesel fuel sulfur content from California Diesel Fuel Regulation.
5. Annual emissions were calculated assuming actual hours of operation for each generator.

RAMBOLL ENVIRON

Table 3-4-10
2014 CAP Emissions - Existing Emergency Diesel Engines
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled Actual Emissions[5]				
BAAQMD Source ID[1]	Engine Rating[1]	Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				

Abbreviations:

CAP - criteria air pollutants
AP 42 - USEPA compilation of air pollutant emission factors
ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
BAAQMD Spec - BAAQMD Specification Sheet
bhp - brake horsepower
CO - carbon monoxide
Exec Order - ARB Executive Order
g - gram
hp - horsepower
hr - hour
ID - identification
NO_x - nitrogen oxides
PM_{10} - particulate matter less than 10 μm in d
POC - precursor organic compound
SO_2 - sulfur dioxide
Tier Std - ARB/USEPA Tier Standards
ton - short tons
μm - micrometer
USEPA - United States Environmental Protection Agency
yr - year

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Table 3-4-11
2015, 2018, and Fall 2035 CAP Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled 2015 Emissions				
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-14	755	10	--	BAAQMD Spec	5.7	0.40	0.14	0.0055	0.0800	0.048	0.0034	0.0012	4.6E-05	6.7E-04
S-15	1490	7.9	--	BAAQMD Spec	5.5	0.7	0.09	0.0055	0.08	0.071	0.0087	0.0012	7.1E-05	0.0010
S-16	73	8.7	--	BAAQMD Spec	6	2.0	0.78	0.0055	0.10	0.0044	0.0014	5.5E-04	3.9E-06	7.0E-05
S-17	300	66	--	BAAQMD Spec	7	0.3	0.16	0.0055	0.07	0.15	0.0063	0.0035	1.2E-04	0.0015
S-18	135	7.3	--	BAAQMD Spec	10.8	1.8	0.80	0.0055	0.25	0.012	0.0020	8.7E-04	6.0E-06	2.7E-04
S-21	465	13	--	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.063	0.0065	0.0017	3.7E-05	0.0010
S-23	465	14.4	--	BAAQMD Spec	10	1.0	0.25	0.0055	0.15	0.070	0.007	0.002	0.000	0.001
S-28	900	8.5	--	BAAQMD Spec	13	1.1	0.42	0.0055	0.18	0.112	0.009	0.004	0.000	0.002
S-30	166	7.4	--	BAAQMD Spec	10.7	3.3	0.30	0.0055	0.25	0.014	0.0045	4.1E-04	7.4E-06	3.4E-04
S-31	166	10.2	--	BAAQMD Spec	11	3.3	0.30	0.0055	0.25	0.020	0.0061	5.6E-04	1.0E-05	4.7E-04
S-32	390	8	--	AP-42	14	3.0	1.14	0.0055	1.00	0.048	0.010	0.0039	1.9E-05	0.0034
S-33	1008	8.3	--	BAAQMD Spec	13.3	1.1	0.42	0.0055	0.18	0.12	0.010	0.0039	5.1E-05	0.0017
S-34	605	46.1	--	Tier Std	7	8.5	1.00	0.0055	0.40	0.21	0.26	0.031	1.7E-04	0.012
S-35	170	7.3	--	Tier Std/AP-42	6.9	3.03	1.14	0.0055	1.00	0.0094	0.0041	0.0016	7.5E-06	0.0014
S-37	207	11.6	--	Tier Std	6.9	8.50	1.00	0.0055	0.40	0.018	0.022	0.0026	1.5E-05	0.0011
S-38	380	8.5	--	BAAQMD Spec	9	1.0	0.50	0.0055	0.50	0.033	0.0036	0.0018	2.0E-05	0.0018
S-39	210	8.1	--	AP-42	14	3.0	1.14	0.0055	1.00	0.026	0.0057	0.0021	1.0E-05	0.0019
S-46	79	7.8	--	AP-42	14	3.0	1.14	0.0055	1.00	0.010	0.0021	7.8E-04	3.8E-06	6.8E-04
S-47	207	8	--	BAAQMD Spec	6.9	11.4	1.30	0.0055	0.40	0.013	0.021	0.0024	1.0E-05	7.3E-04
S-51	86	6.4	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.0085	0.0018	6.9E-04	3.3E-06	6.1E-04
S-56	60	6.5	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.006	0.001	0.000	0.000	0.000
S-57	218	6.5	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.022	0.0047	0.0018	8.6E-06	0.0016
S-58	504	6.5	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.051	0.011	0.0041	2.0E-05	0.0036
S-59	135	7	--	BAAQMD Spec	8.7	0.30	0.06	0.0055	0.13	0.0090	3.1E-04	6.3E-05	5.7E-06	1.4E-04
S-60	317	6.5	--	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.016	0.019	0.0023	1.2E-05	9.1E-04
S-61	300	6.5	--	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.014	0.0013	0.0011	1.2E-05	2.8E-04
S-62	300	6.5	--	BAAQMD Spec	6.3	0.6	0.50	0.0055	0.13	0.014	0.0013	0.0011	1.2E-05	2.8E-04
S-63	300	7	--	BAAQMD Spec	6.3	0.60	0.50	0.0055	0.13	0.015	0.0014	0.0012	1.3E-05	3.0E-04
S-65	672	8.1	--	AP-42	10.9	2.49	0.32	0.0055	0.32	0.065	0.015	0.0019	3.3E-05	0.0019
S-67	1008	6.8	25%	BAAQMD Spec	13.6	1.0	0.30	0.0055	0.15	0.10	0.0076	0.0023	4.2E-05	8.5E-04
S-68	1848	9.9	25%	BAAQMD Spec	14.2	2.4	0.08	0.0055	0.20	0.29	0.049	0.0016	1.1E-04	0.0030
S-71	270	7.7	25%	BAAQMD Spec	7.6	0.7	0.70	0.0055	0.21	0.017	0.0015	0.0016	1.3E-05	3.5E-04
S-72	380	7.5	25%	BAAQMD Spec	9.3	1.0	0.48	0.0055	0.50	0.029	0.0031	0.0015	1.7E-05	0.0012
S-73	900	7.9	25%	BAAQMD Spec	13.6	1.0	0.30	0.0055	0.15	0.11	0.0078	0.0024	4.3E-05	8.8E-04
S-74	102	7.9	--	BAAQMD Spec	9.2	0.8	0.38	0.0055	0.12	0.0082	6.8E-04	3.4E-04	4.9E-06	1.1E-04
S-75	102	8.1	--	BAAQMD Spec	9.2	0.8	0.38	0.0055	0.12	0.0084	7.0E-04	3.5E-04	5.0E-06	1.1E-04
S-76	317	7.8	--	BAAQMD Spec	6.3	0.6	0.50	0.0055	0.13	0.017	0.0016	0.0014	1.5E-05	3.5E-04
S-77	755	8	--	BAAQMD Spec	5.7	0.4	0.14	0.0055	0.08	0.038	0.0027	9.3E-04	3.7E-05	5.3E-04
S-78	2220	12.3	--	BAAQMD Spec	6.9	8.5	1.00	0.0055	0.40	0.21	0.26	0.030	1.7E-04	0.012
S-79	470	6.5	--	BAAQMD Spec	3.2	0.5	0.17	0.0055	0.09	0.011	0.0017	5.7E-04	1.9E-05	3.0E-04
S-80	2220	12.7	--	BAAQMD Spec	7.8	1.3	0.17	0.0055	0.11	0.24	0.040	0.0053	1.7E-04	0.0034
S-81	230	11.5	--	Exec Order	7.6	1.1	0.10	0.0055	0.08	0.022	0.0032	2.9E-04	1.6E-05	2.3E-04
S-82	317	8.1	--	BAAQMD Spec	3.7	0.5	0.14	0.0055	0.14	0.010	0.0013	4.0E-04	1.6E-05	4.0E-04
S-83	755	8.7	--	BAAQMD Spec	5.7	0.4	0.14	0.0055	0.08	0.041	0.0029	0.0010	4.0E-05	5.8E-04

RAMBOLL ENVIRON

Table 3-4-11
2015, 2018, and Fall 2035 CAP Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled 2015 Emissions				
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-84	317	7.5	--	BAAQMD Spec	3.7	0.5	0.14	0.0055	0.14	0.010	0.0012	3.7E-04	1.4E-05	3.7E-04
S-88	395	7.8	--	BAAQMD Spec	3.9	0.2	0.20	0.0055	0.06	0.013	6.8E-04	6.9E-04	1.9E-05	2.0E-04
S-91	395	8.5	--	Exec Order	6.7	1.3	0.35	0.0055	0.19	0.025	0.0049	0.0013	2.0E-05	6.9E-04
S-92	750	9.1	--	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.060	0.0060	0.0032	4.1E-05	0.0010
S-93	325	8.1	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.041	0.0088	0.0033	1.6E-05	0.0029
S-94	277	9.1	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.039	0.0084	0.0032	1.5E-05	0.0028
S-95	750	6.7	--	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.044	0.0044	0.0023	3.0E-05	7.4E-04
S-96	325	8.5	--	Exec Order	4.9	4.3	0.26	0.0055	0.21	0.015	0.013	7.9E-04	1.7E-05	6.5E-04
S-97	1175	7.9	--	Exec Order	7.9	0.9	0.41	0.0055	0.15	0.080	0.010	0.0042	5.6E-05	0.0015
S-98	1523	8.5	--	Exec Order	7.9	0.9	0.41	0.0055	0.15	0.11	0.013	0.0059	7.8E-05	0.0021
S-99	1523	8.7	--	Exec Order	7.9	0.9	0.41	0.0055	0.15	0.11	0.014	0.0060	8.0E-05	0.0021
S-100	2220	10.5	--	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.20	0.041	0.010	1.4E-04	0.0027
S-102	207	2.2	--	Exec Order	5.7	0.6	0.30	0.0055	0.20	0.0029	3.0E-04	1.5E-04	2.8E-06	1.0E-04
S-105	1490	12.3	--	Exec Order	7.5	0.9	0.39	0.0055	0.16	0.15	0.019	0.0079	1.1E-04	0.0032
S-106	755	12.6	--	Exec Order	7.2	0.9	0.38	0.0055	0.17	0.076	0.010	0.0040	5.8E-05	0.0018
S-110	364	8.9	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.050	0.011	0.0041	2.0E-05	5.3E-04
S-111	145	8.2	85%	Exec Order	4.8	1.2	0.25	0.0055	0.17	0.0063	0.0016	3.3E-04	7.2E-06	3.4E-05
S-112	2220	8.3	85%	Exec Order	7.7	1.6	0.41	0.0055	0.11	0.16	0.032	0.0083	1.1E-04	3.2E-04
S-113	398	10.3	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.064	0.014	0.0052	2.5E-05	0.0045
S-115	130	11.2	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.023	0.0049	0.0018	8.8E-06	2.4E-04
S-116	364	10.5	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.059	0.013	0.0048	2.3E-05	6.3E-04
S-124	2206	9	--	0	14.1	3.0	1.14	0.0055	1.00	0.31	0.066	0.025	1.2E-04	0.022
S-125	464	7.1	--	0	14.1	3.0	1.14	0.0055	1.00	0.051	0.011	0.0041	2.0E-05	0.0036
S-44	170	6.7	--	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.0087	0.0038	0.0014	6.9E-06	0.0013
S-66	166	6.8	85%	Tier Std/AP-42	6.9	3.0	1.14	0.0055	1.00	0.0086	0.0038	0.0014	6.8E-06	1.9E-04
S-70	102	6.8	85%	AP-42	14.1	3.0	1.14	0.0055	1.00	0.011	0.0023	8.7E-04	4.2E-06	1.1E-04
S-107	755	7.7	85%	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.051	0.0051	0.0027	3.5E-05	1.3E-04
S-108	755	7.9	85%	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.052	0.0053	0.0028	3.6E-05	1.3E-04
S-109	755	7.5	85%	Exec Order	8.0	0.8	0.42	0.0055	0.13	0.050	0.0050	0.0026	3.4E-05	1.2E-04
None	100	6.5	--	AP-42	14.1	3.0	1.14	0.0055	1.00	0.010	0.0022	8.2E-04	3.9E-06	7.2E-04
S-114	1214	8.5	--	Exec Order	6.8	1.7	0.36	0.0055	0.19	0.078	0.020	0.0041	6.3E-05	0.0021
S-11	1807	14	--	AP-42	10.9	2.5	0.32	0.0055	0.32	0.30	0.070	0.0089	1.5E-04	0.0089
S-12	1186	41	--	AP-42	10.9	2.5	0.32	0.0055	0.32	0.58	0.13	0.017	2.9E-04	0.017
S-13	1186	13	--	AP-42	10.9	2.5	0.32	0.0055	0.32	0.19	0.042	0.0054	9.3E-05	0.0054
S-53	250	13	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.050	0.011	0.0041	2.0E-05	0.0036
S-69	1680	12.6	25%	AP-42	10.9	2.49	0.32	0.0055	0.32	0.25	0.058	0.0075	1.3E-04	0.0056
S-90	102	34	25%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.054	0.012	0.0044	2.1E-05	0.0029
S-101	480	13.6	--	Exec Order	4.3	3.60	0.23	0.0055	0.24	0.031	0.026	0.0016	4.0E-05	0.0017
S-104	2206	41.6	--	Exec Order	7.0	1.60	0.37	0.0055	0.19	0.70	0.16	0.037	5.6E-04	0.019
S-117	274	10.9	--	AP-42	14.1	3.03	1.14	0.0055	1.00	0.046	0.010	0.0038	1.8E-05	0.0033
None	50	10.2	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0079	0.0017	6.4E-04	3.1E-06	5.6E-04
None	50	8.4	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0065	0.0014	5.3E-04	2.5E-06	4.6E-04
None	50	3.6	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0028	6.0E-04	2.3E-04	1.1E-06	2.0E-04
None	50	2.2	0%	AP-42	14.1	3.03	1.14	0.0055	1.00	0.0017	3.7E-04	1.4E-04	6.7E-07	1.2E-04

RAMBOLL ENVIRON

Table 3-4-11
2015, 2018, and Fall 2035 CAP Emissions - Emergency Generators
Stanford University
Stanford, CA

Diesel Generator Data				Uncontrolled Emission Factors						Controlled 2015 Emissions				
BAAQMD Source ID[1]	Engine Rating[1]	2015 Hours of Operation[2]	Diesel Particulate Filter Abatement[1]	Emission Factors Source[3]	NO_x Emission Factor[3]	CO Emission Factor[3]	POC Emission Factor[3]	SO_2 Emission Factor[4]	PM_{10} Emission Factor[3]	NO_x Emissions	CO Emissions	POC Emissions	SO_2 Emissions	PM_{10} Emissions
	[bhp]	[hr/yr]	[%]		[g/bhp-hr]					[ton/yr]				
S-122	755	5.8	85%	SMOP Application	3.7	0.4	0.2	0.01	0.08	0.018	0.0019	0.0010	2.7E-05	5.8E-05
S-123	2922	11.9	85%	SMOP Application	3.6	0.7	0.2	0.01	0.09	0.14	0.027	0.0078	2.1E-04	5.2E-04
S-121	145	5.4	85%	SMOP Application	2.5	0.7	0.1	0.93	0.1	0.0021	6.0E-04	1.2E-04	8.0E-04	1.3E-05
								Total for 2015	[ton/yr]	**6.8**	**1.7**	**0.35**	**0.0051**	**0.20**
									Scaling factor for Fall 2018			8%		
								Total for Fall 2018	[ton/yr]	**7.3**	**1.9**	**0.38**	**0.0055**	**0.21**
									Scaling factor for Fall 2035			22%		
								Total for Fall 2035	[ton/yr]	**9.0**	**2.3**	**0.47**	**0.0068**	**0.26**

Notes:

1. List of campus-wide emergency generators along with their BAAQMD ID, year, engine rating, and diesel particulate filter abatement is provided by Stanford for 2015. There are four generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.
2. 2015 is based on actual non-emergency and emergency run hours in 2015. For Fall 2018, it is assumed that the number of generators will increase proportional to the increase in academic square footage (8%); however, since the size and type of generator is unknown, Ramboll Environ assumed an 8% increase in total emissions. This same methodology was used to represent the increase in academic square footage from Fall 2018 to the buildout of the 2018 GUP (an additional 22% increase).
3. Lists the source for the NOx, CO, POC and PM_{10} emission factor. 'BAAQMD Spec' refers to BAAQMD Specification Sheets for certain generators which was provided by Stanford. 'Exec Order' refers to ARB Executive Order which is available via the ARB Off-road Certification database. 'AP-42' refers to the USEPA compilation of air pollutant emission factors. 'Tier Std' refers to the ARB/USEPA Tier Standards .
4. SO_2 emission factor for all the emergency generators was calculated using 0.0015 weight percent sulfur and the emission factor provided in Table 3.4-1 from AP-42. The % sulfur in fuel oil was assumed to be 15 ppm, based on diesel fuel sulfur content from California Diesel Fuel Regulation.

Abbreviations:

AP 42 - USEPA compilation of air pollutant emission factors
ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
BAAQMD Spec - BAAQMD Specification Sheets
bhp - brake horsepower
CAP - criteria air pollutants
CO - carbon monoxide
Exec Order - ARB Executive Order
g - gram
hp - horsepower
hr - hour
ID - identification
NO_X - nitrogen oxides
PM_{10} - particulate matter under 10 micron diameter
POC - precursor organic compound
ppm - parts per million
SO_2 - sulfur dioxide
Tier Std - ARB/USEPA Tier Standards
ton - short tons
US EPA - United States Environmental Protection Agency
yr - year

References:

ARB. California Diesel Fuel Regulation. Available online at: http://www.arb.ca.gov/fuels/diesel/081404dslregs.pdf
ARB. Off-Road Certification database. Available online at: http://www.arb.ca.gov/msprog/offroad/cert/cert.php
USEPA. Non-road Compression -Ignition Engines - Exhaust Emission Standards. Available online at: http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
USEPA. 1995. AP 42, Volume I, Fifth Edition. §3.4. Large Stationary Diesel and All Stationary Dual-Fuel Engines. Available online at: http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

Table 3-4-12
2014 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2014)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	572	5%	34	0
1,1,2-Trichloroethane	79-00-5	30	164	270	5%	2.5	0
1,2-Dichloroethane	107-06-2	245	164	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	288	100%	177	177
1,4-Dichlorobenzene	106-46-7	15	84	286	1%	0.50	0.50
1,4-Dioxane	123-91-1	166	164	968	5%	49	49
2,4,6-Trichlorophenol	88-06-2	2.9	164	419	1%	0.074	0.074
2-Chlorophenol	95-57-8	6.0	164	323	5%	0.59	0.59
2-Nitropropane	79-46-9	25	164	42	5%	0.32	0.32
Acetaldehyde	75-07-0	35	164	0	5%	0	0
Acetone	67-64-1	5,583	32,613	568,611	100%	97,340	0
Acetonitrile	75-05-8	0,930	164	1,098	5%	0,311	0,311
Acrylamide	79-06-1	42	164	1,105	1%	2.8	2.8
Acrylonitrile	107-13-1	78	164	0	5%	0	0
Ammonia	7664-41-7	156	164	506	100%	481	0
Arsenic and inorganic compounds	7440-38-2	35	164	308	1%	0.66	0
Benzene	71-43-2	1,307	164	1,023	5%	408	408
Beryllium	7440-41-7	0.15	164	226	1%	0.0021	0
Bromine and compounds	7726-95-6	12	164	820	5%	3	0
Butane	106-97-8	21	164	728	100%	93	93
Butyraldhyde	123-72-8	198	164	531	5%	32	32
Cadmium and compounds	7440-43-9	105	164	474	1%	3.03	0
Carbon disulfide	75-15-0	41	164	789	5%	10	0
Carbon tetrachloride	56-23-5	278	164	995	5%	84	0
Chlorine	7782-50-5	1	164	298	100%	1	0
Chlorobenzene	108-90-7	0,314	164	618	5%	59	59
Chloroform	67-66-3	1,795	164	1,181	5%	0,646	0,646
Chloromethane	74-87-3	57	62	62	100%	57	57
Cresol	1319-77-3	102	164	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,120	5%	1,658	1,658
Dimethyl formamide	68-12-2	0,859	164	1,128	5%	0,295	0,295
Dimethyl sulfate	77-78-1	104	164	707	5%	22	22
Epichlorohydrin	106-89-8	343.0	164	290	5%	30.33	30.33
Ethanol	64-17-5	1,012	164	1,186	5%	0,366	0,366
Ethyl acetate	141-78-6	5,291	164	1,123	5%	1,812	1,812
Ethyl benzene	100-41-4	29	164	403	5%	3.6	3.6
Ethyl diazoacetate	623-73-4	6.4	164	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	428	5%	1.0	1.0
Ethylene glycol	107-21-1	0,391	164	1,176	5%	140	140
Ethylene glycol butyl ether	111-76-2	55	164	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	510	5%	8	8
Ethylene glycol methyl ether	109-86-4	579	164	979	5%	173	173
Ethylene oxide	75-21-8	2.9	164	0	100%	0	0
Formaldehyde	50-00-0	32	164	143	5%	1	1
Glutaraldehyde	111-30-8	31	164	1,028	5%	10	10
Hexachlorobenzene	118-74-1	1.3	164	164	1%	0.013	0.013
Hexanal	66-25-1	2	164	288	5%	0.2	0.2
Hexavalent chromium	18540-29-9	590	164	908	1%	33	0
Hydrazine	302-01-2	88	164	834	5%	22.4	22.4
Hydrogen chloride	7647-01-0	299	164	1,186	5%	108	0
Hydrogen fluoride	7664-39-3	29	164	190	100%	34	0
Hydrogen sulfide	7783-06-4	4.9	164	216	100%	6.5	0
Isopentane	78-78-4	9	164	964	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	303,330	100%	18,025	18,025
Lead and compounds	7439-92-1	165	164	430	1%	4.3	0
Maleic anhydride	108-31-6	36	164	656	1%	1.4	1.4
Manganese and compounds	7439-96-5	276	164	481	1%	8.09	0
Mercury and inorganic compounds	7439-97-6	1135	164	816	5%	282	0
Methanol	67-56-1	1,257	164	1,181	5%	0,453	0,453
Methyl bromide	74-83-9	109	62	93	100%	163	0
Methyl ethyl ketone	78-93-3	59	164	791	5%	14	14
Methyl methacrylate	80-62-6	43	164	705	5%	9.2	9.2
Methylene chloride	75-09-2	6,823	164	1,154	20%	9,602	0
Naphthalene	91-20-3	18	164	879	1%	1	1

Table 3-4-12
2014 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2014)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
n-Heptane	142-82-5	1,284	164	1,060	5%	415	415
n-Hexane	110-54-3	2,195	164	1,147	5%	0,768	0,768
Nickel and compounds	7440-02-0	238	164	631	1%	9.16	0
Nitric acid	7697-37-2	412	164	1,156	5%	145	145
Nitrobenzene	98-95-3	222	164	516	5%	35	0
n-Methylpyrollidone	872-50-4	0,454	164	1,014	5%	140	140
Octane	111-65-9	6	164	859	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	632	1%	0.578	0
Pentachlorophenol	87-86-5	2.9	31	163	1%	0.15	0.15
Pentane	109-66-0	0,924	164	1,014	5%	0,286	0,286
Phenol	108-95-2	145	164	1,046	5%	46	46
Phosgene	75-44-5	0.32	164	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,176	5%	79	79
Propylene oxide	75-56-9	59	164	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,114	5%	140	140
Sodium hydroxide	1310-73-2	0,566	164	1,181	1%	41	0
Styrene	100-42-5	45	164	589	5%	8	8
t-Butyl alcohol	75-65-0	111	164	1,021	5%	35	35
tert-Butylbenzene	98-06-6	28	164	349	5%	3.0	3.0
Tetrachloroethylene	127-18-4	29	164	491	5%	4	4
Tetrahydrofuran	109-99-9	1,856	164	1,081	5%	0,612	0,612
Toluene	108-88-3	1,012	164	1,176	5%	0,363	0,363
Trichloroethylene	79-01-6	119	164	753	5%	27	0
Trichlorotrifluroethane	76-13-1	51	164	539	5%	8.4	0.0
Triethylamine	121-44-8	0,424	164	1,085	5%	140	140
Valeraldehyde	110-62-3	12	164	301	5%	1.1	1.1
Vinyl chloride	75-01-4	132	164	218	100%	175	175
Xylenes	1330-20-7	0,496	164	1,088	5%	165	165
Zinc and compounds	7440-66-6	625	164	991	1%	38	0
Total						**136,775**	**28,414**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)
   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used is assumed to scale linearly with the number of fume hoods in each laboratory. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%
   Emission Factor for Liquids = 5%
   Emission Factor for Solids/Metals = 1%
   Emission Factor for Methylene Chloride = 20%

4. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

5. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

6. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf.

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstract
HHRA - human health risk assessment
lb - pound
ROG - Reactive Organic Gas
TAC - Toxic Air Contaminant

Table 3-4-13
2015 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	572	5%	34	0
1,1,2-Trichloroethane	79-00-5	30	164	270	5%	2.5	0
1,2-Dichloroethane	107-06-2	245	164	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	288	100%	177	177
1,4-Dichlorobenzene	106-46-7	15	84	286	1%	0.50	0.50
1,4-Dioxane	123-91-1	166	164	968	5%	49	49
2,4,6-Trichlorophenol	88-06-2	2.9	164	419	1%	0.074	0.074
2-Chlorophenol	95-57-8	6.0	164	323	5%	0.59	0.59
2-Nitropropane	79-46-9	25	164	42	5%	0.32	0.32
Acetaldehyde	75-07-0	35	164	0	5%	0	0
Acetone	67-64-1	5,583	32,613	568,611	100%	97,340	0
Acetonitrile	75-05-8	0,930	164	1,098	5%	0,311	0,311
Acrylamide	79-06-1	42	164	1,105	1%	2.8	2.8
Acrylonitrile	107-13-1	78	164	0	5%	0	0
Ammonia	7664-41-7	156	164	506	100%	481	0
Arsenic and inorganic compounds	7440-38-2	35	164	308	1%	0.66	0
Benzene	71-43-2	1,307	164	1,023	5%	408	408
Beryllium	7440-41-7	0.15	164	226	1%	0.0021	0
Bromine and compounds	7726-95-6	12	164	820	5%	3	0
Butane	106-97-8	21	164	728	100%	93	93
Butyraldhyde	123-72-8	198	164	531	5%	32	32
Cadmium and compounds	7440-43-9	105	164	474	1%	3.03	0
Carbon disulfide	75-15-0	41	164	789	5%	10	0
Carbon tetrachloride	56-23-5	278	164	995	5%	84	0
Chlorine	7782-50-5	1	164	298	100%	1	0
Chlorobenzene	108-90-7	0,314	164	618	5%	59	59
Chloroform	67-66-3	1,795	164	1,181	5%	0,646	0,646
Chloromethane	74-87-3	57	62	62	100%	57	57
Cresol	1319-77-3	102	164	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,120	5%	1,658	1,658
Dimethyl formamide	68-12-2	0,859	164	1,128	5%	0,295	0,295
Dimethyl sulfate	77-78-1	104	164	707	5%	22	22
Epichlorohydrin	106-89-8	343.0	164	290	5%	30.33	30.33
Ethanol	64-17-5	1,012	164	1,186	5%	0,366	0,366
Ethyl acetate	141-78-6	5,291	164	1,123	5%	1,812	1,812
Ethyl benzene	100-41-4	29	164	403	5%	3.6	3.6
Ethyl diazoacetate	623-73-4	6.4	164	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	428	5%	1.0	1.0
Ethylene glycol	107-21-1	0,391	164	1,176	5%	140	140
Ethylene glycol butyl ether	111-76-2	55	164	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	510	5%	8	8
Ethylene glycol methyl ether	109-86-4	579	164	979	5%	173	173
Ethylene oxide	75-21-8	2.9	164	0	100%	0	0
Formaldehyde	50-00-0	32	164	143	5%	1	1
Glutaraldehyde	111-30-8	31	164	1,028	5%	10	10
Hexachlorobenzene	118-74-1	1.3	164	164	1%	0.013	0.013
Hexanal	66-25-1	2	164	288	5%	0.2	0.2
Hexavalent chromium	18540-29-9	590	164	908	1%	33	0
Hydrazine	302-01-2	88	164	834	5%	22.4	22.4
Hydrogen chloride	7647-01-0	299	164	1,186	5%	108	0
Hydrogen fluoride	7664-39-3	29	164	190	100%	34	0
Hydrogen sulfide	7783-06-4	4.9	164	216	100%	6.5	0
Isopentane	78-78-4	9	164	964	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	303,330	100%	18,025	18,025
Lead and compounds	7439-92-1	165	164	430	1%	4.3	0
Maleic anhydride	108-31-6	36	164	656	1%	1.4	1.4
Manganese and compounds	7439-96-5	276	164	481	1%	8.09	0
Mercury and inorganic compounds	7439-97-6	1135	164	816	5%	282	0
Methanol	67-56-1	1,257	164	1,181	5%	0,453	0,453
Methyl bromide	74-83-9	109	62	93	100%	163	0
Methyl ethyl ketone	78-93-3	59	164	791	5%	14	14
Methyl methacrylate	80-62-6	43	164	705	5%	9.2	9.2
Methylene chloride	75-09-2	6,823	164	1,154	20%	9,602	0
Naphthalene	91-20-3	18	164	879	1%	1	1
n-Heptane	142-82-5	1,284	164	1,060	5%	415	415
n-Hexane	110-54-3	2,195	164	1,147	5%	0,768	0,768
Nickel and compounds	7440-02-0	238	164	631	1%	9.16	0
Nitric acid	7697-37-2	412	164	1,156	5%	145	145
Nitrobenzene	98-95-3	222	164	516	5%	35	0

Table 3-4-13
2015 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	ROG Emissions[4,6] [lbs/year]
n-Methylpyrollidone	872-50-4	0,454	164	1,014	5%	140	140
Octane	111-65-9	6	164	859	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	632	1%	0.578	0
Pentachlorophenol	87-86-5	2.9	31	163	1%	0.15	0.15
Pentane	109-66-0	0,924	164	1,014	5%	0,286	0,286
Phenol	108-95-2	145	164	1,046	5%	46	46
Phosgene	75-44-5	0.32	164	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,176	5%	79	79
Propylene oxide	75-56-9	59	164	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,114	5%	140	140
Sodium hydroxide	1310-73-2	0,566	164	1,181	1%	41	0
Styrene	100-42-5	45	164	589	5%	8	8
t-Butyl alcohol	75-65-0	111	164	1,021	5%	35	35
tert-Butylbenzene	98-06-6	28	164	349	5%	3.0	3.0
Tetrachloroethylene	127-18-4	29	164	491	5%	4	4
Tetrahydrofuran	109-99-9	1,856	164	1,081	5%	0,612	0,612
Toluene	108-88-3	1,012	164	1,176	5%	0,363	0,363
Trichloroethylene	79-01-6	119	164	753	5%	27	0
Trichlorotrifluroethane	76-13-1	51	164	539	5%	8.4	0.0
Triethylamine	121-44-8	0,424	164	1,085	5%	140	140
Valeraldehyde	110-62-3	12	164	301	5%	1.1	1.1
Vinyl chloride	75-01-4	132	164	218	100%	175	175
Xylenes	1330-20-7	0,496	164	1,088	5%	165	165
Zinc and compounds	7440-66-6	625	164	991	1%	38	0
Total						**136,775**	**28,414**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)
   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used is assumed to scale linearly with the number of fume hoods in each laboratory. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%
   Emission Factor for Liquids = 5%
   Emission Factor for Solids/Metals = 1%
   Emission Factor for Methylene Chloride = 20%

4. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

5. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

6. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
HHRA - human health risk assessment
lb - pound
ROG - reactive organic gas
TAC - toxic air contaminants
yr - year

Table 3-4-14
Fall 2018 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Scaling for Fall 2018[3]	Fume Hoods on Campus with Chemical (Fall 2018)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	572	8%	618	5%	37	0
1,1,2-Trichloroethane	79-00-5	30	164	270	8%	292	5%	2.7	0
1,2-Dichloroethane	107-06-2	245	164	0	8%	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	288	8%	311	100%	192	192
1,4-Dichlorobenzene	106-46-7	15	84	286	8%	309	1%	0.54	0.54
1,4-Dioxane	123-91-1	166	164	968	8%	1,046	5%	53	53
2,4,6-Trichlorophenol	88-06-2	2.9	164	419	8%	453	1%	0.080	0.080
2-Chlorophenol	95-57-8	6.0	164	323	8%	349	5%	0.64	0.64
2-Nitropropane	79-46-9	25	164	42	8%	45	5%	0.35	0.35
Acetaldehyde	75-07-0	35	164	0	8%	0	5%	0	0
Acetone	67-64-1	5,583	32,613	568,611	8%	614,575	100%	105,209	0
Acetonitrile	75-05-8	0,930	164	1,098	8%	1,187	5%	0,336	0,336
Acrylamide	79-06-1	42	164	1,105	8%	1,194	1%	3.1	3.1
Acrylonitrile	107-13-1	78	164	0	8%	0	5%	0	0
Ammonia	7664-41-7	156	164	506	8%	547	100%	520	0
Arsenic and inorganic compounds	7440-38-2	35	164	308	8%	333	1%	0.71	0
Benzene	71-43-2	1,307	164	1,023	8%	1,106	5%	441	441
Beryllium	7440-41-7	0.15	164	226	8%	244	1%	0.0022	0
Bromine and compounds	7726-95-6	12	164	820	8%	886	5%	3	0
Butane	106-97-8	21	164	728	8%	787	100%	101	101
Butyraldhyde	123-72-8	198	164	531	8%	574	5%	35	35
Cadmium and compounds	7440-43-9	105	164	474	8%	512	1%	3.28	0
Carbon disulfide	75-15-0	41	164	789	8%	853	5%	11	0
Carbon tetrachloride	56-23-5	278	164	995	8%	1,075	5%	91	0
Chlorine	7782-50-5	1	164	298	8%	322	100%	1	0
Chlorobenzene	108-90-7	0,314	164	618	8%	668	5%	64	64
Chloroform	67-66-3	1,795	164	1,181	8%	1,276	5%	0,699	0,699
Chloromethane	74-87-3	57	62	62	8%	67	100%	62	62
Cresol	1319-77-3	102	164	0	8%	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,120	8%	1,211	5%	1,793	1,793
Dimethyl formamide	68-12-2	0,859	164	1,128	8%	1,219	5%	0,319	0,319
Dimethyl sulfate	77-78-1	104	164	707	8%	764	5%	24	24
Epichlorohydrin	106-89-8	343.0	164	290	8%	313	5%	32.78	32.78
Ethanol	64-17-5	1,012	164	1,186	8%	1,282	5%	0,396	0,396
Ethyl acetate	141-78-6	5,291	164	1,123	8%	1,214	5%	1,958	1,958
Ethyl benzene	100-41-4	29	164	403	8%	436	5%	3.9	3.9
Ethyl diazoacetate	623-73-4	6.4	164	0	8%	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	428	8%	463	5%	1.0	1.0
Ethylene glycol	107-21-1	0,391	164	1,176	8%	1,271	5%	152	152
Ethylene glycol butyl ether	111-76-2	55	164	0	8%	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	510	8%	551	5%	9	9
Ethylene glycol methyl ether	109-86-4	579	164	979	8%	1,058	5%	187	187
Ethylene oxide	75-21-8	2.9	164	0	8%	0	100%	0	0
Formaldehyde	50-00-0	32	164	143	8%	155	5%	2	2
Glutaraldehyde	111-30-8	31	164	1,028	8%	1,111	5%	11	11

RAMBOLL ENVIRON

Table 3-4-14
Fall 2018 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Scaling for Fall 2018[3]	Fume Hoods on Campus with Chemical (Fall 2018)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Hexachlorobenzene	118-74-1	1.3	164	164	8%	177	1%	0.014	0.014
Hexanal	66-25-1	2	164	288	8%	311	5%	0.2	0.2
Hexavalent chromium	18540-29-9	590	164	908	8%	981	1%	35	0
Hydrazine	302-01-2	88	164	834	8%	901	5%	24.2	24.2
Hydrogen chloride	7647-01-0	299	164	1,186	8%	1,282	5%	117	0
Hydrogen fluoride	7664-39-3	29	164	190	8%	205	100%	36	0
Hydrogen sulfide	7783-06-4	4.9	164	216	8%	233	100%	7.0	0
Isopentane	78-78-4	9	164	964	8%	1,042	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	303,330	8%	327,850	100%	19,482	19,482
Lead and compounds	7439-92-1	165	164	430	8%	465	1%	4.7	0
Maleic anhydride	108-31-6	36	164	656	8%	709	1%	1.6	1.6
Manganese and compounds	7439-96-5	276	164	481	8%	520	1%	8.75	0
Mercury and inorganic compounds	7439-97-6	1135	164	816	8%	882	5%	305	0
Methanol	67-56-1	1,257	164	1,181	8%	1,276	5%	0,489	0,489
Methyl bromide	74-83-9	109	62	93	8%	101	100%	177	0
Methyl ethyl ketone	78-93-3	59	164	791	8%	855	5%	15	15
Methyl methacrylate	80-62-6	43	164	705	8%	762	5%	10.0	10.0
Methylene chloride	75-09-2	6,823	164	1,154	8%	1,247	20%	10,378	0
Naphthalene	91-20-3	18	164	879	8%	950	1%	1	1
n-Heptane	142-82-5	1,284	164	1,060	8%	1,146	5%	448	448
n-Hexane	110-54-3	2,195	164	1,147	8%	1,240	5%	0,830	0,830
Nickel and compounds	7440-02-0	238	164	631	8%	682	1%	9.90	0
Nitric acid	7697-37-2	412	164	1,156	8%	1,249	5%	157	157
Nitrobenzene	98-95-3	222	164	516	8%	558	5%	38	0
n-Methylpyrollidone	872-50-4	0,454	164	1,014	8%	1,096	5%	152	152
Octane	111-65-9	6	164	859	8%	928	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	632	8%	683	1%	0.625	0
Pentachlorophenol	87-86-5	2.9	31	163	8%	176	1%	0.17	0.17
Pentane	109-66-0	0,924	164	1,014	8%	1,096	5%	0,309	0,309
Phenol	108-95-2	145	164	1,046	8%	1,131	5%	50	50
Phosgene	75-44-5	0.32	164	0	8%	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,176	8%	1,271	5%	86	86
Propylene oxide	75-56-9	59	164	0	8%	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,114	8%	1,204	5%	151	151
Sodium hydroxide	1310-73-2	0,566	164	1,181	8%	1,276	1%	44	0
Styrene	100-42-5	45	164	589	8%	637	5%	9	9
t-Butyl alcohol	75-65-0	111	164	1,021	8%	1,104	5%	37	37
tert-Butylbenzene	98-06-6	28	164	349	8%	377	5%	3.2	3.2
Tetrachloroethylene	127-18-4	29	164	491	8%	531	5%	5	5
Tetrahydrofuran	109-99-9	1,856	164	1,081	8%	1,168	5%	0,661	0,661
Toluene	108-88-3	1,012	164	1,176	8%	1,271	5%	0,392	0,392
Trichloroethylene	79-01-6	119	164	753	8%	814	5%	30	0
Trichlorotrifluroethane	76-13-1	51	164	539	8%	583	5%	9.1	0.0
Triethylamine	121-44-8	0,424	164	1,085	8%	1,173	5%	152	152
Valeraldehyde	110-62-3	12	164	301	8%	325	5%	1.2	1.2

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Table 3-4-14
Fall 2018 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (2015)[2]	Scaling for Fall 2018[3]	Fume Hoods on Campus with Chemical (Fall 2018)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Vinyl chloride	75-01-4	132	164	218	8%	236	100%	190	190
Xylenes	1330-20-7	0,496	164	1,088	8%	1,176	5%	178	178
Zinc and compounds	7440-66-6	625	164	991	8%	1,071	1%	41	0
Total								**147,831**	**30,711**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)

   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used in 2015 is assumed to scale linearly with the number of fume hoods in each laboratory. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Scaling for Fall 2018 is based on the increase in academic square footage expected from December 2015 to full buildout of the 2000 GUP, with the assumption that the increase in laboratory space is proportional to the increase in overall academic space.

4. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%

   Emission Factor for Liquids = 5%

   Emission Factor for Solids/Metals = 1%

   Emission Factor for Methylene Chloride = 20%

5. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

6. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

7. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
HHRA - human health risk assessment
lb - pound
ROG - reactive organic gas
TAC - toxic air contaminants
yr - year

RAMBOLL ENVIRON

Table 3-4-15
Fall 2035 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (Fall 2018)[2]	Scaling for Fall 2035[3]	Fume Hoods on Campus with Chemical (Fall 2035)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
1,1,1-Trichloroethane	71-55-6	195	164	618	22%	755	5%	45	0
1,1,2-Trichloroethane	79-00-5	30	164	292	22%	356	5%	3.3	0
1,2-Dichloroethane	107-06-2	245	164	0	22%	0	5%	0	0
1,3-Butadiene	106-99-0	101	164	311	22%	380	100%	234	234
1,4-Dichlorobenzene	106-46-7	15	84	309	22%	377	1%	0.65	0.65
1,4-Dioxane	123-91-1	166	164	1,046	22%	1,278	5%	65	65
2,4,6-Trichlorophenol	88-06-2	2.9	164	453	22%	553	1%	0.098	0.098
2-Chlorophenol	95-57-8	6.0	164	349	22%	426	5%	0.78	0.78
2-Nitropropane	79-46-9	25	164	45	22%	55	5%	0.42	0.42
Acetaldehyde	75-07-0	35	164	0	22%	0	5%	0	0
Acetone	67-64-1	5,583	32,613	614,575	22%	750,492	100%	128,476	0
Acetonitrile	75-05-8	0,930	164	1,187	22%	1,449	5%	0,411	0,411
Acrylamide	79-06-1	42	164	1,194	22%	1,458	1%	3.7	3.7
Acrylonitrile	107-13-1	78	164	0	22%	0	5%	0	0
Ammonia	7664-41-7	156	164	547	22%	668	100%	635	0
Arsenic and inorganic compounds	7440-38-2	35	164	333	22%	407	1%	0.87	0
Benzene	71-43-2	1,307	164	1,106	22%	1,350	5%	538	538
Beryllium	7440-41-7	0.15	164	244	22%	298	1%	0.0027	0
Bromine and compounds	7726-95-6	12	164	886	22%	1,082	5%	4	0
Butane	106-97-8	21	164	787	22%	961	100%	123	123
Butyraldhyde	123-72-8	198	164	574	22%	701	5%	42	42
Cadmium and compounds	7440-43-9	105	164	512	22%	626	1%	4.01	0
Carbon disulfide	75-15-0	41	164	853	22%	1,041	5%	13	0
Carbon tetrachloride	56-23-5	278	164	1,075	22%	1,313	5%	111	0
Chlorine	7782-50-5	1	164	322	22%	393	100%	2	0
Chlorobenzene	108-90-7	0,314	164	668	22%	816	5%	78	78
Chloroform	67-66-3	1,795	164	1,276	22%	1,559	5%	0,853	0,853
Chloromethane	74-87-3	57	62	67	22%	82	100%	76	76
Cresol	1319-77-3	102	164	0	22%	0	1%	0	0
Diethyl ether	60-29-7	4,857	164	1,211	22%	1,478	5%	2,189	2,189
Dimethyl formamide	68-12-2	0,859	164	1,219	22%	1,489	5%	0,390	0,390
Dimethyl sulfate	77-78-1	104	164	764	22%	933	5%	30	30
Epichlorohydrin	106-89-8	343.0	164	313	22%	383	5%	40.03	40.03
Ethanol	64-17-5	1,012	164	1,282	22%	1,565	5%	0,483	0,483
Ethyl acetate	141-78-6	5,291	164	1,214	22%	1,482	5%	2,391	2,391
Ethyl benzene	100-41-4	29	164	436	22%	532	5%	4.7	4.7
Ethyl diazoacetate	623-73-4	6.4	164	0	22%	0	5%	0	0
Ethylene dibromide	106-93-4	7.4	164	463	22%	565	5%	1.3	1.3
Ethylene glycol	107-21-1	0,391	164	1,271	22%	1,552	5%	185	185
Ethylene glycol butyl ether	111-76-2	55	164	0	22%	0	5%	0	0
Ethylene glycol ethyl ether	110-80-5	54	164	551	22%	673	5%	11	11
Ethylene glycol methyl ether	109-86-4	579	164	1,058	22%	1,292	5%	228	228
Ethylene oxide	75-21-8	2.9	164	0	22%	0	100%	0	0
Formaldehyde	50-00-0	32	164	155	22%	189	5%	2	2
Glutaraldehyde	111-30-8	31	164	1,111	22%	1,357	5%	13	13

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Table 3-4-15
Fall 2035 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (Fall 2018)[2]	Scaling for Fall 2035[3]	Fume Hoods on Campus with Chemical (Fall 2035)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Hexachlorobenzene	118-74-1	1.3	164	177	22%	216	1%	0.017	0.017
Hexanal	66-25-1	2	164	311	22%	380	5%	0.3	0.3
Hexavalent chromium	18540-29-9	590	164	981	22%	1,198	1%	43	0
Hydrazine	302-01-2	88	164	901	22%	1,101	5%	29.5	29.5
Hydrogen chloride	7647-01-0	299	164	1,282	22%	1,565	5%	143	0
Hydrogen fluoride	7664-39-3	29	164	205	22%	251	100%	44	0
Hydrogen sulfide	7783-06-4	4.9	164	233	22%	285	100%	8.6	0
Isopentane	78-78-4	9	164	1,042	22%	1,272	5%	3	3
Isopropyl alcohol	67-63-0	1,938	32,613	327,850	22%	400,356	100%	23,791	23,791
Lead and compounds	7439-92-1	165	164	465	22%	568	1%	5.7	0
Maleic anhydride	108-31-6	36	164	709	22%	866	1%	1.9	1.9
Manganese and compounds	7439-96-5	276	164	520	22%	635	1%	10.68	0
Mercury and inorganic compounds	7439-97-6	1135	164	882	22%	1,077	5%	373	0
Methanol	67-56-1	1,257	164	1,276	22%	1,559	5%	0,597	0,597
Methyl bromide	74-83-9	109	62	101	22%	123	100%	216	0
Methyl ethyl ketone	78-93-3	59	164	855	22%	1,044	5%	19	19
Methyl methacrylate	80-62-6	43	164	762	22%	931	5%	12.2	12.2
Methylene chloride	75-09-2	6,823	164	1,247	22%	1,523	20%	12,674	0
Naphthalene	91-20-3	18	164	950	22%	1,160	1%	1	1
n-Heptane	142-82-5	1,284	164	1,146	22%	1,399	5%	548	548
n-Hexane	110-54-3	2,195	164	1,240	22%	1,514	5%	1,013	1,013
Nickel and compounds	7440-02-0	238	164	682	22%	833	1%	12.09	0
Nitric acid	7697-37-2	412	164	1,249	22%	1,526	5%	192	192
Nitrobenzene	98-95-3	222	164	558	22%	681	5%	46	0
n-Methylpyrollidone	872-50-4	0,454	164	1,096	22%	1,338	5%	185	185
Octane	111-65-9	6	164	928	22%	1,134	5%	2	2
Osmium tetroxide	20816-12-0	15.00	164	683	22%	834	1%	0.763	0
Pentachlorophenol	87-86-5	2.9	31	176	22%	215	1%	0.20	0.20
Pentane	109-66-0	0,924	164	1,096	22%	1,338	5%	0,377	0,377
Phenol	108-95-2	145	164	1,131	22%	1,381	5%	61	61
Phosgene	75-44-5	0.32	164	0	22%	0	100%	0	0
Phosphoric acid	7664-38-2	221	164	1,271	22%	1,552	5%	105	105
Propylene oxide	75-56-9	59	164	0	22%	0	5%	0	0
Pyridine	110-86-1	0,412	164	1,204	22%	1,470	5%	185	185
Sodium hydroxide	1310-73-2	0,566	164	1,276	22%	1,559	1%	54	0
Styrene	100-42-5	45	164	637	22%	777	5%	11	11
t-Butyl alcohol	75-65-0	111	164	1,104	22%	1,348	5%	46	46
tert-Butylbenzene	98-06-6	28	164	377	22%	461	5%	4.0	4.0
Tetrachloroethylene	127-18-4	29	164	531	22%	648	5%	6	6
Tetrahydrofuran	109-99-9	1,856	164	1,168	22%	1,427	5%	0,807	0,807
Toluene	108-88-3	1,012	164	1,271	22%	1,552	5%	0,479	0,479
Trichloroethylene	79-01-6	119	164	814	22%	994	5%	36	0
Trichlorotrifluroethane	76-13-1	51	164	583	22%	711	5%	11.1	0.0
Triethylamine	121-44-8	0,424	164	1,173	22%	1,432	5%	185	185
Valeraldehyde	110-62-3	12	164	325	22%	397	5%	1.5	1.5

RAMBOLL ENVIRON

Table 3-4-15
Fall 2035 TAC and ROG Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Fume Hoods in Representative Lab[2]	Fume Hoods on Campus with Chemical (Fall 2018)[2]	Scaling for Fall 2035[3]	Fume Hoods on Campus with Chemical (Fall 2035)[3]	Emission Factor[4]	TAC Emissions[5,6] [lbs/year]	ROG Emissions[5,7] [lbs/year]
Vinyl chloride	75-01-4	132	164	236	22%	288	100%	232	232
Xylenes	1330-20-7	0,496	164	1,176	22%	1,436	5%	217	217
Zinc and compounds	7440-66-6	625	164	1,071	22%	1,308	1%	50	0
Total for Fall 2035								**180,525**	**37,503**

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from a Stanford 2001 inventory for the ChemBio building, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)

   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. The quantity of chemicals used in Fall 2018 is assumed to scale linearly with the number of fume hoods in each laboratory as shown in Table 3-4-14. The exception to this assumption is for isopropanol and acetone where the emissions are assumed to scale by wet laboratory square footage.

3. Scaling for Fall 2035 is based on the increase in academic square footage expected from Fall 2018 to full buildout of the 2018 GUP, with the assumption that the increase in laboratory space is proportional to the increase in overall academic space.

4. Emission factors represent what percentage of the mass usage of the chemical is emitted into the air. Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%

   Emission Factor for Liquids = 5%

   Emission Factor for Solids/Metals = 1%

   Emission Factor for Methylene Chloride = 20%

5. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

6. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

7. ROGs are identified by ARB. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf

Abbreviations:

ARB - California Air Resources Board
BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
HHRA - human health risk assessment
lb - pound
ROG - reactive organic gas
TAC - toxic air contaminants
yr - year

RAMBOLL ENVIRON

Table 3-4-16
2014 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Maximum Gasoline Annual Throughput[1]	Emission Factor	Emissions
		VOC[2]	VOC
	[gal/yr]	[lb/1000 gal]	[ton/yr]
Bonair	147,671	1.06	7.8E-02
Valero	1,013,866	1.06	5.4E-01
		Total [ton/yr]	**6.2E-01**

Notes:

1. Gasoline annual throughput is obtained from Stanford University. Valero throughput scaled from 13-month to 12-month period.
2. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Management District

EF - emission factor

gal - gallon

lb - pound

ROG - reactive organic gas

ton - short tons

VOC - volatile organic compounds

yr - year

RAMBOLL ENVIRON

Table 3-4-17
2015 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Maximum Gasoline Annual Throughput[1] [gal/yr]	Emission Factor VOC[2] [lb/1000 gal]	Emissions VOC [ton/yr]
Bonair	147,671	1.06	7.8E-02
Valero	1,013,866	1.06	5.4E-01
		Total [ton/yr]	**6.2E-01**

Notes:

1. Gasoline annual throughput is obtained from Stanford University.
2. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Management District

EF - emission factor

gal - gallon

ROG - reactive organic gas

ton - short tons

VOC - volatile organic compounds

yr - year

RAMBOLL ENVIRON

Table 3-4-18
Fall 2018 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Maximum Gasoline Annual Throughput[1,2]	Emission Factor	Emissions
		VOC[3]	VOC
	[gal/yr]	[lb/1000 gal]	[ton/yr]
Bonair	140,288	1.06	7.4E-02
		Total [ton/yr]	**7.4E-02**

Notes:

1. Gasoline annual throughput is obtained from Stanford University.
2. By fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles. This will also result in a 5% reduction in annual gasoline throughput at the Bonair fuel station.
3. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Manageme
EF - emission factors
gal - gallon
GUP - general use permit
lb - pound
ton - short tons
ROG - reactive organic gas
VOC - volatile organic compounds
yr - year

RAMBOLL ENVIRON

Table 3-4-19
Fall 2035 ROG Emissions - Fuel Station
Stanford University
Stanford, CA

Source	Fall 2018 Maximum Gasoline Annual Throughput[1]	Scaling Factor for Increase in Electric Vehicles in the Campus Fleet[2]	Fall 2035 Maximum Gasoline Annual Throughput[1]	Emission Factor	Emissions
				VOC[3]	VOC
	[gal/yr]	[%]	[gal/yr]	[lb/1000 gal]	[ton/yr]
Bonair	140,288	-50%	70,144	1.06	3.7E-02
				Total for Fall 2035 [ton/yr]	**3.7E-02**

Notes:

1. Fall 2018 gasoline annual throughput is shown in Table 3-4-18.
2. By Fall 2035, 70% of campus fleet is expected to be electric; 40% was electric by Fall 2018, so the 2018 fuel consumption was assumed to represent the emissions for the 60% of the campus fleet that use internal combustion engines. Therefore, the fuel usage was scaled down by (1-40%)/(1-70%) since the remaining vehicles are assumed to use electricity.
3. Controlled VOC emission factors (EF) are obtained from the source specific guidance section for the petroleum industry from BAAQMD's Permit Handbook. Controlled baseline EF is estimated by multiplying the uncontrolled baseline EF by the percent of the emissions which would not be controlled by a fully functional Phase II system. Uncontrolled VOC emissions are due to tank filling, vehicle fueling, and minor spillage.

   Equation Used:

   Controlled VOC EF = 21.2 lb/1000 gal of gasoline * (1.00 - 0.95)

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
EF - emission factors
gal - gallon
GUP - general use permit
lb - pound
ton - short tons
ROG - reactive organic gas
VOC - volatile organic compounds
yr - year

Table 4-1-1
2014 TAC Emissions - Cardinal Cogen
Stanford University
Stanford, CA

Facility	Emissions Sources	Average Daily Emissions [lbs/day]			Annual Emissions [lbs/year]		
		Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
Cardinal Cogen	Cogen Total Emissions[1,2]	0.39	2.7	0.0033	143	978	1.2

Notes:

1. BAAQMD 2014 Cardinal Cogen Criteria Air Pollutant Emissions (For 2014 calendar year emissions) presents annual average emissions in lbs/day for criteria pollutants. Ramboll Environ assumed 365 days/year to calculate total annual emissions.

2. Although the Cardinal Cogen exports electricity and steam to outside the study area, all CAP and TAC emissions are assumed to contribute to local air quality.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CAP - criteria air pollutants
GUP - General Use Permit
lb - pound
TAC - toxic air contaminants

Table 4-1-2
2014 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Source	Annual Natural Gas Usage		TAC Emission Factors[3]			TAC Emissions[3]		
			Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	[therms]	[MMBtu]	[lb/MMBTu]			[lbs/yr]		
Other Natural Gas - Total	**1,461,298**	**146,130**				**0.30**	**10.74**	**0.49**
PGE Residential[1]	632,937	63,294	2.1E-06	7.4E-05	3.3E-06	0.13	4.65	0.21
PGE Commercial[1]	814,953	81,495				0.17	5.99	0.27
PGE Other Housing[2]	13,408	1,341				0.003	0.099	0.004

Notes:

1. Annual Natural Gas usage provided by Stanford. Addresses were geocoded, and natural gas use from addresses outside of unincorporated Santa Clara County was removed. Cardinal Cogen emissions are shown separately in Table 4-1-1.
2. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.
3. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emission Estimator Model
lb - pound
MMBTU - million British thermal units
PGE - Pacific Gas & Electric
TAC - toxic air contaminants
therms - 100,000 British thermal units
yr - year

Table 4-1-3
2015 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Total NG Throughput	Emission Factors[1]			Emissions		
		Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	MMBtu/yr	[lb/MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/yr]	[lb/yr]	[lb/yr]
Hot Water Generators	101,408	2.1E-06	7.4E-05	3.3E-06	0.21	7.5	0.34
Replacement Process Steam Plant	82,363	2.1E-06	7.4E-05	3.3E-06	0.17	6.1	0.27
Other Natural Gas - Total	354,139	2.1E-06	7.4E-05	3.3E-06	0.73	26	1.2
PGE Residential	56,643	2.1E-06	7.4E-05	3.3E-06	0.12	4	0.2
PGE Commercial	296,155	2.1E-06	7.4E-05	3.3E-06	0.61	22	1.0
PGE Searsville/Olmstead[3]	1,341	2.1E-06	7.4E-05	3.3E-06	0.00	0	0.0

Notes:

1. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
lb - pound
MMBTU - million British thermal units
NG - natural gas
TAC - toxic air contaminants
yr - year

Table 4-1-4
Fall 2018 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	2015 Annual Natural Gas Usage[1]	Scaling for Fall 2018[2]	Fall 2018 Annual Natural Gas Usage	Emission Factors[3]			Emissions		
				Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	[MMBtu/yr]	[%]	[MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/yr]	[lb/yr]	[lb/yr]
Hot Water Generators	101,408	8%	109,605	2.1E-06	7.4E-05	3.3E-06	0.23	8.1	0.37
Replacement Process Steam Plant	82,363	8%	89,021				0.18	6.5	0.30
Other Natural Gas - Total	354,139		379,172				0.78	28	1.3
PGE Residential	56,643	4%	58,626				0.12	4.3	0.20
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007				0.023	0.81	0.037
PGE Commercial - Remaining[4]	285,148	8%	308,198				0.63	23	1.0
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				0.0028	0.10	0.0045

Notes:

1. 2015 Annual Natural Gas usage details are shown in **Table 4-1-3.**
2. Scaling for Fall 2018 is primarily based on the increase in academic square footage and student beds expected from December 2015 to Fall 2018. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the CEF, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings.
3. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® default for single family homes built to 2008 Title 24 standards in climate zone 4.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
GUP - general usage plan
lb - pound
MMBTU - million British thermal units
PGE - Pacific Gas & Electric
TAC - toxic air contaminants
yr - year

Table 4-1-5
Fall 2035 TAC Emissions - Natural Gas
Stanford University
Stanford, CA

Equipment	Fall 2018 Annual Natural Gas Usage[1]	Scaling for Fall 2035[2]	Fall 2035 Annual Natural Gas Usage	Emission Factors[3]			Emissions		
				Benzene	Formaldehyde	Toluene	Benzene	Formaldehyde	Toluene
	[MMBtu/yr]	[%]	[MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/MMBtu]	[lb/yr]	[lb/yr]	[lb/yr]
Hot Water Generators	109,605	22%	133,845	2.1E-06	7.4E-05	3.3E-06	0.28	9.8	0.45
Replacement Process Steam Plant	89,021	22%	108,709				0.22	8.0	0.36
Other Natural Gas - Total	379,172		475,887				0.98	35	1.6
PGE Residential	58,626	38%	80,651				0.17	5.9	0.27
PGE Commercial - Individual Replacement Boilers[4]	11,007	0%	11,007				0.023	0.81	0.037
PGE Commercial - Remaining[4]	308,198	22%	376,358				0.77	28	1.3
PGE Searsville/Olmstead Housing[5]	1,341	0%	1,341				0.0028	0.10	0.0045
PGE New Faculty/Staff Housing[6]	0	N/A	6,531				0.0134	0.48	0.0218

Notes:

1. Fall 2018 Annual Natural Gas usage details are shown in **Table 4-1-4.**
2. Scaling for Fall 2035 is primarily based on the increase in academic square footage and student beds expected from Fall 2018 to full buildout of the 2018 GUP. The majority of PGE Residential addresses are student housing, so the increase is based on number of beds. PGE Commercial, the Hot Water Generators, and the Replacement Process Steam Plant serve largely academic buildings, so the increase is based on academic square footage. Estimates for new faculty/staff housing are added. The six individual replacement boilers are not expected to increase in use. Gas use is assumed to scale linearly; i.e., efficiency and use in new buildings is assumed equal to current buildings. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.
3. Benzene, formaldehyde and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion from boilers. Emission factors were taken from the BAAQMD Permit Handbook, Section 2.1, Miscellaneous Natural Gas Combustion. http://hank.baaqmd.gov/pmt/handbook/rev02/PH_00_05_02_01.pdf
4. The six individual replacement boilers are not expected to increase in gas consumption. Based on matching up PGE commercial addresses, Ramboll Environ estimated the gas consumption from these boilers and separated this from the total PGE commercial gas. Not all boilers addresses could be matched, and not all gas used at a given address is necessarily due to the boilers, so this breakdown is approximate.
5. Areas on campus for which Stanford did not provide detailed gas data include the Searsville Block and Olmsted Staff faculty/staff housing. The annual gas use is based on the CalEEMod® version 2013.2.2 default for single family homes built to 2008 Title 24 standards in climate zone 4.
6. This represents the natural gas consumption from the 550 new faculty/staff high density homes to be constructed within the study boundary. The annual natural gas use is based on the CalEEMod® version 2013.2.2 default for condo/townhouse built to 2008 Title 24 standards in climate zone 4. This is likely very conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod® - California Emission Estimator Model
CEF - Central Energy Facility
GUP - general usage plan
lb - pound
MMBTU - million British thermal units
PGE - Pacific Gas & Electric
TAC - toxic air contaminants
yr - year

Table 4-1-6
2014 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[9] [ton/year]					Total Emissions[9,12] [ton/year]		
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[3,11]	Undergraduate	234	2.0	70,286		512,385		0.0022		3.8E-04		0.0022	3.8E-04	
	Graduate	1,259	2.0	523,894		4,793,631		0.018		0.0031		0.018	0.0031	
	Post-doc	555	2.0	246,412		2,335,983		0.0084		0.0015		0.0084	0.0015	
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160		0.089		0.016		0.089	0.016	
	Casual Employees	302	2.0	133,960		1,793,719		0.0052		9.3E-04		0.0052	9.3E-04	
	Contingent Employees	294	2.0	130,354		1,596,836		0.0049		8.7E-04		0.0049	8.7E-04	
	Temporary Employees	604	2.0	268,165		3,421,786		0.010		0.0018		0.010	0.0018	
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407		0.0028		4.9E-04		0.0028	4.9E-04	
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239		0.015		0.0027		0.015	0.0027	
	Third Party Contractors	244	2.0	108,178		1,537,214		0.0043		7.8E-04		0.0043	7.8E-04	
	Janitorial Shift Workers	195	2.0	86,543		1,229,771		0.0035		6.2E-04		0.0035	6.2E-04	
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596		0.025		0.0041		0.025	0.0041	
	Construction	975	2.0	432,713		6,148,856		0.017		0.0031		0.017	0.0031	
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**		**0.21**		**0.036**		**0.21**	**0.036**	
On-Campus (Resident) Trips[3,11]	Undergraduate	1,582	5.9	1,962,450		7,612,107		0.052		0.0087		0.052	0.0087	
	Graduate	3,648	4.5	5,264,378		27,554,538		0.15		0.025		0.15	0.025	
	Post-doc	28	3.7	33,580		168,975		9.5E-04		1.6E-04		9.5E-04	1.6E-04	
	Faculty/Staff	98	3.1	109,500		616,735		0.0032		5.4E-04		0.0032	5.4E-04	
	Sub-Total	**5,356**		**7,369,908**		**35,952,355**		**0.20**		**0.035**		**0.20**	**0.035**	
Campus Vehicles - On-road[4]	Bonair on-road - gas[7]	470	2.7	454,946	7.3	3,321,104		0.011		0.0021		0.011	0.0021	
	Bonair on-road - diesel[7]	11	3.2	12,890	7.3	94,099	4.7E-05		2.9E-06		0.0070	4.7E-05	2.9E-06	0.0070
	Bonair on-road buses - diesel[7]	10	1.1	4,075	7.3	29,749	3.3E-04		2.0E-05		0.030	3.3E-04	2.0E-05	0.030
	Bonair Unfiltered - on-road - gas[7]	74	1.7	45,317	7.3	330,811		0.0012		2.1E-04		0.0012	2.1E-04	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.0072		4.4E-04		0.36	0.0072	4.4E-04	0.36
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	8.9E-05		5.5E-06		0.013	8.9E-05	5.5E-06	0.013
	Marguerite[10]	66				1,983,931	0.010		6.3E-04		1.3	0.010	6.3E-04	1.3
	Public Safety	31	2.8	31,879	7.3	232,720		7.9E-04		1.5E-04		7.9E-04	1.5E-04	
	Sub-Total	**700**		**614,290**		**8,594,006**	**0.018**	**0.013**	**0.0011**	**0.0025**	**1.7**	**0.031**	**0.0036**	**1.7**
Other Trips[3]	General Visitors (Vendor)[11]	2,016,204	2.0	4,032,408		25,001,480		0.12		0.020		0.12	0.020	
	Worker Non-Commute Trips[11]			301,920		935,952		0.0049		9.1E-04		0.0049	9.1E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443		0.0069		0.0014		0.0069	0.0014	
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.0040		2.5E-04		0.39	0.0040	2.5E-04	0.39
	Event Visitor Traffic[11]	149,958	2.0	299,917		6,652,357		0.015		0.0028		0.015	0.0028	
	Deliveries - Trucks	168,054	2.0	336,108		2,083,870	0.0064		4.0E-04		0.31	0.0064	4.0E-04	0.31
	Construction Vendor Trucks[13]		*2.4*	*8,510*		*62,123*	*1.9E-04*		*1.2E-05*		*0.0092*	*1.9E-04*	*1.2E-05*	*0.0092*
	Construction Haul Trucks[13]		*2.4*	*7,987*		*159,740*	*4.8E-04*		*3.0E-05*		*0.024*	*4.8E-04*	*3.0E-05*	*0.024*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**0.010**	**0.15**	**6.5E-04**	**0.025**	**0.70**	**0.16**	**0.026**	**0.70**
					Total VMT	**143,212,045**								
Campus Vehicles - Off-road Equip[6]						**[bhp-hr/yr][5]**								
	Siebel and Red Barn equip - gas[8]					38,837		0.084		0.0082		0.084	0.0082	
	Siebel and Red Barn equip - diesel[8]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0014		0.014	0.0014	
	Off-road equip - diesel					102,593	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		0.0063		6.1E-06		0.0063	6.1E-06	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Sub-Total					**390,554**	**0.0054**	**0.10**	**3.4E-04**	**0.010**	**0.14**	**0.11**	**0.010**	**0.14**

RAMBOLL ENVIRON

Table 4-1-6
2014 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and NEVES.
6. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
7. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
8. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
9. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM10 emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
12. EMFAC emission factors for 2015 are used for calculating on-road emissions and are summarized in Mobile Appendix C.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
CARB - California Air Resources Board
DPM - diesel particulate matter
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hp - horsepower
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 μm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
USEPA - United States Environmental Protection Agency
TAC - toxic air contaminants
TBD - to be determined
TOG - total organic gas
ton - short tons
μm - micrometer
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 4-1-7
2015 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[9] [ton/year]					Total Emissions[9,12] [ton/year]		
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[3,11]	Undergraduate	234	2.0	70,286		512,385		0.0022		3.8E-04		0.0022	3.8E-04	
	Graduate	1,259	2.0	523,894		4,793,631		0.018		0.0031		0.018	0.0031	
	Post-doc	555	2.0	246,412		2,335,983		0.0084		0.0015		0.0084	0.0015	
	Faculty/Staff	5,443	2.0	2,416,714		27,803,160		0.089		0.016		0.089	0.016	
	Casual Employees	302	2.0	133,960		1,793,719		0.0052		9.3E-04		0.0052	9.3E-04	
	Contingent Employees	294	2.0	130,354		1,596,836		0.0049		8.7E-04		0.0049	8.7E-04	
	Temporary Employees	604	2.0	268,165		3,421,786		0.010		0.0018		0.010	0.0018	
	Non-Employee Affiliates: 20% FTEs	169	2.0	75,118		892,407		0.0028		4.9E-04		0.0028	4.9E-04	
	Non-Employee Affiliates: FTEs	925	2.0	410,795		4,880,239		0.015		0.0027		0.015	0.0027	
	Third Party Contractors	244	2.0	108,178		1,537,214		0.0043		7.8E-04		0.0043	7.8E-04	
	Janitorial Shift Workers	195	2.0	86,543		1,229,771		0.0035		6.2E-04		0.0035	6.2E-04	
	First Mile to Transit (all Workers + Students)	2,039	2.0	903,934		3,707,596		0.025		0.0041		0.025	0.0041	
	Construction	975	2.0	432,713		6,148,856		0.017		0.0031		0.017	0.0031	
	Sub-Total	**13,238**		**5,807,066**		**60,653,583**		**0.21**		**0.036**		**0.21**	**0.036**	
On-Campus (Resident) Trips[3,11]	Undergraduate	1,582	5.9	1,962,450		7,612,107		0.052		0.0087		0.052	0.0087	
	Graduate	3,648	4.5	5,264,378		27,554,538		0.15		0.025		0.15	0.025	
	Post-doc	28	3.7	33,580		168,975		9.5E-04		1.6E-04		9.5E-04	1.6E-04	
	Faculty/Staff	98	2.6	94,698		619,941		0.0029		4.9E-04		0.0029	4.9E-04	
	Sub-Total	**5,356**		**7,355,106**		**35,955,561**		**0.20**		**0.035**		**0.20**	**0.035**	
Campus Vehicles - On-road[4]	Bonair on-road - gas[7]	470	2.7	454,946	7.3	3,321,104		0.011		0.0021		0.011	0.0021	
	Bonair on-road - diesel[7]	11	3.2	12,890	7.3	94,099	4.7E-05		2.9E-06		0.0070	4.7E-05	2.9E-06	0.0070
	Bonair on-road buses - diesel[7]	10	1.1	4,075	7.3	29,749	3.3E-04		2.0E-05		0.030	3.3E-04	2.0E-05	0.030
	Bonair Unfiltered - on-road - gas[7]	74	1.7	45,317	7.3	330,811		0.0012		2.1E-04		0.0012	2.1E-04	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.0072		4.4E-04		0.36	0.0072	4.4E-04	0.36
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	8.9E-05		5.5E-06		0.013	8.9E-05	5.5E-06	0.013
	Marguerite[10]	66				1,983,931	0.010		6.3E-04		1.3	0.010	6.3E-04	1.3
	Public Safety	31	2.8	31,879	7.3	232,720		7.9E-04		1.5E-04		7.9E-04	1.5E-04	
	Sub-Total	**700**		**614,290**		**8,594,006**	**0.018**	**0.013**	**0.0011**	**0.0025**	**1.7**	**0.031**	**0.0036**	**1.7**
Other Trips[3]	General Visitors (Vendor)[11]	2,016,204	2.0	4,032,408		25,001,480		0.12		0.020		0.12	0.020	
	Worker Non-Commute Trips[11]			301,920		935,952		0.0049		9.1E-04		0.0049	9.1E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		2,948,443		0.0069		0.0014		0.0069	0.0014	
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	0.0040		2.5E-04		0.39	0.0040	2.5E-04	0.39
	Event Visitor Traffic[11]	149,958	2.0	299,917		6,652,357		0.015		0.0028		0.015	0.0028	
	Deliveries - Trucks	168,054	2.0	336,108		2,083,870	0.0064		4.0E-04		0.31	0.0064	4.0E-04	0.31
	Construction Vendor Trucks[13]		*2.4*	*8,510*		*62,123*	*1.9E-04*		*1.2E-05*		*0.0092*	*1.9E-04*	*1.2E-05*	*0.0092*
	Construction Haul Trucks[13]		*2.4*	*7,987*		*159,740*	*4.8E-04*		*3.0E-05*		*0.024*	*4.8E-04*	*3.0E-05*	*0.024*
	Sub-Total	**2,401,301**		**5,120,900**		**38,012,101**	**0.010**	**0.15**	**6.5E-04**	**0.025**	**0.70**	**0.16**	**0.026**	**0.70**
					Total VMT	**143,215,251**								
Campus Vehicles - Off-road Equip[6]						**[bhp-hr/yr][5]**								
	Siebel and Red Barn equip - gas[8]					38,837		0.084		0.0082		0.084	0.0082	
	Siebel and Red Barn equip - diesel[8]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0014		0.014	0.0014	
	Off-road equip - diesel					102,593	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		0.0063		6.1E-06		0.0063	6.1E-06	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Sub-Total					**390,554**	**0.0054**	**0.10**	**3.4E-04**	**0.010**	**0.14**	**0.11**	**0.010**	**0.14**

RAMBOLL ENVIRON

Table 4-1-7
2015 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix A. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix A. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year based on data for 2015 provided by Fehr & Peers in SB 743 VMT Analysis Appendix A.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites are adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and NEVES.
6. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
7. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
8. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
9. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM10 emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C.
11. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
12. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
CARB - California Air Resources Board
DPM - diesel particulate matter
equip - equipment
FTE - full-time equivalent
GUP - general use permit
hp - horsepower
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 µm in diameter
PSSI - Peninsula Sanitary Service, Inc.
ROG - reactive organic gas
USEPA - United States Environmental Protection Agency
TAC - toxic air contaminants
TBD - to be determined
TOG - total organic gas
ton - short tons
µm - micrometer
USEPA - United States Environmental Protection Agency
VMT - vehicle miles traveled
yr - year

Table 4-1-8
Fall 2018 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[9] [ton/year]					Total Emissions[9,13] [ton/year]		
	Group	Number of Vehicles[2]	Trips per Day per Vehicle[2]	Total Vehicle Trips per Year[2]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[3,12]	Undergraduate	185	2.0	55,470		404,378		0.0007		1.2E-04		0.0007	1.2E-04	
	Graduate	1286	2.0	534,884		4,894,189		0.0076		1.3E-03		0.008	1.3E-03	
	Post-doc	589	2.0	261,730		2,481,198		0.0038		6.5E-04		0.004	6.5E-04	
	Faculty/Staff	5,682	2.0	2,522,720		28,678,561		0.0397		0.0071		0.04	0.0071	
	Casual Employees	314	2.0	139,563		1,868,744		0.0024		4.3E-04		0.002	4.3E-04	
	Contingent Employees	306	2.0	135,808		1,663,642		0.0022		4.0E-04		0.0022	4.0E-04	
	Temporary Employees	629	2.0	279,355		3,564,566		0.0047		8.4E-04		0.005	8.4E-04	
	Non-Employee Affiliates: 20% FTEs	176	2.0	78,281		929,974		0.0013		2.3E-04		0.0013	2.3E-04	
	Non-Employee Affiliates: FTEs	964	2.0	428,097		5,085,797		0.0069		1.2E-03		0.007	1.2E-03	
	Third Party Contractors	263	2.0	116,833		1,660,191		0.0021		3.8E-04		0.0021	3.8E-04	
	Janitorial Shift Workers	210	2.0	93,394		1,327,128		0.0017		3.0E-04		0.0017	3.0E-04	
	First Mile to Transit (all Workers + Students)	2,125	2.0	941,983		3,864,416		0.0100		1.6E-03		0.0100	1.6E-03	
	Construction	975	2.0	432,713		6,148,856		0.0077		1.4E-03		0.008	1.4E-03	
	Sub-Total	**13,705**		**6,020,830**		**62,571,641**		**0.09**		**0.0159**		**0.091**	**0.0159**	
On-Campus (Resident) Trips[3,12]	Sub-Total	1,654	5.8	2,028,810		7,869,489		0.0197		3.3E-03		0.020	0.0033	
	Undergraduate	3,829	4.4	5,479,152		28,680,441		0.0592		1.0E-02		0.06	0.0100	
	Post-doc	28	3.7	33,580		168,975		3.6E-04		6.1E-05		3.6E-04	6.1E-05	
	Post-doc	98	2.6	94,698		619,941		0.0011		1.9E-04		0.0011	1.9E-04	
	Faculty/Staff	**5,609**		**7,636,240**		**37,338,845**		**0.08**		**0.0136**		**0.08**	**0.0136**	
Campus Vehicles - On-road[4]	Bonair on-road - gas[7]	470	2.5	432,198	7.3	3,155,049		0.008		1.4E-03		0.0075	0.0014	
	Bonair on-road - diesel[7]	11	3.0	12,246	7.3	89,394	2.9E-05		1.8E-06		0.0058	2.9E-05	1.8E-06	0.0058
	Bonair on-road buses - diesel[7]	10	1.1	3,871	7.3	28,261	2.2E-04		1.4E-05		0.025	2.2E-04	1.4E-05	0.025
	Bonair Unfiltered - on-road - gas[7]	74	1.6	43,051	7.3	314,270		0.0008		1.4E-04		7.7E-04	1.4E-04	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	6.4E-03		4.0E-04		0.3342	6.4E-03	4.0E-04	0.3342
	PSSI - Company Vehicles - diesel	10	6.66	24,303	7.3	177,409	5.8E-05		3.6E-06		0.0115	5.8E-05	3.6E-06	0.0115
	Marguerite[10]	66				2,144,233	0.0087		5.4E-04		1.3	0.0087	5.4E-04	1.3
	Public Safety	31	2.8	31,879	7.3	232,720		0.0005		1.0E-04		0.0005	1.0E-04	
	Public Safety	**700**		**588,428**		**8,565,520**	**0.0154**	**0.009**	**9.5E-04**	**1.6E-03**	**1.6**	**0.024**	**0.0026**	**1.6**
Other Trips[3]	General Visitors (Vendor)[12]	2,177,501	2.0	4,355,001		27,001,599		0.05		0.0086		0.053	0.0086	
	Worker Non-Commute Trips[12]			326,074		1,010,828		0.0037		6.5E-04		0.0037	6.5E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	147,705		3,130,985		0.0051		1.0E-03		0.0051	0.0010	
	Non-event Visitor Trips - Buses	5,250	2.0	11,074		390,000	0.0029		1.8E-04		0.34	0.0029	1.8E-04	0.34
	Event Visitor Traffic[12]	67,085	2.0	301,862		6,695,507		0.007		1.4E-03		0.0071	0.0014	
	Deliveries - Trucks	181,499	2.0	362,997		2,250,579	0.0062		3.9E-04		0.32	0.0062	3.9E-04	0.32
	Construction Vendor Trucks[14]		*2.4*	*8,510*	*7.3*	*62,123*	*0.0002*		*1.1E-05*		*0.01*	*0.0002*	*1.1E-05*	*0.01*
	Construction Haul Trucks[14]		*2.4*	*7,987*	*20*	*159,740*	*0.0004*		*2.6E-05*		*0.02*	*0.0004*	*2.6E-05*	*0.02*
	Off-road equip - diesel	**2,493,169**		**5,504,713**		**40,479,498**	**0.009**	**0.07**	**5.7E-04**	**0.0117**	**0.65**	**0.078**	**0.0122**	**0.65**
					Total VMT	**148,955,504**								
Campus Vehicles - Off-road Equip[6]						**[bhp-hr/yr][5]**								
	Siebel and Red Barn equip - gas[8]					38,837		0.084		0.0187		0.084	0.0187	
	Siebel and Red Barn equip - diesel[8]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0032		0.014	0.0032	
	Off-road equip - diesel					102,570	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		6.3E-05		1.4E-05		6.3E-05	1.4E-05	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Deliveries - Trucks (total)					**390,532**	**0.0054**	**0.098**	**3.4E-04**	**0.0219**	**0.14**	**0.104**	**0.0223**	**0.14**

Table 4-1-8
Fall 2018 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix B1. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix B1 (e.g., trip lengths for workers).
2. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix B1. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
3. VMT per year for Fall 2018 inventory based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix B1.
4. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Marguerite vehicle emissions are calculated on a per vehicle basis using mileage provided by Stanford. Emissions for Marguerites is adjusted for hybrid/electric vehicles as well as removal of emissions from routes that never cross into the study area. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
5. Conversion factors from fuel usage in gallons to bhp-hr for off-road equipment originate from the USEPA NEVES.
6. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
7. EMFAC mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption.
8. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
9. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM_{10} emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
10. Marguerite emissions are refined to estimate emissions for each bus individually. Emissions calculations and emission factors can be found in Appendix C. By Fall 2018, Ramboll Environ assumed that the 10 oldest buses in the Marguerite fleet were converted from diesel-powered to electric-powered. These calculation are shown in Appendix C.
11. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles.
12. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
13. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
14. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
DPM - diesel particulate matter
EMFAC - emissions factors
FTE - full-time equivalent
GUP - general usage plan
hp - horsepower
hr - hour
PSSI - Peninsula Sanitary Service, Inc.
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 microns in diameter
RE - Ramboll Environ
ROG - reactive organic gas
TAC - toxic air contaminants
TOG - total organic gases
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles travelled
yr - year

Table 4-1-9
Fall 2035 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Trip Type	Trip Information[1]						Speciated Total Emissions[2] [ton/year]					Total Emissions[3] [ton/year]		
	Group	Number of Vehicles[4]	Trips per Day per Vehicle[4]	Total Vehicle Trips per Year[4]	Trip Length [mile]	Total VMT [mile/year]	Benzene (Diesel)	Benzene (Gas)	1,3-butadiene (Diesel)	1,3-butadiene (Gas)	DPM	Benzene	1,3-butadiene	DPM
Off-Campus (Worker) Trips[5,6]	Undergraduate	185	2.0	55,470		404,378		2.3E-04		3.2E-05		2.3E-04	3.2E-05	
	Graduate	764	2.0	317,833		2,908,174		0.0014		2.1E-04		0.0014	2.1E-04	
	Post-doc	828	2.0	367,634		3,485,170		0.0017		2.5E-04		0.0017	2.5E-04	
	Faculty/Staff	7,220	2.0	3,205,524		35,698,523		0.016		0.0024		0.016	0.0024	
	Casual Employees	398	2.0	176,826		2,367,699		0.0010		1.5E-04		0.0010	1.5E-04	
	Contingent Employees	388	2.0	172,068		2,107,835		9.0E-04		1.4E-04		9.0E-04	1.4E-04	
	Temporary Employees	797	2.0	353,942		4,516,305		0.0019		3.0E-04		0.0019	3.0E-04	
	Non-Employee Affiliates: 20% FTEs	223	2.0	99,182		1,178,277		5.1E-04		7.9E-05		5.1E-04	7.9E-05	
	Non-Employee Affiliates: FTEs	1,222	2.0	542,399		6,443,705		0.0028		4.3E-04		0.0028	4.3E-04	
	Third Party Contractors	321	2.0	142,671		2,027,352		8.1E-04		1.3E-04		8.1E-04	1.3E-04	
	Janitorial Shift Workers	257	2.0	114,049		1,620,630		6.4E-04		1.0E-04		6.4E-04	1.0E-04	
	First Mile to Transit (all Workers + Students)	2,654	2.0	1,177,343		4,853,984		0.0041		4.9E-04		0.0041	4.9E-04	
	Construction	975	2.0	432,713		6,148,856		0.0024		3.9E-04		0.0024	3.9E-04	
	Sub-Total	**16,231**		**7,157,654**		**73,760,888**		**0.034**		**0.0052**		**0.034**	**0.0052**	
On-Campus (Resident) Trips[5,6]	Sub-Total	2,079	5.8	2,550,030		9,891,078		0.0078		0.0010		0.0078	0.0010	
	Undergraduate	5,974	4.5	8,613,822		45,087,773		0.029		0.0041		0.029	0.0041	
	Post-doc	28	3.7	33,580		168,975		1.1E-04		1.6E-05		1.1E-04	1.6E-05	
	Post-doc	1511	2.7	1,463,463		9,574,762		0.0056		7.9E-04		0.0056	7.9E-04	
	Faculty/Staff	**9,592**		**12,660,895**		**64,722,587**		**0.043**		**0.0059**		**0.043**	**0.0059**	
Campus Vehicles - On-road[7]	Bonair on-road - gas[8]	470	2.5	432,198	7.3	3,155,049		0.0038		6.8E-04		0.0019	3.4E-04	
	Bonair on-road - diesel[8]	11	3.0	12,246	7.3	89,394	7.6E-06		4.7E-07		0.0046	3.8E-06	2.4E-07	0.0023
	Bonair on-road buses - diesel[9]	10	1.1	3,871	7.3	28,261	7.4E-05		4.6E-06		0.017	3.7E-05	2.3E-06	0.0085
	Bonair Unfiltered - on-road - gas[9]	74	1.6	43,051	7.3	314,270		3.9E-04		6.7E-05		2.0E-04	3.4E-05	
	PSSI - Collection Trucks - diesel	28	4.0	40,880	59.3	2,424,184	0.0047		2.9E-04		0.29	0.0047	2.9E-04	0.29
	PSSI - Company Vehicles - diesel	10	6.7	24,303	7.3	177,409	1.5E-05		9.4E-07		0.0091	1.5E-05	9.4E-07	
	Marguerite[9]	66				2,618,108	0		0		0	0	0	0
	Public Safety	31	2.8	31,879	7.3	232,720		2.6E-04		5.0E-05		2.6E-04	5.0E-05	
	Public Safety	**700**		**588,428**		**9,039,395**	**0.0048**	**0.0045**	**3.0E-04**	**7.9E-04**	**0.32**	**0.0071**	**7.2E-04**	**0.30**
Other Trips[5]	General Visitors (Vendor)	2,656,551	2.0	5,313,101		32,968,952		0.021		0.0028		0.021	0.0028	
	Worker Non-Commute Trips			397,810		1,234,221		0.0021		3.5E-04		0.0021	3.5E-04	
	Non-event Visitor Trips - Passenger	61,835	2.0	140,047		3,675,599		0.0032		6.5E-04		0.0032	6.5E-04	
	Non-event Visitor Trips - Buses	5,250	2.0	10,500		390,000	9.4E-04		5.9E-05		0.23	9.4E-04	5.9E-05	0.23
	Event Visitor Traffic	67,085	2.0	299,917		6,980,045		0.0023		4.1E-04		0.0023	4.1E-04	
	Deliveries - Trucks	221,428	2.0	442,856		2,747,957	0.0057		3.5E-04		0.33	0.0057	3.5E-04	0.33
	Construction Vendor Trucks[13]		*2.4*	*8,510*	*7.3*	*62,123*	*1.25E-04*		*7.8E-06*		*0.01*	*0.0001*	*7.8E-06*	*0.01*
	Construction Haul Trucks[13]		*2.4*	*7,987*	*20*	*159,740*	*3.14E-04*		*1.9E-05*		*0.02*	*0.0003*	*1.9E-05*	*0.02*
	Off-road equip - gas	**3,012,148**		**6,604,231**		**47,996,774**	**0.0066**	**0.028**	**4.1E-04**	**0.0042**	**0.56**	**0.035**	**0.0046**	**0.56**
					Total VMT	**195,519,644**								
Campus Vehicles - Off-road Equip[10]						**[bhp-hr/yr][11]**								
	Siebel and Red Barn equip - gas[12]					38,837		0.084		0.019		0.084	0.019	
	Siebel and Red Barn equip - diesel[12]					52,854	0.0011		7.0E-05		0.031	0.0011	7.0E-05	0.031
	Off-road equip - gas					6,553		0.014		0.0032		0.014	0.0032	
	Off-road equip - diesel					102,570	0.0022		1.4E-04		0.060	0.0022	1.4E-04	0.060
	Light Towers - gas					2,925		6.3E-05		1.4E-05		6.3E-05	1.4E-05	
	Light Towers - diesel					186,791	0.0021		1.3E-04		0.053	0.0021	1.3E-04	0.053
	Deliveries - Trucks (total)					**390,532**	**0.0054**	**0.10**	**3.4E-04**	**0.022**	**0.14**	**0.10**	**0.022**	**0.14**

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Table 4-1-9
Fall 2035 TAC Emissions - Mobile Use
Stanford University
Stanford, CA

Notes:

1. Trip information is provided by Fehr & Peers or derived using data from SB 743 VMT Analysis Appendix C. Greyed out cells are either not needed for this analysis (e.g., off-road equipment trips per year) or irrelevant because the assumptions are already embedded into SB 743 VMT Analysis Appendix C (e.g., trip lengths for workers).
2. Benzene and 1,3-butadiene speciation percentages for gasoline exhaust and evaporative are from BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards 2011, Table 14 (http://www.baaqmd.gov/~/media/Files/Planning%20and%20Research/CEQA/BAAQMD%20Modeling%20Approach.ashx?la=en), and for diesel exhaust from MOVES 2007. Gasoline is speciated from TOG emissions and diesel is speciated from ROG emissions. DPM is equivalent to PM10 emissions (see Mobile CAPs tab) for diesel vehicles. For Benzene, gasoline exhaust speciation percentage of 2.47% is used, gasoline evaporative speciation percentage of 0.36% is used, and diesel speciation percentage of 1.29% is used. For 1,3-Butadiene, gasoline speciation percentage of 0.55% is used and diesel speciation percentage of 0.08% is used. Benzene and 1,3-butadiene account for 92% of the cancer risk from all toxic compounds listed in the speciation of TOG due to Tailpipe Emissions, shown in Table 14 offrom the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (2011) Table 14: Toxic Speciation of TOG due to Tailpipe Emissions. Therefore, so only those two compounds are included for gasoline TAC calculations.
3. EMFAC emission factors used for calculating on-road emissions are summarized in Mobile Appendix C.
4. Number of vehicles and trips per vehicle are used to estimate starting and idling emissions. The number of vehicles for residents is based on parking permits. For workers and other trips types, number of vehicles is based on trips per year divided by commuting or driving to campus days per year. Trip counts for worker and resident trips, visitors, and vendors are described by Fehr & Peers in SB 743 VMT Analysis Appendix C. Trip count for shuttles/buses is provided by Stanford. Bonair, PSSI, and Public Safety trip counts are calculated from total vehicle trips and number of vehicles in the fleet. Total vehicle trips per year calculated from total VMT divided by the trip length or provided by Fehr & Peers.
5. VMT per year for Fall 2035 inventory based on data provided by Fehr & Peers in SB 743 VMT Analysis Appendix C.
6. The vehicle fleet is comprised of 99% gasoline-powered vehicles so only a gasoline speciation was used for these entries and chemicals from non-gasoline vehicles were assumed to be negligible.
7. VMT for on-road campus vehicles is split into four categories: Bonair, Marguerite, PSSI, and Public Safety. Bonair vehicles are separated by fuel type and vehicle weight class and uses gallons of fuel used with the EMFAC mpg for that vehicle class in Santa Clara county to estimate VMT. Diesel fuel usage, number of vehicles, and trip rate/length was obtained from Stanford and used to estimate PSSI vehicle emissions. Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was estimated to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are estimated by scaling assuming only 30% non-electric vehicles contribute to emissions in 2035 versus 60% in 2018. This scaling is done in the "Total Emissions" column. Additionally, Stanford expects the entire Marguerite fleet to be electric by 2035. Fuel usage and number of vehicles in the fleet were provided by Stanford for public safety vehicles; these are assumed to be a fleet of light duty vehicles.
8. EMFAC2014 mpg is calculated by summing the VMT for specific weight classes and dividing by the fuel consumption. Emission factors are shown in Mobile Appendix C.
9. Marguerite buses are assumed to all be electric by 2035. By Fall 2018, Ramboll Environ assumed that the Bonair fleet, by switching from a "service yard" system to a "hub" system, will see a 5% reduction in VMT from Bonair vehicles; this is kept constant through 2035.
10. Off-road equipment emission factors for smaller gasoline equipment are from CalEEMod® Table 7.2 under category "Other Lawn and Garden Equipment." Emission factors for light towers are from CalEEMod® Table 3.4 under category "Generator Sets" and emission factors from diesel off-road equipment are from CalEEMod® Table 3.4 under category "Other General Industrial Equipment" for equipment between 6-50 HP.
11. Conversion factors from fuel usage to bhp-hr for off-road equipment originate from the USEPA Nonroad Engine and Vehicle Emission Study (NEVES).
12. Bhp-hr per year for Siebel and Red Barn off-road equipment is estimated from fuel consumption using a conversion factor (for gas and diesel) to convert from gallons to bhp-hr.
13. Vendor and Hauling VMT are based on the defaults that would be calculated using CalEEMod 2013.2.2 for Santa Clara County based on the annual average construction. This consists of 37 trips per day, 7.3 miles per trip for the 230 day building construction phase each year for vendor trips, and 7,987 trips per year, 20 miles per trip for haul trips. These VMT and emissions are a sub-category of the 'Other Trips - Trucks' VMT because these trips would be counted in the Fehr & Peers cordon reconciliation analysis and because the primary vehicle type would be medium- and heavy-duty vehicles. Because over 90% of MHDT and HHDT trucks are diesel in the EMFAC2014 fleet, the diesel emission factors for the overall "Trucks" category are used here.

Abbreviations:

ARB - California Air Resources Board
bhp - brake horsepower
CalEEMod® - California Emission Estimator Model
CAP - criteria air pollutants
DPM - diesel particulate matter
EMFAC - emissions factors
FTE - full-time equivalent
GUP - general usage plan
hp - horsepower
hr - hour
mpg - miles per gallon
NEVES - Nonroad Engine and Vehicle Emission Study
PM_{10} - particulate matter less than 10 microns in diameter
PSSI - Peninsula Sanitary Service, Inc.
RE - Ramboll Environ
ROG - reactive organic gas
TAC - toxic air contaminants
TOG - total organic gases
ton - short tons
USEPA - United States Environmental Protection Agency
VMT - vehicle miles travelled
yr - year

Table 4-2
2014, 2015, Fall 2018, and Fall 2035 TAC Emissions - Summary
Stanford University
Stanford, CA

Sources	Toxic Air Contaminant Emissions																			
	2014 Inventory					2015 Inventory					Fall 2018 (Baseline) Inventory					Fall 2035 (Project) Inventory[1]				
	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM	Benzene	Formaldehyde	Toluene	1,3-Butadiene	PM_{10}/DPM
	[ton/yr]																			
Stationary Sources																				
Cardinal Cogen	0.072	0.49	5.9E-04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water Generators	-	-	-	-	-	1.0E-04	0.0037	1.7E-04	-	-	1.1E-04	0.0040	1.8E-04	-	-	1.4E-04	4.92E-03	2.2E-04	-	-
Replacement Process Steam	-	-	-	-	-	8.5E-05	0.0030	1.4E-04	-	-	9.2E-05	0.0033	1.5E-04	-	-	1.1E-04	4.00E-03	1.8E-04	-	-
Other Natural Gas (e.g., PGE boilers)	1.5E-04	0.0054	2.4E-04	-	-	3.6E-04	0.013	5.9E-04	-	-	3.9E-04	0.014	6.3E-04	-	-	4.9E-04	1.75E-02	7.9E-04	-	-
Emergency Generators	-	-	-	-	0.15	-	-	-	-	0.20	-	-	-	-	0.21	-	-	-	-	0.26
Laboratories	0.20	7.0E-04	0.18	0.089	-	0.20	7.0E-04	0.18	0.089	-	0.22	7.5E-04	0.20	0.10	-	2.7E-01	9.21E-04	2.4E-01	0	-
Valero Fuel Station	0.0016	-	-	-	-	0.0016	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bonair Fuel Station	2.3E-04					2.3E-04					1.1E-07					5.6E-08	-	-	-	-
Subtotal [ton/yr]	**0.28**	**0.50**	**0.18**	**0.089**	**0.15**	**0.21**	**0.020**	**0.18**	**0.089**	**0.20**	**0.22**	**0.022**	**0.20**	**0.096**	**0.21**	**0.27**	**0.027**	**0.24**	**0.12**	**0.26**
Mobile Sources																				
Worker Trips	0.21	-	-	0.036	-	0.21	-	-	0.036	-	0.091	-	-	0.016	-	0.034	-	-	0.0052	-
Resident Trips	0.20	-	-	0.035	-	0.20	-	-	0.035	-	0.08	-	-	0.014	-	0.043	-	-	0.0059	--
Campus Vehicles - On Road	0.031	-	-	0.0036	1.7	0.031	-	-	0.0036	1.7	0.024	-	-	0.0026	1.6	0.0071	-	-	7.2E-04	0.30
Campus Vehicles - Off Road	0.110	-	-	0.0099	0.14	0.110	-	-	0.0099	0.14	0.104	-	-	0.0223	0.14	0.10	-	-	0.022	0.14
Other Trips	0.16	-	-	0.026	0.70	0.16	-	-	0.026	0.70	0.078	-	-	0.012	0.65	0.035	-	-	0.0046	0.56
Construction Off-Road Equipment[2]	-	-	-	-	0.02	-	-	-	-	0.02	-	-	-	-	0.018	-	-	-	-	0.010
Subtotal [ton/yr]	**0.71**	**-**	**-**	**0.11**	**2.6**	**0.71**	**-**	**-**	**0.11**	**2.6**	**0.38**	**-**	**-**	**0.067**	**2.5**	**0.22**	**-**	**-**	**0.039**	**1.01**

Notes:

1. Fall 2035 represents full buildout of the Project. Mobile emission factors are conservatively used from year 2030, to be consistent with the GHG report and comparison to State 2030 targets.

2. Construction emissions are estimated using CalEEMod® 2013.2.2 using the average annual square footage of construction and demolition and estimated excavation from fiscal year 2001 through fiscal year 2015 with default construction schedules and equipment lists. Construction equipment is all assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment. All PM_{10} exhaust emissions are assumed to be DPM.

Abbreviations:

CalEEMod® - California Emission Estimator Model
DPM - diesel particulate matter
PGE - Pacific Gas & Electric
PM_{10} - particulate matter under 10 microns
ton - short tons
yr - year

FIGURES

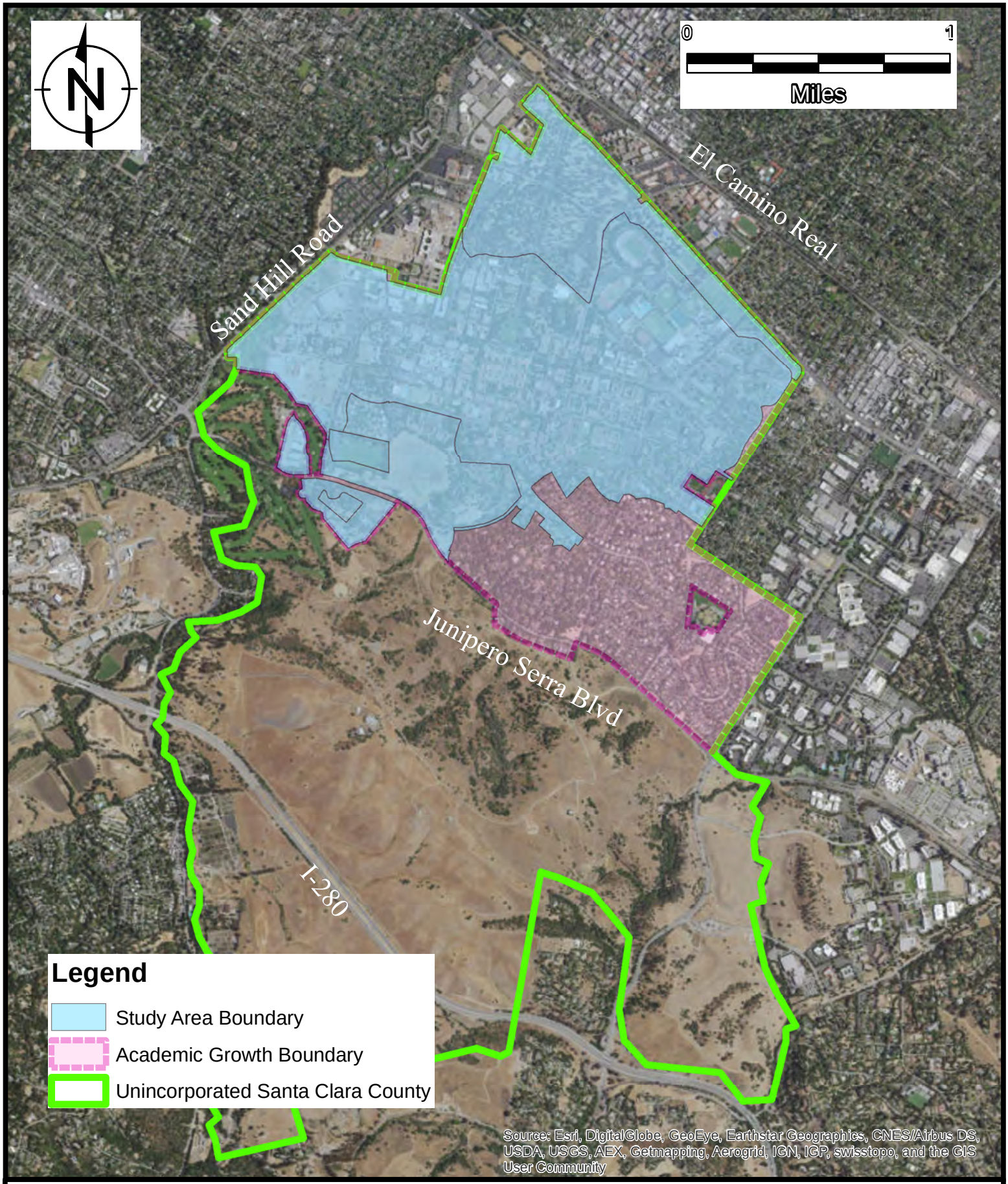

Figure 1-2 Study Area Boundaries
Stanford University
Stanford, CA

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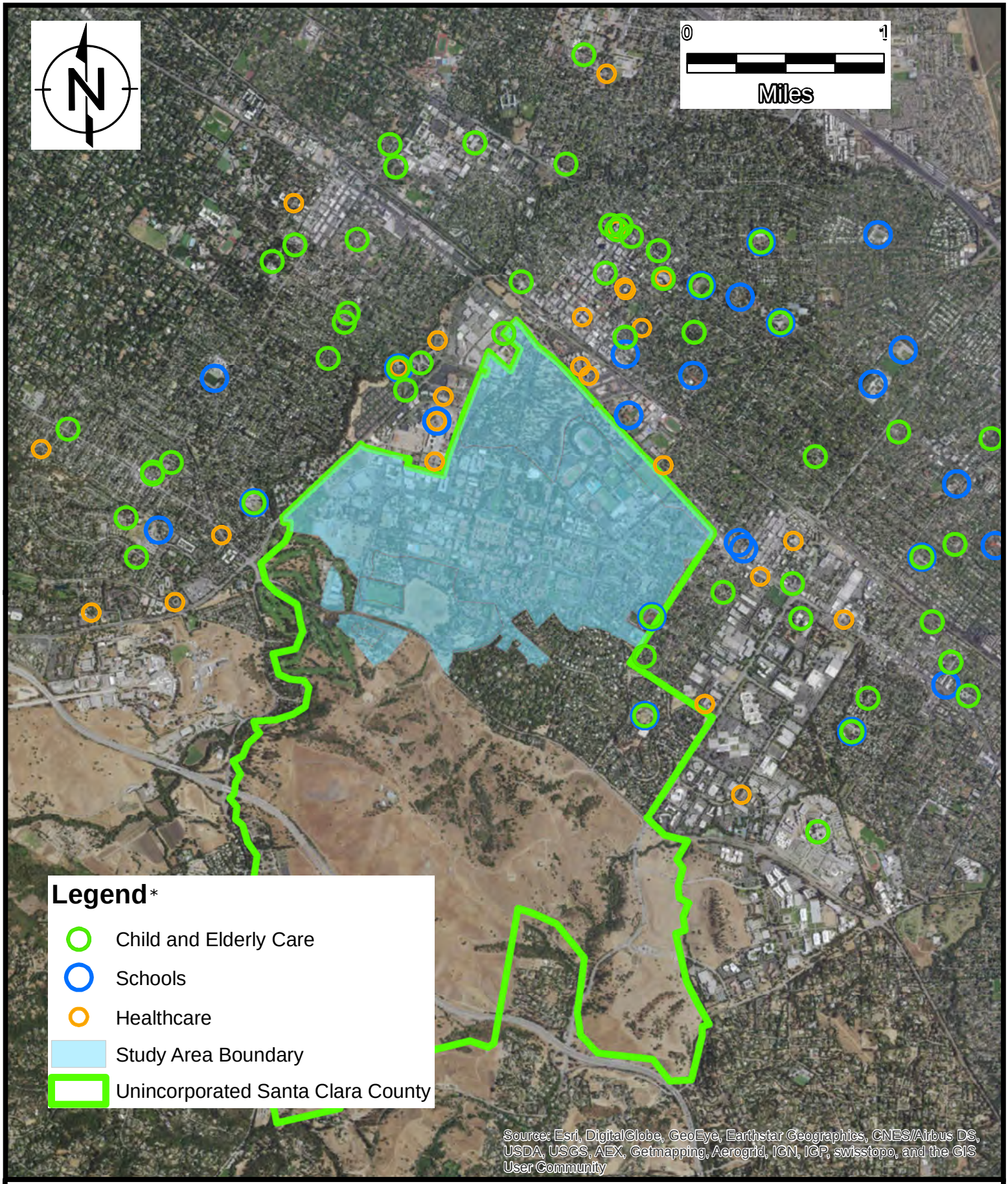

Figure 2-1 Sensitive Receptor Locations

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Stanford University
Stanford, CA

*Residential areas where children may live are also in the vicinity of Stanford and constitute additional sensitive receptors.

APPENDIX A
RAMBOLL ENVIRON AIR QUALITY TECHNICAL APPENDIX

Prepared for
Stanford University
Stanford, California

Project Number
0338006A

Date
July 24, 2018

APPENDIX A
STANFORD 2018 GENERAL USE PERMIT: AIR QUALITY TECHNICAL REPORT
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

RAMBOLL ENVIRON

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Figure 1-3-1 2014 Natural Gas Account Locations
Figure 1-4-1 2015 Natural Gas Account Locations

ACRONYMS AND ABBREVIATIONS

ARB	California Air Resources Board
BAAQMD	Bay Area Air Quality Management District
bhp-hr	brake horsepower-hour
CalEEMod®	California Emissions Estimator Model
CAP	criteria air pollutant
CAPCOA	California Air Pollution Control Officers Association
CEF	Central Energy Facility
CO	carbon monoxide
CY	Cubic yards
DPM	diesel particulate matter
EMFAC	EMission FACtor model
GHG	greenhouse gas
GUP	General Use Permit
MMBtu	million British thermal unit
NO_X	nitrogen oxides
OFFROAD	Emissions Inventory Program model
PGE	Pacific Gas & Electric
Ramboll Environ	Ramboll Environ US Corporation
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 micron in diameter
PM_{10}	particulate matter less than 10 micron in diameter
PSSI	Peninsula Sanitary Service, Inc.
ROG	reactive organic gas
SCAQMD	South Coast Air Quality Management District
SESI	Stanford Energy Systems Innovations
SO_2	sulfur dioxide
sq ft	square feet
TAC	toxic air contaminant
US	United States
USEPA	Unites States Environmental Protection Agency
VMT	vehicle miles traveled

VOC	volatile organic compound

1. CRITERIA POLLUTANT EMISSIONS INVENTORIES

1.1 Methodology for Calculating Emissions

This section describes the methodology that Ramboll Environ US Corporation (Ramboll Environ) used to develop the existing conditions and Project criteria air pollutant (CAP) and toxic air contaminant (TAC) emission inventories, for construction and operational emissions. Sub-categories of criteria pollutant operational emissions within the study area at Stanford University include: onsite electricity generation, boilers, mobile sources, emergency generator use, laboratories, and fuel stations. The section provides the methodology for the inventories developed for the existing conditions analysis years (i.e., 2014, 2015, and Fall 2018) and Project year (2035). The three existing conditions analysis years were selected based on the following factors: 2014 represents the actual historic annual emissions before implementation of the Stanford Energy Systems Innovations (SESI), 2015 represents current campus emissions after the implementation of SESI, and Fall 2018 represents the annualized emissions expected to exist immediately prior to commencement of the proposed 2018 General Use Permit (GUP). For the Fall 2018 analysis, it is assumed that the development authorized by the 2000 GUP is permitted. The Fall 2035 ("Project") analysis includes the anticipated construction and operation of the additional academic buildings and residences proposed in the 2018 GUP.

1.1.1 Units of measurement: Tons of criteria pollutant

As discussed in Section 2 of the Air Quality Technical Report, Federal and State air quality laws identify CAPs, including particulate matter (PM), ground-level ozone, carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_X), and lead. Volatile organic compounds (VOCs) as a precursor to ozone is also quantified as a CAP. In this report, pollutant emissions are presented in United States (US) short tons. A ton refers to 2,000 pounds (907.2 kilograms). Additionally, exact totals presented in all tables and report sections may not equal the sum of components due to independent rounding of numbers.

1.1.2.1

1.1.2 Resources

CalEEMod®

Ramboll Environ primarily utilized the methodology from the California Emissions Estimator Model (CalEEMod®) version 2013.2.2[1] to assist in quantifying the criteria pollutant emissions in the inventories presented in this report. CalEEMod® is a statewide program designed to calculate both criteria and greenhouse gas (GHG) emissions from development projects in California. This model was developed under the auspices of the South Coast Air Quality Management District (SCAQMD) and received input from other California air districts, and is currently supported by numerous lead agencies for use in quantifying the emissions associated with development projects undergoing environmental review. CalEEMod® utilizes widely accepted models for emission estimates combined with appropriate default data that can be used if site-specific information is not available.

CalEEMod® provides a platform to calculate annual operational criteria pollutant emissions from a land use development project. The model also provides default values for water and energy use. Specifically, the model aids the user in estimating emissions from operational emissions associated with the fully built out land use development. This includes emissions

[1] SCAQMD. 2013. California Emissions Estimator Model®. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

from on-road mobile vehicle traffic associated with the land uses, emissions from landscaping equipment and other off-road mobile sources, emissions from natural gas usage in the buildings, emissions associated with electricity usage in the buildings and electricity use associated with water usage. This also includes emissions associated with solid waste disposal.

CalEEMod® uses sources such as the US Environmental Protection Agency (USEPA) AP-42 emission factors,[2] California Air Resources Board's (ARB's) approved on-road and off-road equipment emission models such as the EMission FACtor model (EMFAC) and the Emissions Inventory Program model (OFFROAD), and studies commissioned by California agencies such as the California Energy Commission and CalRecycle. OFFROAD[3] is an emission factor model used to calculate emission rates from off-road mobile sources (e.g., construction equipment, agricultural equipment). The off-road diesel emission factors used by CalEEMod® are based on the ARB OFFROAD2011 program. EMFAC[4] is an emission factor model used to calculate emissions rates from on-road vehicles (e.g., passenger vehicles). The emission factors used by CalEEMod® are based on the ARB EMFAC2011 program. ARB has released an updated EMFAC2014 version that includes various updates, notably the incorporation of USEPA and ARB regulations and standards (e.g., Advanced Clean Cars and the Truck and Bus Rule). To more accurately assess the mobile CAP emission inventories, EMFAC2014 was incorporated into the analysis.

In addition, CalEEMod® contains default values and existing regulatory methodologies to use in each specific local air district or county. Appropriate statewide default values can be utilized if regional default values are not defined. Ramboll Environ used default factors for Santa Clara County for the CAP emission inventory, unless otherwise noted in the methodology descriptions below.

1.1.2.2

Other Resources

Ramboll Environ directly or indirectly relied on emissions estimation guidance from government-sponsored organizations, government-commissioned studies of energy use patterns, Project specific studies, and emission estimation software as described above. In cases noted below, third-party studies were also relied upon to support analyses and assumptions made outside of the approach described above. Where Stanford-specific data were available, it was used preferentially instead of model defaults. The methodology used to calculate this emissions inventory is described in detail in the following sections, including citations to information used in this inventory.

1.2 Construction Emissions

This section describes the estimation of CAP and TAC emissions from construction activities within the study area. Average annual construction and demolition square footage from fiscal year 2001 through fiscal year 2015 were used to estimate the annual emissions from construction and demolition for all existing conditions inventory years and the Project year. The major construction phases included in this analysis are:

[2] The USEPA maintains a compilation of Air Pollutant Emission Factors and process information for several air pollution source categories. The data is based on source test data, material balance studies, and engineering estimates. Available at: http://epa.gov/ttnchie1/ap42/. Accessed: May 2016.

[3] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: May 2016.

[4] ARB. 2011. Release. Available at: http://www.arb.ca.gov/msei/modeling.htm. Accessed: May 2016.

- Demolition: involves demolishing/removing existing buildings.
- Site Preparation: involves clearing vegetation (grubbing and tree/stump removal) and stones prior to grading.
- Grading: involves the cut and fill of land to ensure the proper base and slope for the construction foundation.
- Paving: involves the laying of concrete or asphalt such as in parking lots or roads.
- Building Construction: involves the construction of structures and buildings.
- Architectural Coating: involves the application of coatings to both the interior and exterior of buildings or structures.

CAP and TAC emissions from these construction activities are largely attributable to fuel use from off-road construction equipment and vendor vehicles. VOCs can be emitted from architectural coating activities. CAP and TAC emissions from construction worker, vendor, and hauling vehicles are already included separately in the mobile emissions section. All particulate matter less than 10 µm in diameter (PM_{10}) is assumed to be diesel particulate matter (DPM) for purposes of health risk calculations.

Ramboll Environ used CalEEMod® version 2013.2.2 to quantify the construction emissions. The construction schedule, off-road equipment lists, and equipment specifications are CalEEMod® defaults for the construction of an annual average of 225,492 square feet (sq ft),demolition of 50,306 sq ft of buildings, and excavation of 62,062 cubic yards (CY) of soil per year, with the default start and end dates of the phases moved such that the annual construction activities occur each year while maintaining the total default number of equipment-hours. This annual average is based on the average construction and demolition on the Stanford campus from 2001 to 2015. If this constant annual construction activity is projected forward from Fall 2018 to Fall 2035, the total construction square footage will be similar to the total anticipated in the 2018 GUP. Approximately 200,000 net sq ft per year of construction is proposed in the 2018 GUP, on average. Annual demolition square footage is likely to be lower than in the 2000 GUP because most of the in-fill development under the 2000 GUP has been in the denser core campus, whereas much of the 2018 GUP development would occur as redevelopment at the less dense fringes or on parking lots. Overall, this analysis is likely to be conservative because the total disturbed area (and thus construction emissions) in the 2018 GUP are likely to be lower than in this analysis.

1.2.1 Emissions from Construction Equipment

The emission calculations associated with construction equipment are from off-road equipment engine use based on the equipment list and phase length, and on-road vehicle trips and phase length.

Since the majority of the off-road construction equipment used for construction projects are diesel fueled, CalEEMod® assumes all of the equipment operates on diesel fuel. The calculations associated with this screen include the running exhaust emissions from off-road equipment. Since the equipment is assumed to be diesel, there are no starting emissions associated with the equipment, as these are de minimis for diesel-fueled equipment.

CalEEMod® calculates the exhaust emissions based on ARB's OFFROAD2011 methodology using the equation presented below.[5]

$$Emissions_{Diesel} = \sum_{i} (EF_i \times Pop_i \times AvgHP_i \times Load_i \times Activity_i)$$

Where:

EF = Emission factor in grams per horsepower-hour (g/bhp-hr) as processed from OFFROAD2011

Pop = Population, or the number of pieces of equipment

AvgHp = Maximum rated average horsepower

Load = Load factor

Activity = Hours of operation

i = equipment type

Ramboll Environ understands based on communications with Stanford's construction project managers that the majority of construction equipment used by contractors building projects at Stanford meets final Tier 4 emissions standards. All construction equipment is assumed to meet Final Tier 4 standards, except for chainsaws and paving phase equipment.

Emissions from On-Road Construction Trips

1.2.1.1

Construction generates on-road vehicle CAP emissions trucks for soil and material hauling. These emissions are based on the number of trips and vehicle miles traveled (VMT) along with emission factors from EMFAC2011. Emissions associated with on-road worker, vendor, and hauling vehicles are captured separately in the operational mobile category, as these vehicle trips are included in the traffic analysis by Fehr & Peers (see **SB 743 VMT Analysis Appendices A, B, and C**).

The emissions from mobile sources were calculated in Excel with the trip rates, trip lengths and emission factors for running from EMFAC2014 as follows:[6]

$$Emissions_{pollutant} = VMT * EF_{running,\ pollutant}$$

Where:

$Emissions_{pollutant}$ = emissions from vehicle running for each pollutant

VMT = vehicle miles traveled

1.2.1.2

$EF_{running,\ pollutant}$ = emission factor for running emissions

Starting and idling emissions were also calculated in Excel by multiplying the number of trips by the respective emission factor for each pollutant.

Total Construction Emissions

The total emissions from construction are summarized in Air Quality Technical Report Table 3-1-1. The construction emissions vary slightly based on the scenario analysis years

[5] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

[6] SCAQMD. 2013. California Emissions Estimator Model® User's Guide, Appendix A. Available at: http://www.CalEEMod.com/. Accessed: May 2016.

(i.e., 2014, 2015, Fall 2018, and Fall 2035 Project) because the emission factors for the off-road equipment and hauling trucks become cleaner over time. The Project inventory conservatively uses 2030 vehicle emission factors; if 2035 vehicle emission factors were used instead, it is expected that emissions would decrease. Detailed emission inventories from the CalEEMod® output files are included in **Air Quality Technical Report Appendix B**.

1.3 Annual Operational Emissions: 2014

1.3.1 Natural Gas

PGE Residential

1.3.1.1 Monthly natural gas consumption for all Pacific Gas and Electricity (PGE) residential addresses associated with Stanford University were provided. This includes addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. It does not include private staff/faculty residences in the Searsville Block and Olmsted Staff Rental subdivisions located within the study area. All addresses are geocoded using Batchgeo[7] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE residential accounts within the study area, mainly concentrated in Escondido Village. The locations with residential PGE accounts are shown in **Figure 1-3-1**. The total gas consumption is the sum of the gas consumption from each of these addresses.

The resulting energy use (in million British thermal units [MMBtu]) are converted to criteria pollutant emissions. Emissions are calculated based on NO_X, VOC, CO, SO_2, and PM_{10} emission factors (on a per MMBtu basis) presented in Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. Emissions are summarized in **Air Quality Technical Report Table 3-3-1.**

1.3.1.2

PGE Commercial

Monthly natural gas consumption for all PGE commercial addresses associated with Stanford University were provided. PGE commercial accounts include addresses outside the study area, such as the Redwood City campus and Stanford-owned accounts as far away as Livermore and Monterey. All addresses are geocoded using Batchgeo[8] then mapped in ArcGIS. Addresses outside the study area are removed, such that the remaining addresses represent PGE commercial accounts within the study area. The locations with commercial PGE accounts are shown in **Figure 1-3-1.** The total gas consumption is the sum of the gas consumption from each of these addresses.

1.3.1.3 The resulting energy use (in MMBtu) are converted to criteria pollutant emissions. Emissions are calculated based on NO_X, VOC, CO, SO_2, and PM_{10} emission factors (on a per MMBtu basis) presented in Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. Emissions are summarized in **Air Quality Technical Report Table 3-3-1.**

PGE Other Housing

Natural gas consumption and emissions from the private faculty/staff housing in the Searsville Block and Olmsted Staff Rental subdivisions, which are included in the study area, are estimated using CalEEMod® default assumptions. CalEEMod® can be used to estimate CAPs from buildings from natural gas use. CalEEMod® defaults are used to calculate the residential energy use, with the assumption that the average faculty/staff unit uses a similar

[7] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

[8] Batchgeo. 2016. Available at: http://batchgeo.com/. Accessed: July 2016.

amount of natural gas as a single-family home built to 2008 Title 24 standards in Santa Clara County.

The resulting energy use (in MMBtu) is converted to criteria pollutant emissions. Emissions are calculated based on NO_X, VOC, CO, SO_2, and PM_{10} emission factors (on a per MMBtu basis) presented in Table 1.4-2 of Section 1.4 (Natural Gas Combustion) of AP-42. Emissions are summarized in **Air Quality Technical Report Table 3-4-1.**

Cardinal Cogen

The Cardinal Cogen emitted criteria pollutants through combustion of natural gas. Emissions are summarized in **Air Quality Technical Report Table 3-4-2.**

1.3.1.4 Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Tables 3-4-1** and **3-4-2**.

1.3.1.5

1.3.2 Mobile Sources

Criteria pollutant emissions associated with on-road mobile sources are generated from residents, workers, visitors, and delivery vehicles visiting the various land use types at Stanford. The types of emissions processes contributing to criteria pollutant emissions include running exhaust emissions, idle exhaust emissions, start exhaust tailpipe emissions, diurnal evaporative hydrocarbon emissions, resting evaporative losses, hot soak evaporative hydrocarbon emissions, running loss evaporative hydrocarbon emissions, tire and brake wear particulate matter emissions, and entrained roadway particulate matter emissions. Running exhaust, tire and brake wear particulate matter, and entrained roadway particulate emissions are dependent on VMT. Starting exhaust, hot soak evaporative, and running loss evaporative emissions are dependent on the number of starts or trips that a vehicle makes. Idle exhaust, resting evaporative, and diurnal evaporative emissions are dependent on the number of vehicles. Assumptions and calculations used to determine these values are described below. Ramboll Environ estimated trip rates and trip length information specified by Fehr & Peers as described in **SB 743 VMT Analysis Appendix A**, with the exception of the on-campus fleet, for which Stanford provided data.

The criteria pollutant emission factors for the emission processes mentioned above were generated with the most recently approved version of ARB's EMission FACtor model (EMFAC2014), approved by the USEPA on December 14, 2015. This version reflects the emissions benefits of ARB's recent rulemakings including on-road diesel fleet rules, and Pavley Clean Car Standards.[9] The model also includes updated information on California's car and truck fleets and travel activity. Mobile emissions were estimated for the following pollutants: reactive organic gas (ROG), CO, NO_X, PM_{10}, particulate matter less than 2.5 µm in diameter ($PM_{2.5}$), sulfur oxide. Detailed emission factor calculations and fleet breakdowns are shown in **Air Quality Technical Report Appendix C.**

A methodology consistent with CalEEMod® was used to develop the entrained roadway dust inventories. As described in the CalEEMod® calculation guide, "Vehicles that drive on both

[9] Assembly Bill 1493 ("the Pavley Standard" or AB 1493) required ARB to, among other things, adopt regulations by January 1, 2005, to reduce GHG emissions from non-commercial passenger vehicles and light duty trucks of model year 2009 through 2016. More information is available online at: http://www.arb.ca.gov/cc/ccms/ccms.htm.

paved and unpaved roads generate fugitive dust by dispersing the silt from the roads."[10] CalEEMod® calculates entrained roadway dust using the USEPA AP-42 method. The particulate emissions depend on the particle size, the road surface silt loading, and the average weight of vehicles traveling the road. The ARB also provides a methodology for entrained roadway dust that utilizes the AP-42 method but incorporates the effects of precipitation and region-specific silt loading values that depend on the roadway type (ARB Miscellaneous Process Methodology 7.9, Entrained Road Travel, Paved Road Dust, November, 2016, herein referred to as "ARB Entrained Roadway Dust Methodology").[11] This refined methodology is also used by the BAAQMD in the development of their Roadway Screening Analysis Calculator.[12]

To calculate an entrained roadway dust emission factor in pounds of PM_{10} and $PM_{2.5}$ per VMT for the inventory, data for Santa Clara County as presented in the ARB Entrained Roadway Dust Methodology was used.[13] These calculations are shown in **Air Quality Technical Report Table 3-4-6b**. Total $PM_{2.5}$ and PM_{10} emissions from entrained roadway dust are calculated using these emissions factors and the VMT associated with each inventory.

Off-campus (Worker) Trips

1.3.2.1 Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-6**.

1.3.2.2 ### On-campus (Resident) trips

Fehr & Peers calculated on-campus trips and VMT associated with workers or residents who travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix A**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with

1.3.2.3 EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-6**.

Campus fleet: On-road

Stanford-owned on-road vehicles can be split into the following fleets: Bonair fueling station fleet, Peninsula Sanitary Service, Inc. (PSSI) fleet, Marguerite shuttle/buses, and Public Safety vehicles. Methodologies used for estimating emissions from each fleet are described in the sections below.

Bonair Fueling Station Fleet

Stanford provided a vehicles list with annual fuel totals for each vehicle using the Bonair fuel station for refueling. This list of vehicles was filtered using keywords to generate four major categories of vehicles: light passenger/mid-duty, buses, off-road/landscaping equipment, and light towers/generators. Stanford also provided additional "off-ledger" fuel totals that

[10] CalEEMod. 2016. Appendix A. Available at: http://www.aqmd.gov/docs/default-source/caleemod/upgrades/2016.3/02_appendix-a2016-3-1.pdf?sfvrsn=2.

[11] ARB. 2016. Miscellaneous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust. Available at: https://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2016.pdf. November.

[12] BAAQMD. Roadway Screening Analysis Calculator. Available at: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools.

[13] ARB. 2016. Miscellaneous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust. Available at: https://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2016.pdf. Table 5.

include gasoline and diesel purchases made outside the Bonair fueling station but used to fuel the campus fleet. This off-ledger fuel usage was added to the Bonair fuel totals to calculate GHG emissions. Annual fuel usage was converted to annual VMT using ARB's EMission FACtor model (EMFAC2014) average miles per gallons based on the specific vehicle category. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions. Fuel usage from off-road equipment and light towers/generators was converted to brake horsepower-hour (bhp-hr) in order to calculate emissions. More detail on off-road vehicle estimates can be found in Section 1.3.2.4.

PSSI Fleet

Peninsula Sanitary Service, Inc. (PSSI) operates an aboveground diesel storage tank within the Bonair fuel station service yard to fuel its own fleet of recycling, compost, and garbage collection and hauling trucks, as well as some light duty company vehicles. Stanford provided fuel usage and fleet size for this fleet as well as an estimate of the trip length and frequency for the collection trucks. To estimate emissions, the fleet was split into larger hauling trucks and light duty company vehicles. Based on communication with Stanford, large trucks were assumed to travel 4 one-way 52-mile trips per day to the end-use facility plus the default trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) for collection. This information was used to estimate annual VMT and estimate emissions using ARB's EMission FACtor model (EMFAC2014). Only fuel usage information was available for the light duty company vehicle fleet, so annual fuel usage was converted to annual VMT using ARB's EMission FACtor model (EMFAC2014) average miles per gallons for light duty diesel vehicles. Vehicle miles traveled, number of vehicles, and an assumed trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County) were used to calculate emissions.

Marguerite Bus/Shuttle Fleet

Stanford provided detailed data on vehicles and mileage traveled for each vehicle in this fleet. Emissions were estimated for each bus and shuttle individually based on the vehicle classification, model year, fuel type, total VMT, and a fleet average trip length. Some routes never cross into the study area, so the VMT for the entire fleet was adjusted to remove mileage from routes that never cross into the boundary. Only brake and tire wear particulate matter emissions were estimated for electric buses. Hybrid bus fuel efficiency is 33% greater than that of a normal bus so VMT for hybrid buses was reduced by 33% to account for the higher fuel efficiency.[14,15] By calculating emissions for each vehicle individually, future changes in the Marguerite fleet can be easily incorporated.

Public Safety Fleet

Stanford provided total VMT (cumulative for all vehicles in the fleet) and the total number of vehicles. Criteria pollutant emissions were calculated using the data provided and an assumed fleet population of light duty vehicles and trip rate of 7.3 miles/trip (CalEEMod® default trip length for Santa Clara County).

[14] Duluth Transit Authority, 2016. http://www.duluthtransit.com/green/hybrid

[15] Iowa State University Institute for Transportation, 2012. Assessing the Costs for Hybrid versus Regular Transit Buses. http://www.intercitytransit.com/SiteCollectionDocuments/HybridFactSheet20120802.pdf

Campus fleet: Off-road

Off-road equipment, including landscaping equipment and light towers/generators is also fueled at the Bonair fueling station. Annual fuel totals for the off-road equipment were used to estimate total bhp-hr using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate criteria pollutant emissions.

1.3.2.4

Additionally, although the Stanford golf course (and fuel tanks at the golf course) is located outside of the study area boundary, some of the off-road equipment that fuel at the golf course also service parts of the campus within the study area boundary. To be conservative, emissions were included from equipment activity at the Siebel Varsity Golf Training Complex and Red Barn, which are both within the study area boundary. Equipment activity occurring in these two areas was estimated from a location-based allocation of total fuel usage from the golf course fuel tanks, provided by Stanford. Emissions were estimated using this annual fuel consumption estimate provided by Stanford to estimate total bhp-hr using conversion factors that originate from the USEPA Nonroad Engine and Vehicle Emission Study. CalEEMod® off-road emission factors for the represented equipment type category were used to estimate criteria pollutant emissions.

Visitors

1.3.2.5

Ramboll Environ calculated the trips and VMT associated with various types of campus visitors based on Stanford-specific information and assumptions. These visitor categories are divided below on whether they represent regular weekday trips or one-time weekend trips to allow a determination of whether they should be considered in the total weekday cordon count.

- One-time visitor events primarily on weekends include the following types of events:
- Athletic events
- Milestone events (Graduation, Parent's Weekend, Homecoming, etc.)
- Camps
- Stanford Live performances

Frequent visitor trips that happen throughout the year include the following categories:

- Alumni center
- Conferences
- Walking tours

1.3.2.6

- Tour bus visitors
- Executive education

Emissions are shown in **Air Quality Technical Report Table 3-4-6.** VMT data and trip assumptions are shown in Fehr & Peers **SB 743 VMT Analysis Appendix A**.

Vendors

Vendor trips include deliveries and other commercial-nonwork visitors not described above. Fehr & Peers estimated the number of vendor trips as described in **SB 743 VMT Analysis Appendix A**. Emissions are shown in **Air Quality Technical Report Table 3-4-6.**

Emissions Summary

Mobile emissions are summarized in **Air Quality Technical Report Tables 3-4-6 and 3-4-9b.**

1.3.3 Emergency Generators

1.3.2.7

A list of campus-wide emergency generators along with their Bay Area Air Quality Management District (BAAQMD) Source ID, year, engine rating, and actual non-emergency and emergency run hours in 2014 was provided by Stanford. There are three generators smaller than 50 hp that are exempt from permitting; they are conservatively assumed to be 50 hp each for emission calculations.

Criteria pollutant emissions are calculated by multiplying the engine rating, hours of operation, and emission factors for NO_x, CO, POC, SO_2, and PM_{10}. Emissions are shown in **Air Quality Technical Report Table 3-4-10.**

1.3.4 Laboratories

A single estimate of laboratory emissions is prepared to represent the 2014 and 2015 inventories, since it is assumed laboratory operations do not change significantly between these years. Laboratory emissions are estimated for 93 chemicals, the list of which was approved in BAAQMD protocols and provided by Stanford in a 2001 chemical inventory. Chemicals include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments. The objective of the chemicals of potential concern selection methodology was to consider the comprehensive list of chemicals used in normal operations at the laboratories and to identify those chemicals that have the potential to contribute at least 90 to 95 percent of the estimated risk for the building. ROG emissions are calculated based on the chemical type and volatility, as shown in **Air Quality Technical Report Table 3-4-12.**

Detailed chemical inventory data was not available for all laboratories on campus. To estimate usage across all labs, Ramboll Environ derived a representative chemical usage per fume hood based on a 2001 chemical inventory provided by Stanford for the ChemBio building, and then scaled this usage by the total number of fume hoods assumed to contain the chemical in 2015. For any chemical that was not present in the 2001 inventory, usage per fume hood was estimated from the largest of four laboratory buildings. Detailed 2015 chemical inventory information was provided for four buildings that contain the bulk of the large laboratories, including the Lokey Laboratory Building (ChemBio), the Shriram Center (BioE/ChemE), Mudd (Seeley G) Chemistry, and the Environment and Energy building. The same methodology as used in the 2001 inventory is used to develop estimates for annual usage of each chemical for the four laboratory buildings listed above. To develop these estimates, Ramboll Environ assumed the quantity of each chemical in the inventory snapshot represents a one-month supply of the chemical, plus adds an extra 10% buffer for any reporting errors in the inventory. Archival chemicals that are used only very rarely (ethylene dibromide and hexachlorobenzene) are assumed to be used over the course of the year. These usage estimates are conservative, as laboratory questionnaires have indicated that actual annual usage of most chemicals is lower than assumed with the scaling methodology above.

Using this methodology, an estimated representative usage is established for each of the 93 chemicals. The estimated usage per fume hood of a chemical is derived from the 2001 inventory (as this is the most complete inventory), but if the 2001 inventory did not

report usage of that chemical, usage is based on one of the other four laboratory buildings in 2015; for example, if the Lokey Laboratory uses a particular chemical, that quantity is used to develop the chemical usage metric. If Lokey Laboratory does not have that chemical, the quantity for the ChemBio study is used, then Shriram, then Mudd, then Environment and Energy. This methodology ensures that each of the 93 chemicals is represented in the inventory and can be scaled up for future inventories.

To estimate the chemical usage across all labs on campus, the representative usage described above is multiplied by the total fume hoods on campus expected to contain the chemical. Stanford provided a list of 51 campus laboratories, including the number of fume hoods and net wet laboratory square footage. SmartMart chemical purchasing records were provided for all of these campus laboratories for the first half of 2015. These records are then used to determine whether or not each laboratory contains a given chemical. This is an approximation, since the SmartMart procurement records do not contain all laboratory purchases. The TAC emissions are calculated by normalizing the representative usage to the number of fume hoods in the parent lab, multiplying by the number of total fume hoods in all laboratories on campus that purchased that chemical in the SmartMart data, then multiplying by an emission factor. Solids are assumed to emit 1%, liquids 5%, and gases 100%.

For example, the estimated usage for 1,3-butadiene is based on 101 lbs used in a month from the 2001 inventory. The 101 lbs is divided by 164 fume hoods for the Lokey Lab Building, multiplied by the 288 fume hoods that use this chemical, then multiplied by a 100% emission factor (because it is gas) to estimate emissions. This is used to calculate final campus-wide TAC emissions of 177 lbs. ROG emissions are only estimated for chemicals identified as ROGs by the ARB.[16]

1.3.5 Fuel Stations

In 2014, two fuel stations existed on the Stanford campus: the Valero fuel station and the Bonair fuel station. The Valero fuel station was accessible to the public while the Bonair fuel station is used to fuel campus vehicles. Evaporative VOC emissions from gasoline fueling were estimated using the annual gasoline throughput provided by Stanford for all fueling stations and a VOC emission factor from the source specific guidance for gasoline dispensing facilities from BAAQMD Permit Handbook.[17] VOC emissions from the fueling stations are shown in **Air Quality Technical Report Table 3-4-16.**

1.3.6 Emissions Summary

A summary of emissions from the 2014 inventory are shown in **Air Quality Technical Report Table 3-1-1.**

1.4 Annual Operational Emissions: 2015

1.4.1 Natural Gas

The emission factors for natural gas usage are from the same source as described in the 2015 calculations.

[16] ARB. 2009. Definitions of VOC and ROG. Available at: http://www.arb.ca.gov/ei/speciate/voc_rog_dfn_1_09.pdf. Accessed: July 2016.

[17] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

PGE Residential

1.4.1.1 The same methodology is used as that for the 2014 inventory, except usage data from July through December 2015 is doubled to represent the 2015 natural gas consumption. The locations of PGE residential gas accounts for the 2015 inventory, which are slightly different than for 2014 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

PGE Commercial

1.4.1.2 The same methodology is used as that for the 2014 inventory, except data from July through December 2015 is doubled to represent the 2015 natural gas consumption. The individual replacement boilers are included in the PGE commercial invoices. The locations of PGE commercial gas accounts for the 2015 inventory, which are slightly different than for the 2014 inventory are shown in **Figure 1-4-1**. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

PGE, Other Housing

1.4.1.3 The same methodology is used as that for the 2014 inventory, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

New CEF and Replacement Process Steam Plant

1.4.1.4 Natural gas throughputs were provided for the hot water generators of the new Central Energy Facility (CEF) and Replacement Process Steam Plant. This natural gas usage served as a replacement to the natural gas usage from the Cardinal Cogen in 2014. Throughput from July through December 2015 is doubled to represent the 2015 natural gas consumption. Emissions are summarized in **Air Quality Technical Report Table 3-4-3.**

1.4.1.5

Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Table 3-4-3**.

1.4.2 Mobile Sources

The same methodology is used as that for the 2014 inventory. Exhaust, brake wear, and tire wear emissions are summarized in **Air Quality Technical Report Table 3-4-7**, while entrained roadway dust emissions are shown in **Air Quality Technical Report Table 3-4-9b.**

1.4.3 Emergency Generators

The same methodology is used as that for the 2014 inventory (that uses 2014 data), except 2015 actual hours of operation are used and certain generators are added or retired. Emissions are summarized in **Air Quality Technical Report Table 3-4-11.**

1.4.4 Laboratories

No changes were made in laboratory emissions from the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-13.**

1.4.5 Fuel Stations

The same methodology is used as that for the 2014 inventory. The same throughput was assumed for 2015 as in 2014 for the Bonair and Valero fuel stations. Emissions are summarized in **Air Quality Technical Report Table 3-4-17.**

1.4.6 Emissions Summary

A summary of emissions from the 2015 inventory are shown in **Air Quality Technical Report Table 3-1-1.**

1.5 Annual Operational Emissions: Fall 2018

The Fall 2018 inventory is based on the assumption that the remaining 2000 GUP square footage is permitted by Fall 2018. The 2015 inventory emissions are based on all the buildings and residences constructed as of December 2015. The electricity, natural gas, and laboratory chemical consumption for Fall 2018 are assumed to increase proportionally with academic square footage or number of residential beds, depending on sub-category. The mobile emissions are updated to account for fleet turnover and changes in VMT as described in **SB 743 VMT Analysis Appendix B** prepared by Fehr & Peers.

1.5.1 Natural Gas

PGE Residential

1.5.1.1 Natural gas usage for Fall 2018 is based on the ratio of natural gas usage per bed in 2015, scaled for the increase in beds from new graduate and undergraduate housing projects by 2018 (8%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the amount of gas per bed remains constant. This natural gas consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-4.**

1.5.1.2 #### PGE Commercial

Natural gas usage for Fall 2018 is based on the ratio of natural gas usage to built-and-occupied academic GUP square footage by December 2015, scaled by the remaining GUP square footage allocation to be used by 2018. Six individual replacement boilers included in the 2015 inventory serve select locations that do not connect to the new CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the

1.5.1.3 approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-4.**

PGE, Other Housing

1.5.1.4 The same methodology is used as that for the 2014 and 2015 inventories, with CalEEMod® assumptions for the number of single-family homes and gas consumption per home remaining constant. Emissions are summarized in **Air Quality Technical Report Table 3-4-4.**

New CEF and Replacement Process Steam Plant

1.5.1.5 The same methodology is used as that for the 2015 inventory. The throughputs for the new CEF and the Process Steam Plant are expected to linearly increase based on the total academic square footage increase by 2018. Emissions are summarized in **Air Quality Technical Report Table 3-4-4.**

Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Table 3-4-4.**

1.5.2 Mobile Sources

Off-Campus (Worker) and On-Campus (Resident) Trips

1.5.2.1 Number of trips and VMT for workers and residents are scaled up for Fall 2018 based on scaled values provided by Fehr & Peers. Values are scaled by increase in academic square footage or number of residents (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B**. The methodology used to estimate emissions remained unchanged from the 2015 inventory.

Campus Fleet

1.5.2.2 No changes will be made to emissions estimates for the Public Safety fleets from the 2015 inventory. The 10 oldest vehicles from the Marguerite fleet will be replaced with electric vehicles by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. Additionally, to accommodate for growth, Marguerite VMT was scaled up by the remaining GUP square footage allocation to be used by 2018. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, reducing the mileage that the fleet drives. This reduction program is assumed to reduce VMT from Bonair vehicles by 5%. Emission factors for operational year 2018 are used. Exhaust, brake wear, and tire wear emissions are summarized in **Air Quality Technical Report Table 3-4-8,** while entrained roadway dust emissions are shown in **Air Quality Technical Report Table 3-4-9b**.

Visitors

1.5.2.3 Only those visitor trip categories expected to change with increased academic square footage or population are scaled up for Fall 2018, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix B**.

1.5.3 Emergency Generators

Emissions from emergency generators are assumed to scale linearly with the increase in academic square footage by Fall 2018 (8% increase). Emissions are summarized in **Air Quality Technical Report Table 3-4-12.**

1.5.4 Laboratories

Laboratory emissions are assumed to increase proportionally with total academic square footage increase from December 2015 to 2018, approximately 8%. Research laboratories constituted approximately 20% of Stanford academic space in 2015. Emissions are summarized in **Air Quality Technical Report Table 3-4-14.**

1.5.5 Fuel Stations

No changes were made to fuel station emissions since campus fleet VMT is assumed to remain constant. The same methodology is used as that for the 2015 inventory except that the Valero fuel station was removed because it is now closed. Emissions are summarized in **Air Quality Technical Report Table 3-4-18.**

1.5.6 Emissions Summary

Emissions from the Fall 2018 inventory are summarized in **Air Quality Technical Report Table 3-1-1.**

1.6 Annual Operational Emissions: Fall 2035 (Project) Inventory

1.6.1 Natural Gas

PGE Residential

1.6.1.1 Natural gas usage for Fall 2035 is scaled based on the percent increase in total number of student beds from Fall 2018 to full buildout of the 2018 GUP (an increase of 38%). Natural gas will be used for purposes such as water heating and laundry for these housing projects, so it is assumed that the amount of gas per bed remains constant. This energy consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to require residences to achieve Zero Net Energy starting with 2019 Title 24. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-5.**

PGE Commercial

1.6.1.2 Natural gas usage for Fall 2035 is based on the percent increase in academic square footage from Fall 2018 to full buildout of the 2018 GUP (an increase of 22%). Six individual replacement boilers included in the 2018 inventory serve select locations that do not connect to the CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Natural gas consumption and scaling ratios are summarized in **Air Quality Technical Report Table 3-4-5.**

PGE, Other Housing

1.6.1.3 No changes in natural gas use were assumed for the Searsville/Olmstead housing units, which is estimated based on CalEEMod® default values for single family homes built to 2008 Title 24 standards in climate zone 4.

Five hundred fifty (550) new faculty/staff high density homes are to be constructed within the study boundary by 2030. The annual natural gas use is based on the CalEEMod® default for condo/townhouse built to 2008 Title 24 standards in climate zone 4, adjusted to an approximation of 2016 Title 24 standards (effective January 1, 2017). The adjustments are shown in **Air Quality Technical Report Table 3-4-5**. This natural gas consumption is likely conservative, as improved California Building Energy Efficiency Standards (Title 24, Part 6) are expected to result in lower natural gas usage in new buildings.

1.6.1.4 Emissions are summarized in **Air Quality Technical Report Table 3-4-5.**

CEF and Replacement Process Steam Plant

1.6.1.5 The throughput for the CEF hot water generators and the Process Steam Plant is expected to linearly increase based on the total academic square footage increase from Fall 2018 to full buildout of the 2018 GUP in 2035 (an increase of 22%). Emissions are summarized in **Air Quality Technical Report Table 3-4-5.**

1.6.2.1

Emissions Summary

Natural gas consumption and emission factors are summarized in **Air Quality Technical Report Table 3-5-5.**

1.6.2 Mobile Sources

Off-Campus (Worker) and On-Campus (Resident) Trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus and on-campus trips and VMT associated with workers or residents who

travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix C**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-9**. Detailed emission factors and fleet breakdowns are shown in **Air Quality Technical Report Appendix C.** Entrained roadway dust emissions are shown in **Air Quality Technical Report Table 3-4-9b.**

Campus Fleet

1.6.2.2 Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was assumed to be 40% electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are estimated by scaling down emissions assuming only 30% non-electric vehicles contribute to emissions versus 60% contributing to emissions in 2018. Additionally, Stanford expects the entire Marguerite fleet to be electric vehicles by 2035. Although running emissions from the entire Marguerite fleet are assumed to be zero, the tire and brake wear particulate matter emissions are still incorporated into emissions estimates. Additionally, to accommodate for growth, Marguerite VMT is scaled up based on the percent increase in academic square footage from Fall 2018 to full buildout of the 2018 GUP (an increase of 22%). Emission factors for operational year 2030 are used for all campus fleet vehicles. Emissions are summarized in **Air Quality Technical Report Tables 3-4-9 and 3-4-9b**.

Visitors

1.6.2.3 Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2035, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix C**.

1.6.3 Emergency Generators

Emergency generator emissions for Fall 2035 is based on the increase in academic square footage from Fall 2018 to the buildout of the 2018 GUP (a 22% increase). Emissions are summarized in **Air Quality Technical Report Table 3-4-13.**

1.6.4 Laboratories

Laboratory emissions are assumed to linearly increase based on the total academic square footage increase from Fall 2018 to full buildout of the 2018 GUP in 2035 (an increase of 22%). Research laboratories constituted approximately 20% of Stanford academic space in 2015. Emissions are summarized in **Air Quality Technical Report Table 3-4-15.**

1.6.5 Fuel Stations

Fuel station emissions are assumed to decrease by the growing number of electric vehicles that are part of the Stanford on-campus fleet. Seventy percent of the campus fleet is expected to be electric by 2035. Forty percent was electric by 2018, so the 2018 fuel consumption was assumed to represent the emissions for the 60% of the campus fleet that use internal combustion engines. Therefore, the fuel usage was scaled down by (1-40%)/(1-70%) since the remaining vehicles are assumed to use electricity. Emissions are summarized in **Air Quality Technical Report Table 3-4-19.**

1.6.6 Emissions Summary

Emissions from the Fall 2035 inventory are summarized in **Air Quality Technical Report Table 3-1-1.**

1.7 Criteria Pollutant Inventories in Context

This section compares the three existing conditions inventories and one Project inventory. A category-by-category comparison of emissions between the three existing conditions and Project inventory inventories is shown in **Air Quality Technical Report Table 3-1-1.**

2. TOXIC AIR CONTAMINANT EMISSIONS INVENTORIES

2.1 Construction Emissions

Construction activities also result in the emissions of DPM, a recognized TAC in California. Since DPM is conservatively assumed to be all PM_{10}, and PM_{10} is discussed and calculated in the CAP section, construction emissions are not further discussed here.

2.2 Annual Operational Emissions: 2014

2.2.1 Natural Gas

TACs were evaluated from natural gas sources within the study area. Benzene, formaldehyde, and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion. Emission factors originate from the BAAQMD Permit Handbook, Section 2.1: Miscellaneous Natural Gas Combustion.[18] TAC emissions from natural gas sources are summarized in **Air Quality Technical Report Table 4-1-2**.

2.2.2 Cardinal Cogen

BAAQMD 2015 Cardinal Cogen Criteria Air Pollutant Emissions presents annual average emissions in lbs/day for criteria pollutants in the 2014 calendar year.**[19]** Ramboll Environ assumed 365 days/year to calculate total annual emissions. TAC emissions from Cardinal Cogen are summarized in **Air Quality Technical Report Table 4-1-1**.

2.2.3 Mobile Sources

DPM, benzene, and 1,3-butadiene emissions were estimated from fuel combustion of mobile sources. BAAQMD California Environmental Quality Act Guidelines indicate that these three pollutants represent a substantial portion of the ambient background risk from TACs in the San Francisco Air Bay Area Air Basin.[20] DPM emissions were assumed to be equivalent to PM_{10} emissions from diesel-powered mobile sources. The methodology for calculating PM_{10} emissions are presented in Section 1.3.2. Benzene and 1,3-butadiene are components of ROG and total organic gas (TOG) emissions (presented in Section 1.3.2), so emissions from total ROG (for diesel mobile sources) or TOG emissions (for gasoline mobile sources) were speciated to determine the benzene and 1,3-butadiene emissions. Speciation percentages for benzene and 1,3-butadiene for gasoline exhaust are from the ARB Profile "OG2303",[21] for gasoline evaporation from ARB Profile "OG2315",[22] and for diesel exhaust from MOVES2007.[23] TAC emissions from mobile sources are summarized in **Air Quality Technical Report Table 4-1-6**.

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[18] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

[19] BAAQMD. Stationary Source Information Request for Plant #15128. Received on October 21st, 2015.

[20] BAAQMD California Environmental Quality Act: Air Quality Guidelines (Updated May 2012). http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/baaqmd-ceqa-guidelines_final_may-2012.pdf?la=en

[21] Organic Gas Speciation Profiles for Catalyzed Gasoline-Powered Vehicle Stabilized Running Exhaust—E6 Fuel (OG2303 & OG2304) Wenli Yang, PhD, PE Air Quality Planning and Science Division December 12, 2013

[22] Organic Gas Speciation Profile for Gasoline-Powered Vehicles Hot Soak Evaporations—E10 Summer Fuel (OG2315), Wenli Yang, PhD, PE, Air Quality Planning and Science Division, (1/28/2015)

[23] USEPA Motor Vehicle Emission Simulator (MOVES), Draft 2007. https://www3.epa.gov/otaq/models/ngm/movesdemo/420p07002.pdf

2.2.4 Emergency Generators

DPM emissions were assumed to be equivalent to PM_{10} emissions from emergency generators. Methodology for calculating PM_{10} emissions are presented in Section 1.3.3 and emissions can be found in **Air Quality Technical Report Table 3-4-10**, under PM_{10} emissions.

2.2.5 Laboratories

Emissions from laboratory chemicals for the 93 chemicals listed in the BAAQMD Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants were estimated using the methodology described in Section 1.3.4. TAC emissions from laboratories are summarized in **Air Quality Technical Report Table 3-4-12**.

2.2.6 Fuel Stations

ROG emissions estimated in Section 1.3.5 were speciated to assume that 0.3% of total emissions are benzene.[24] California Air Pollution Control Officers Association (CAPCOA) Gasoline Service Station Industrywide Risk Assessment Guidelines state that benzene is the most important substance driving risk and therefore only provides information on speciation of benzene in gasoline vapor.[25] TAC emissions from fuel stations are summarized in **Air Quality Technical Report Table 4-2.**

2.3 Annual Operational Emissions: 2015

2.3.1 New CEF, Replacement Process Steam Plant, and Boilers

TACs were evaluated from natural gas sources within the study area. Benzene, formaldehyde, and toluene are the only TACs evaluated by the BAAQMD for natural gas combustion. Emission factors originate from the BAAQMD Permit Handbook, Section 2.1: Miscellaneous Natural Gas Combustion.[26] TAC emissions from natural gas sources are summarized in **Air Quality Technical Report Table 4-1-3**.

2.3.2 Mobile Sources

The same emission factors and methodology were used as in the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-1-7**.

2.3.3 Emergency Generators

The same emission factors and methodology were used as in the 2014 inventory (that uses 2014 data), except 2015 actual hours of operation are used and certain generators are added or retired. Emissions are summarized in **Air Quality Technical Report Table 3-4-11.**

2.3.4 Laboratories

The same emission factors and methodology were used as in the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-13**.

[24] Speciation from Table 1 in CAPCOA Air Toxics "Hot Spots" Program: Gasoline Service Station Industrywide Risk Assessment Guidelines. http://www.arb.ca.gov/ab2588/rrap-iwra/gasiwra.pdf

[25] CAPCOA. 1997. Air Toxics "Hot Spots" Program. Gasoline Service Station Industrywide Risk Assessment Accessed July 8, 2016. Guidelines. http://www.arb.ca.gov/ab2588/rrap-iwra/gasiwra.pdf

[26] BAAQMD. Engineering Division Permit Handbook. Accessed July 8, 2016. http://www.baaqmd.gov/~/media/files/engineering/permit-handbook/baaqmd-permit-handbook.pdf?la=en

2.3.5 Fuel Stations

The same emission factors and methodology were used as in the 2014 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-2**.

2.4 Annual Operational Emissions: Fall 2018

2.4.1 New CEF, Replacement Process Steam Plant, and Boilers

The same methodology is used as that for the 2015 inventory. The throughputs for the hot water generators of the new CEF, Process Steam Plant, and boilers are expected to increase proportionally with the total academic square footage increase by 2018. Emissions are summarized in **Air Quality Technical Report Table 4-1-4.**

2.4.2 Mobile Sources

No changes will be made to emissions estimates for the Public Safety fleets from the 2015 inventory. The 10 oldest vehicles from the Marguerite fleet will be electric by Fall 2018, so only tire and brake wear particulate matter emissions will be considered from those 10 vehicles. The Bonair fueling station fleet is planning to switch from a service yard system to a hub system of vehicle storage, while reducing the total number of vehicles. This fleet reduction program is assumed to reduce emissions from Bonair vehicles by 5%. Emission factors for operational year 2018 are used. Emissions are summarized in **Air Quality Technical Report Table 4-1-8**.

2.4.3 Emergency Generators

Emissions from emergency generators are assumed to scale linearly with the increase in academic square footage by Fall 2018 (8% increase). Emissions are summarized in **Air Quality Technical Report Table 3-4-12.**

2.4.4 Laboratories

Laboratory emissions are assumed to increase proportionally with total academic square footage increase from December 2015 to 2018, approximately 8%. Research laboratories constituted approximately 20% of Stanford academic space in 2015, and this percentage is assumed to hold constant in 2018. Emissions estimates are shown in **Air Quality Technical Report Table 3-4-14**.

2.4.5 Fuel Stations

The same emission factors and methodology were used as in the 2015 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-2**.

2.5 Annual Operational Emissions: Fall 2035 (Project)

2.5.1 Natural Gas

Throughputs for the hot water generators of the CEF, Process Steam Plant, and boilers are expected to increase proportionally with the total academic square footage increase by 2035. Six individual replacement boilers included in the 2018 inventory serve select locations that do not connect to the CEF and Process Steam Plant systems. Throughput to these boilers is not expected to increase, so the approximate gas usage associated with them remains the same. Residential natural gas usage for Fall 2035 is scaled based on the percent increase in total number of student beds from Fall 2018 to full buildout of the 2018 GUP (an increase of 38%). Emissions are summarized in **Air Quality Technical Report Table 4-1-5.**

2.5.2 Mobile Sources

Off-Campus (Worker) and On-Campus (Resident) Trips

Fehr & Peers calculated off-campus trips and VMT associated with workers or students who commute to campus and on-campus trips and VMT associated with workers or residents who travel from campus. Details on these calculations are shown in **SB 743 VMT Analysis Appendix C**. Ramboll Environ used this VMT, trip, and fleet data to calculate emissions with

2.5.2.1 EMFAC2014. Results are shown in **Air Quality Technical Report Table 3-4-9**. Detailed emission factors and fleet breakdowns are shown in **Air Quality Technical Report Appendix C.** The same speciation percentages are used as in the 2018 inventory.

Campus Fleet

Stanford indicated that their on-campus fleet will incorporate higher percentages of electric vehicles over time. The on-campus fleet for the 2018 inventory was assumed to be 40%

2.5.2.2 electric and is expected to be 70% electric by 2035. Since emissions for the 2018 inventory were based on fueling data (no data on electric vehicles), emissions from on-campus vehicles for 2035 are scaled down assuming only 30% non-electric vehicles contribute to emissions versus 60% in 2018. Emission factors for operational year 2030 are used for all campus fleet vehicles. The same speciation percentages are used as in the 2018 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-9**.

Visitors

2.5.2.3 Only those visitor trip categories expected to change with increased academic square footage and housing are scaled up for Fall 2035, including trips associated with the alumni center, conferences, camps, Big 5 events, and executive training. These categories are scaled by increase in academic square footage, number of residents, or population (depending on the category). Details are shown in **SB 743 VMT Analysis Appendix C**. The same speciation percentages are used as in the 2018 inventory. Emissions are summarized in **Air Quality Technical Report Table 3-4-9**.

2.5.3 Emergency Generators

Emergency generator emissions for Fall 2035 is based on the increase in academic square footage from Fall 2018 to the buildout of the 2018 GUP (a 22% increase). All PM_{10} emissions are assumed to be DPM. Emissions are summarized in **Air Quality Technical Report Table 3-4-13.**

2.5.4 Laboratories

Laboratory emissions are assumed to increase proportionally with total academic square footage increase from Fall 2018 to the buildout of the 2018 GUP (a 22% increase). Research laboratories constituted approximately 20% of Stanford academic space in 2015, and this percentage is assumed to hold constant in 2035. Emissions estimates are shown in **Air Quality Technical Report Table 3-4-15**.

2.5.5 Fuel Stations

Fuel station emissions are assumed to decrease by the growing number of electric vehicles that are part of the Stanford on-campus fleet. Seventy percent of the campus fleet is expected to be electric by 2035. Forty percent was electric by 2018, so the 2018 fuel consumption was assumed to represent the emissions for the 60% of the campus fleet that use internal combustion engines. Therefore, the fuel usage was scaled down by (1-40%)/(1-70%) since the remaining vehicles are assumed to use electricity. The same speciation

percentages and methodology were used as in the 2018 inventory. Emissions are summarized in **Air Quality Technical Report Table 4-2**.

2.6 Toxic Air Contaminant Inventories

A summary of TAC emissions for the 2014, 2015, Fall 2018, and Fall 2035 inventories can be found in **Air Quality Technical Report Table 4-2**.

FIGURES

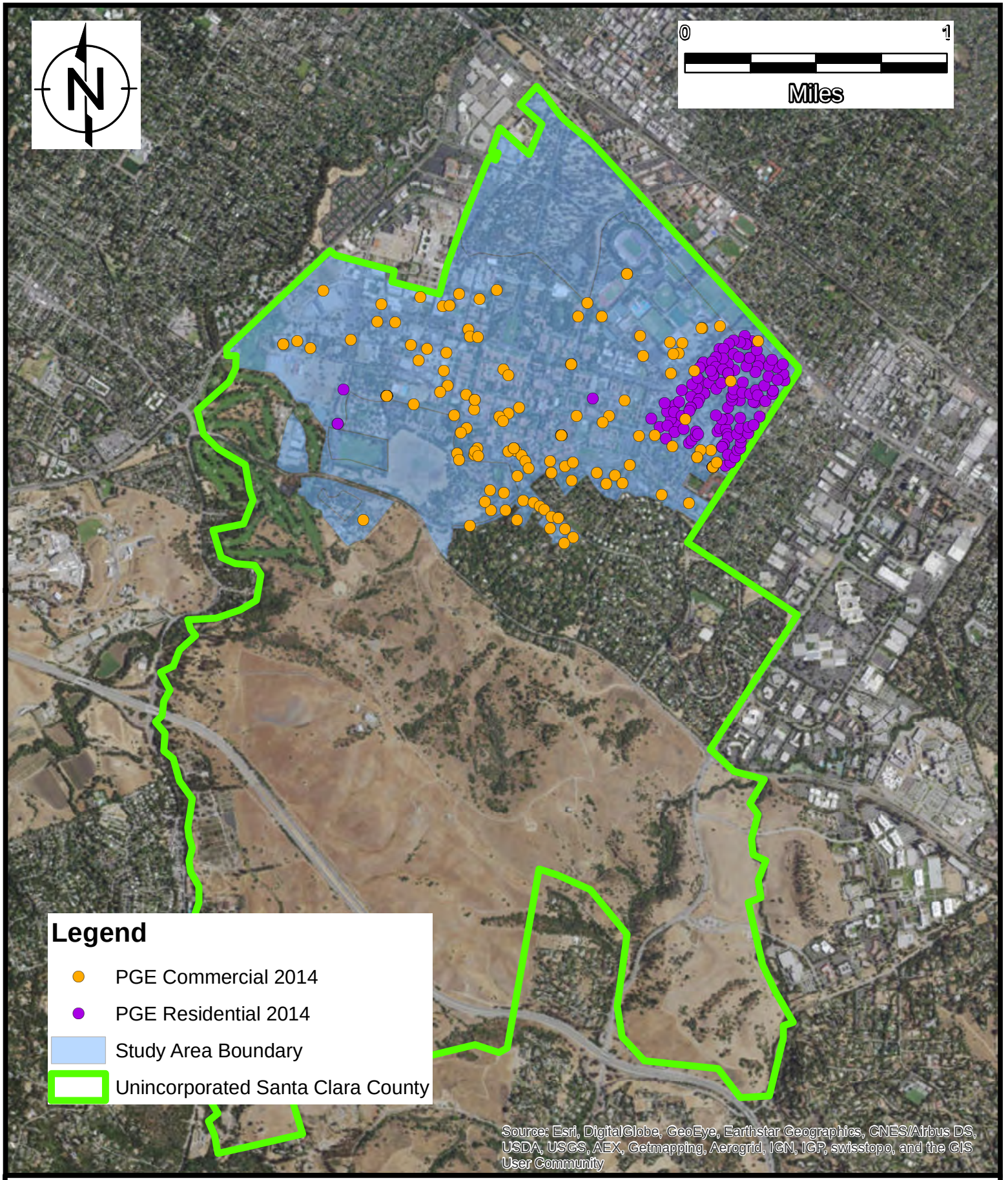

Figure 1-3-1 2014 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

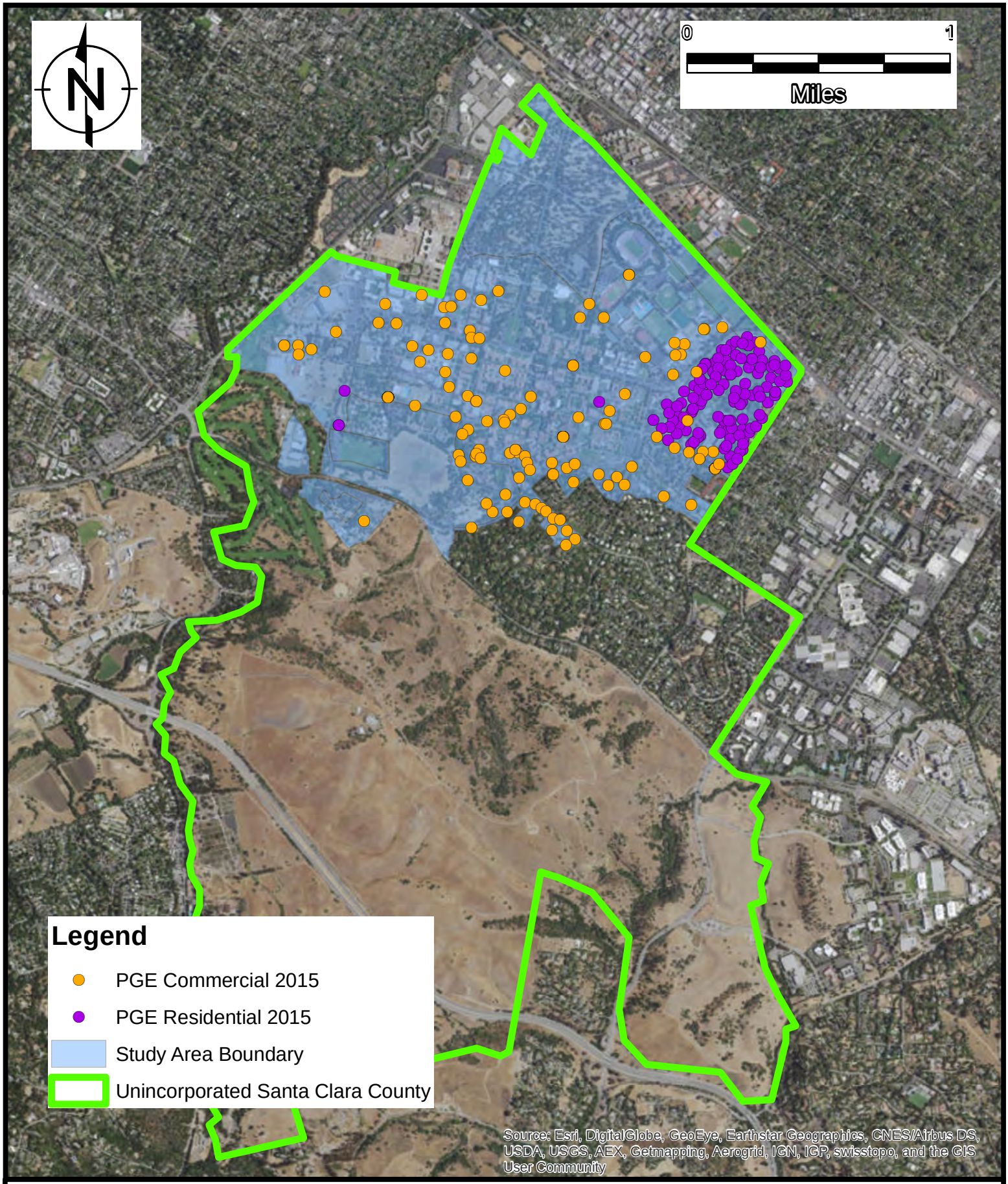

Figure 1-4-1 2015 Natural Gas Account Locations
Stanford University
Stanford, CA

RAMBOLL ENVIRON

APPENDIX B
CALEEMOD® CONSTRUCTION OUTPUT FILES

Table B-1. CalEEMod® Model Outputs Descriptions
Stanford University
Stanford, California

Construction CalEEMod® Runs	
Output	**Scenario**
2014 Average Output	2014 Annual Average Off-Road Construction Emissions
2015 Average Output	2015 Annual Average Off-Road Construction Emissions
2018 Average Output	2018 Annual Average Off-Road Construction Emissions
2030 Average Output	2030 Annual Average Off-Road Construction Emissions
2018 Peak Output	2018 Peak Construction Emissions
2023 Peak Output	2023 Peak Construction Emissions

Abbreviations:

CalEEMod® - CALifornia Emissions Estimator MODel

Stanford Construction/Demolition, Average Year (2014)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2014
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2014. Made schedule fit in 1 year

Trips and VMT - Worker/vendor trips already captured in other mobile emissions calcs. - Hauling trips also captured in mobile emission calcs

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/6/2014	12/31/2014
tblConstructionPhase	PhaseEndDate	1/13/2015	12/31/2014
tblConstructionPhase	PhaseEndDate	1/14/2015	3/11/2014
tblConstructionPhase	PhaseStartDate	4/9/2014	12/4/2014
tblConstructionPhase	PhaseStartDate	2/26/2014	2/13/2014
tblConstructionPhase	PhaseStartDate	1/1/2015	2/26/2014

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Year	tons/yr										MT/yr					
2014	1.7598	5.0773	3.1910	4.2300e-003	0.1841	0.3379	0.5220	0.0876	0.3168	0.4045	0.0000	391.9506	391.9506	0.1028	0.0000	394.1099
Total	**1.7598**	**5.0773**	**3.1910**	**4.2300e-003**	**0.1841**	**0.3379**	**0.5220**	**0.0876**	**0.3168**	**0.4045**	**0.0000**	**391.9506**	**391.9506**	**0.1028**	**0.0000**	**394.1099**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2014	1.2552	0.6161	2.7110	4.2300e-003	0.1841	0.0249	0.2090	0.0876	0.0237	0.1113	0.0000	391.9502	391.9502	0.1028	0.0000	394.1095
Total	**1.2552**	**0.6161**	**2.7110**	**4.2300e-003**	**0.1841**	**0.0249**	**0.2090**	**0.0876**	**0.0237**	**0.1113**	**0.0000**	**391.9502**	**391.9502**	**0.1028**	**0.0000**	**394.1095**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**28.67**	**87.87**	**15.04**	**0.00**	**0.00**	**92.64**	**59.96**	**0.00**	**92.51**	**72.48**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2014	1/28/2014	5	20	
2	Paving	Paving	1/29/2014	2/25/2014	5	20	
3	Building Construction	Building Construction	2/13/2014	12/31/2014	5	230	
4	Site Preparation	Site Preparation	2/26/2014	3/11/2014	5	10	
5	Grading	Grading	3/12/2014	4/8/2014	5	20	
6	Architectural Coating	Architectural Coating	12/4/2014	12/31/2014	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0460	0.4954	0.3629	4.0000e-004		0.0253	0.0253		0.0236	0.0236	0.0000	37.7760	37.7760	0.0102	0.0000	37.9903

Total	**0.0460**	**0.4954**	**0.3629**	**4.0000e-004**	**0.0248**	**0.0253**	**0.0500**	**3.7500e-003**	**0.0236**	**0.0273**	**0.0000**	**37.7760**	**37.7760**	**0.0102**	**0.0000**	**37.9903**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0119	0.0716	0.2380	4.0000e-004		4.8500e-003	4.8500e-003		4.8500e-003	4.8500e-003	0.0000	37.7759	37.7759	0.0102	0.0000	37.9903
Total	**0.0119**	**0.0716**	**0.2380**	**4.0000e-004**	**0.0248**	**4.8500e-003**	**0.0296**	**3.7500e-003**	**4.8500e-003**	**8.6000e-003**	**0.0000**	**37.7759**	**37.7759**	**0.0102**	**0.0000**	**37.9903**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0236	0.2609	0.1497	2.2000e-004		0.0145	0.0145		0.0134	0.0134	0.0000	21.4412	21.4412	6.3400e-003	0.0000	21.5743
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0236**	**0.2609**	**0.1497**	**2.2000e-004**		**0.0145**	**0.0145**		**0.0134**	**0.0134**	**0.0000**	**21.4412**	**21.4412**	**6.3400e-003**	**0.0000**	**21.5743**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4448	3.5942	2.1769	3.0900e-003		0.2562	0.2562		0.2412	0.2412	0.0000	282.6403	282.6403	0.0719	0.0000	284.1495
Total	**0.4448**	**3.5942**	**2.1769**	**3.0900e-003**		**0.2562**	**0.2562**		**0.2412**	**0.2412**	**0.0000**	**282.6403**	**282.6403**	**0.0719**	**0.0000**	**284.1495**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0900e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	282.6400	282.6400	0.0719	0.0000	284.1492
Total	**0.0376**	**0.2563**	**2.0023**	**3.0900e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**282.6400**	**282.6400**	**0.0719**	**0.0000**	**284.1492**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Site Preparation - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0265	0.2881	0.2148	2.0000e-004		0.0157	0.0157		0.0144	0.0144	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**0.0265**	**0.2881**	**0.2148**	**2.0000e-004**	**0.0903**	**0.0157**	**0.1060**	**0.0497**	**0.0144**	**0.0641**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.8508	18.8508	5.5700e-003	0.0000	18.9678
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.8508**	**18.8508**	**5.5700e-003**	**0.0000**	**18.9678**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Grading - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0387	0.4110	0.2675	3.0000e-004		0.0237	0.0237		0.0218	0.0218	0.0000	28.6891	28.6891	8.4800e-003	0.0000	28.8671
Total	**0.0387**	**0.4110**	**0.2675**	**3.0000e-004**	**0.0690**	**0.0237**	**0.0927**	**0.0342**	**0.0218**	**0.0560**	**0.0000**	**28.6891**	**28.6891**	**8.4800e-003**	**0.0000**	**28.8671**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.6890	28.6890	8.4800e-003	0.0000	28.8671
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.6890**	**28.6890**	**8.4800e-003**	**0.0000**	**28.8671**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2014

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.4600e-003	0.0278	0.0192	3.0000e-005		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1803**	**0.0278**	**0.0192**	**3.0000e-005**		**2.4500e-003**	**2.4500e-003**		**2.4500e-003**	**2.4500e-003**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.6000e-004	0.0000	2.5609
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.6000e-004**	**0.0000**	**2.5609**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-...	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058138	0.185246	0.125281	0.029961	0.004506	0.012317	0.020953	0.001764	0.001280	0.005920	0.000536	0.001765

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e

Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Unmitigated	0.8809	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.2000e-004	2.0000e-005	2.1700e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2800e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1700e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2800e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e

Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000

Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2015)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2015
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2015. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido.

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/26/2016	12/29/2015
tblConstructionPhase	PhaseEndDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseEndDate	2/24/2015	2/23/2015
tblConstructionPhase	PhaseEndDate	3/9/2015	2/10/2015
tblConstructionPhase	PhaseStartDate	12/30/2015	12/2/2015
tblConstructionPhase	PhaseStartDate	3/11/2015	2/11/2015
tblConstructionPhase	PhaseStartDate	1/28/2015	1/27/2015
tblConstructionPhase	PhaseStartDate	2/24/2015	1/28/2015
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2015

tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.7313	4.8790	3.1470	4.2100e-003	0.1829	0.3218	0.5047	0.0874	0.3015	0.3889	0.0000	386.9797	386.9797	0.1008	0.0000	389.0955
Total	**1.7313**	**4.8790**	**3.1470**	**4.2100e-003**	**0.1829**	**0.3218**	**0.5047**	**0.0874**	**0.3015**	**0.3889**	**0.0000**	**386.9797**	**386.9797**	**0.1008**	**0.0000**	**389.0955**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2015	1.2535	0.5998	2.6990	4.2100e-003	0.1829	0.0239	0.2068	0.0874	0.0227	0.1102	0.0000	386.9792	386.9792	0.1008	0.0000	389.0951
Total	**1.2535**	**0.5998**	**2.6990**	**4.2100e-003**	**0.1829**	**0.0239**	**0.2068**	**0.0874**	**0.0227**	**0.1102**	**0.0000**	**386.9792**	**386.9792**	**0.1008**	**0.0000**	**389.0951**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**27.60**	**87.71**	**14.24**	**0.00**	**0.00**	**92.59**	**59.03**	**0.00**	**92.46**	**71.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2015	1/27/2015	5	20	
2	Paving	Paving	1/27/2015	2/23/2015	5	20	
3	Site Preparation	Site Preparation	1/28/2015	2/10/2015	5	10	
4	Grading	Grading	2/11/2015	3/10/2015	5	20	
5	Building Construction	Building Construction	2/11/2015	12/29/2015	5	230	
6	Architectural Coating	Architectural Coating	12/2/2015	12/29/2015	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0428	0.4595	0.3427	3.8000e-004		0.0233	0.0233		0.0217	0.0217	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0428**	**0.4595**	**0.3427**	**3.8000e-004**	**0.0235**	**0.0233**	**0.0468**	**3.5600e-003**	**0.0217**	**0.0253**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0235	0.0000	0.0235	3.5600e-003	0.0000	3.5600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0107	0.0644	0.2258	3.8000e-004		4.2100e-003	4.2100e-003		4.2100e-003	4.2100e-003	0.0000	35.5692	35.5692	9.6400e-003	0.0000	35.7717
Total	**0.0107**	**0.0644**	**0.2258**	**3.8000e-004**	**0.0235**	**4.2100e-003**	**0.0277**	**3.5600e-003**	**4.2100e-003**	**7.7700e-003**	**0.0000**	**35.5692**	**35.5692**	**9.6400e-003**	**0.0000**	**35.7717**

3.2 Demolition - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0232	0.2518	0.1498	2.2000e-004		0.0142	0.0142		0.0130	0.0130	0.0000	21.2272	21.2272	6.3400e-003	0.0000	21.3603
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0232**	**0.2518**	**0.1498**	**2.2000e-004**		**0.0142**	**0.0142**		**0.0130**	**0.0130**	**0.0000**	**21.2272**	**21.2272**	**6.3400e-003**	**0.0000**	**21.3603**

3.3 Paving - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0263	0.2845	0.2132	2.0000e-004		0.0154	0.0154		0.0142	0.0142	0.0000	18.6506	18.6506	5.5700e-003	0.0000	18.7675
Total	**0.0263**	**0.2845**	**0.2132**	**2.0000e-004**	**0.0903**	**0.0154**	**0.1058**	**0.0497**	**0.0142**	**0.0639**	**0.0000**	**18.6506**	**18.6506**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	18.6505	18.6505	5.5700e-003	0.0000	18.7675
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**18.6505**	**18.6505**	**5.5700e-003**	**0.0000**	**18.7675**

3.4 Site Preparation - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0383	0.4042	0.2667	3.0000e-004		0.0233	0.0233		0.0214	0.0214	0.0000	28.3860	28.3860	8.4700e-003	0.0000	28.5639
Total	**0.0383**	**0.4042**	**0.2667**	**3.0000e-004**	**0.0690**	**0.0233**	**0.0923**	**0.0342**	**0.0214**	**0.0556**	**0.0000**	**28.3860**	**28.3860**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	28.3859	28.3859	8.4700e-003	0.0000	28.5639
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**28.3859**	**28.3859**	**8.4700e-003**	**0.0000**	**28.5639**

3.5 Grading - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.4208	3.4534	2.1556	3.0800e-003		0.2434	0.2434		0.2289	0.2289	0.0000	280.5935	280.5935	0.0704	0.0000	282.0719
Total	**0.4208**	**3.4534**	**2.1556**	**3.0800e-003**		**0.2434**	**0.2434**		**0.2289**	**0.2289**	**0.0000**	**280.5935**	**280.5935**	**0.0704**	**0.0000**	**282.0719**

3.6 Building Construction - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	280.5932	280.5932	0.0704	0.0000	282.0716
Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**280.5932**	**280.5932**	**0.0704**	**0.0000**	**282.0716**

3.6 Building Construction - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	4.0700e-003	0.0257	0.0190	3.0000e-005		2.2100e-003	2.2100e-003		2.2100e-003	2.2100e-003	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1799**	**0.0257**	**0.0190**	**3.0000e-005**		**2.2100e-003**	**2.2100e-003**		**2.2100e-003**	**2.2100e-003**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	3.3000e-004	0.0000	2.5602
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**3.3000e-004**	**0.0000**	**2.5602**

3.7 Architectural Coating - 2015

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552608	0.057937	0.185322	0.124470	0.029726	0.004465	0.012479	0.021685	0.001768	0.001276	0.005971	0.000530	0.001762

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Unmitigated	0.8809	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.1000e-004	2.0000e-005	2.1400e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2700e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1400e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2700e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2018)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2018. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	5/4/2018	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	12/28/2018
tblConstructionPhase	PhaseEndDate	1/25/2019	4/6/2018
tblConstructionPhase	PhaseStartDate	4/7/2018	12/2/2018
tblConstructionPhase	PhaseStartDate	3/10/2018	2/10/2018
tblConstructionPhase	PhaseStartDate	12/29/2018	3/10/2018

tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2018
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.5889	3.7737	2.9182	4.2300e-003	0.1841	0.2299	0.4140	0.0876	0.2153	0.3029	0.0000	376.3667	376.3667	0.0972	0.0000	378.4085
Total	**1.5889**	**3.7737**	**2.9182**	**4.2300e-003**	**0.1841**	**0.2299**	**0.4140**	**0.0876**	**0.2153**	**0.3029**	**0.0000**	**376.3667**	**376.3667**	**0.0972**	**0.0000**	**378.4085**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	1.2451	0.5122	2.7052	4.2300e-003	0.1841	0.0181	0.2022	0.0876	0.0174	0.1050	0.0000	376.3663	376.3663	0.0972	0.0000	378.4080
Total	**1.2451**	**0.5122**	**2.7052**	**4.2300e-003**	**0.1841**	**0.0181**	**0.2022**	**0.0876**	**0.0174**	**0.1050**	**0.0000**	**376.3663**	**376.3663**	**0.0972**	**0.0000**	**378.4080**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**21.64**	**86.43**	**7.30**	**0.00**	**0.00**	**92.12**	**51.15**	**0.00**	**91.93**	**65.34**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	1/26/2018	5	20	
2	Site Preparation	Site Preparation	1/27/2018	2/9/2018	5	10	
3	Grading	Grading	2/10/2018	3/9/2018	5	20	
4	Building Construction	Building Construction	2/10/2018	12/28/2018	5	230	
5	Paving	Paving	3/10/2018	4/6/2018	5	20	
6	Architectural Coating	Architectural Coating	12/2/2018	12/28/2018	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Paving	Pavers	2	8.00	125	0.42

Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0356	0.3683	0.3173	4.0000e-004		0.0181	0.0181		0.0169	0.0169	0.0000	36.1362	36.1362	9.9900e-003	0.0000	36.3460
Total	**0.0356**	**0.3683**	**0.3173**	**4.0000e-004**	**0.0248**	**0.0181**	**0.0429**	**3.7500e-003**	**0.0169**	**0.0206**	**0.0000**	**36.1362**	**36.1362**	**9.9900e-003**	**0.0000**	**36.3460**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.3100e-003	0.0570	0.2369	4.0000e-004		3.2200e-003	3.2200e-003		3.2200e-003	3.2200e-003	0.0000	36.1361	36.1361	9.9900e-003	0.0000	36.3459
Total	**9.3100e-003**	**0.0570**	**0.2369**	**4.0000e-004**	**0.0248**	**3.2200e-003**	**0.0280**	**3.7500e-003**	**3.2200e-003**	**6.9700e-003**	**0.0000**	**36.1361**	**36.1361**	**9.9900e-003**	**0.0000**	**36.3459**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0215	0.2280	0.1812	2.0000e-004		0.0118	0.0118		0.0109	0.0109	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**0.0215**	**0.2280**	**0.1812**	**2.0000e-004**	**0.0903**	**0.0118**	**0.1022**	**0.0497**	**0.0109**	**0.0605**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.0000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	17.8705	17.8705	5.5600e-003	0.0000	17.9873
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.0000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**17.8705**	**17.8705**	**5.5600e-003**	**0.0000**	**17.9873**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0300	0.3107	0.2400	3.0000e-004		0.0172	0.0172		0.0158	0.0158	0.0000	27.1530	27.1530	8.4500e-003	0.0000	27.3305
Total	**0.0300**	**0.3107**	**0.2400**	**3.0000e-004**	**0.0690**	**0.0172**	**0.0862**	**0.0342**	**0.0158**	**0.0500**	**0.0000**	**27.1530**	**27.1530**	**8.4500e-003**	**0.0000**	**27.3305**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1966	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	27.1529	27.1529	8.4500e-003	0.0000	27.3304
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.0000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**27.1529**	**27.1529**	**8.4500e-003**	**0.0000**	**27.3304**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3069	2.6750	2.0163	3.0800e-003		0.1718	0.1718		0.1616	0.1616	0.0000	272.2851	272.2851	0.0666	0.0000	273.6844
Total	**0.3069**	**2.6750**	**2.0163**	**3.0800e-003**		**0.1718**	**0.1718**		**0.1616**	**0.1616**	**0.0000**	**272.2851**	**272.2851**	**0.0666**	**0.0000**	**273.6844**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.0800e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	272.2848	272.2848	0.0666	0.0000	273.6841

Total	**0.0376**	**0.2563**	**2.0023**	**3.0800e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**272.2848**	**272.2848**	**0.0666**	**0.0000**	**273.6841**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0161	0.1716	0.1449	2.2000e-004		9.3900e-003	9.3900e-003		8.6400e-003	8.6400e-003	0.0000	20.3687	20.3687	6.3400e-003	0.0000	20.5019
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0161**	**0.1716**	**0.1449**	**2.2000e-004**		**9.3900e-003**	**9.3900e-003**		**8.6400e-003**	**8.6400e-003**	**0.0000**	**20.3687**	**20.3687**	**6.3400e-003**	**0.0000**	**20.5019**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.9900e-003	0.0201	0.0185	3.0000e-005		1.5100e-003	1.5100e-003		1.5100e-003	1.5100e-003	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1788**	**0.0201**	**0.0185**	**3.0000e-005**		**1.5100e-003**	**1.5100e-003**		**1.5100e-003**	**1.5100e-003**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	2.4000e-004	0.0000	2.5584
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**2.4000e-004**	**0.0000**	**2.5584**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Unmitigated	0.8809	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.0000e-004	2.0000e-005	2.1000e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2600e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8809**	**2.0000e-005**	**2.1000e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2600e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Average Year (2030)

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	225.49	1000sqft	5.18	225,490.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2030
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Average construction sf from FY2001-FY2015

Construction Phase - Changed start year for construction to 2030. Made schedule fit in 1 year

Trips and VMT - Worker/vendor/hauling trips already captured in other mobile emissions calcs.

Demolition - Average demolition sqft from FY2001-FY2015

Grading -

Architectural Coating -

Vehicle Trips - not modeling operation here

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws. Based on Escondido

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	PhaseEndDate	1/24/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/13/2031	12/20/2030
tblConstructionPhase	PhaseEndDate	1/17/2031	12/27/2030
tblConstructionPhase	PhaseEndDate	1/10/2031	12/27/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	2/26/2030	2/2/2030

tblConstructionPhase	PhaseStartDate	12/21/2030	12/2/2030
tblConstructionPhase	PhaseStartDate	12/28/2030	12/14/2030
tblEnergyUse	LightingElect	4.07	0.00
tblEnergyUse	NT24E	4.80	0.00
tblEnergyUse	NT24NG	1.01	0.00
tblEnergyUse	T24E	5.01	0.00
tblEnergyUse	T24NG	19.28	0.00
tblGrading	MaterialExported	0.00	62,062.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2030
tblSolidWaste	SolidWasteGenerationRate	209.71	0.00
tblTripsAndVMT	HaulingTripNumber	229.00	0.00
tblTripsAndVMT	HaulingTripNumber	7,758.00	0.00
tblTripsAndVMT	VendorTripNumber	37.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	72.00	0.00
tblTripsAndVMT	WorkerTripNumber	18.00	0.00
tblTripsAndVMT	WorkerTripNumber	15.00	0.00
tblTripsAndVMT	WorkerTripNumber	14.00	0.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	40,077,182.84	0.00
tblWater	OutdoorWaterUseRate	24,563,434.64	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.3898	1.2250	2.4831	4.8400e-003	0.1841	0.0284	0.2125	0.0876	0.0284	0.1160	0.0000	419.4097	419.4097	0.0173	0.0000	419.7725
Total	**1.3898**	**1.2250**	**2.4831**	**4.8400e-003**	**0.1841**	**0.0284**	**0.2125**	**0.0876**	**0.0284**	**0.1160**	**0.0000**	**419.4097**	**419.4097**	**0.0173**	**0.0000**	**419.7725**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2030	1.2396	0.3886	2.7145	4.8400e-003	0.1841	9.6700e-003	0.1938	0.0876	9.6700e-003	0.0973	0.0000	419.4092	419.4092	0.0173	0.0000	419.7720
Total	**1.2396**	**0.3886**	**2.7145**	**4.8400e-003**	**0.1841**	**9.6700e-003**	**0.1938**	**0.0876**	**9.6700e-003**	**0.0973**	**0.0000**	**419.4092**	**419.4092**	**0.0173**	**0.0000**	**419.7720**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**10.81**	**68.27**	**-9.32**	**0.00**	**0.00**	**65.94**	**8.81**	**0.00**	**65.94**	**16.14**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e

Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2030	1/28/2030	5	20	
2	Paving	Paving	1/29/2030	2/25/2030	5	20	
3	Building Construction	Building Construction	2/2/2030	12/20/2030	5	230	
4	Grading	Grading	12/2/2030	12/27/2030	5	20	
5	Architectural Coating	Architectural Coating	12/2/2030	12/27/2030	5	20	
6	Site Preparation	Site Preparation	12/14/2030	12/27/2030	5	10	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 338,235; Non-Residential Outdoor: 112,745 (Architectural Coating

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74

Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	0.00	0.00	0.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0208	0.0941	0.1962	4.4000e-004		3.4300e-003	3.4300e-003		3.4300e-003	3.4300e-003	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**0.0208**	**0.0941**	**0.1962**	**4.4000e-004**	**0.0248**	**3.4300e-003**	**0.0282**	**3.7500e-003**	**3.4300e-003**	**7.1800e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0248	0.0000	0.0248	3.7500e-003	0.0000	3.7500e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.4200e-003	0.0352	0.2360	4.4000e-004		9.2000e-004	9.2000e-004		9.2000e-004	9.2000e-004	0.0000	40.7184	40.7184	1.6900e-003	0.0000	40.7538
Total	**6.4200e-003**	**0.0352**	**0.2360**	**4.4000e-004**	**0.0248**	**9.2000e-004**	**0.0257**	**3.7500e-003**	**9.2000e-004**	**4.6700e-003**	**0.0000**	**40.7184**	**40.7184**	**1.6900e-003**	**0.0000**	**40.7538**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Paving - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0136	0.0698	0.1552	2.7000e-004		3.2300e-003	3.2300e-003		3.2300e-003	3.2300e-003	0.0000	23.5867	23.5867	1.1100e-003	0.0000	23.6099
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0136**	**0.0698**	**0.1552**	**2.7000e-004**		**3.2300e-003**	**3.2300e-003**		**3.2300e-003**	**3.2300e-003**	**0.0000**	**23.5867**	**23.5867**	**1.1100e-003**	**0.0000**	**23.6099**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Building Construction - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1500	0.9106	1.8551	3.5400e-003		0.0170	0.0170		0.0170	0.0170	0.0000	300.9635	300.9635	0.0121	0.0000	301.2172
Total	**0.1500**	**0.9106**	**1.8551**	**3.5400e-003**		**0.0170**	**0.0170**		**0.0170**	**0.0170**	**0.0000**	**300.9635**	**300.9635**	**0.0121**	**0.0000**	**301.2172**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.2563	2.0023	3.5400e-003		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	300.9631	300.9631	0.0121	0.0000	301.2168
Total	**0.0376**	**0.2563**	**2.0023**	**3.5400e-003**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**300.9631**	**300.9631**	**0.0121**	**0.0000**	**301.2168**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Grading - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0163	0.0766	0.1739	3.4000e-004		2.4500e-003	2.4500e-003		2.4500e-003	2.4500e-003	0.0000	31.1492	31.1492	1.3100e-003	0.0000	31.1768
Total	**0.0163**	**0.0766**	**0.1739**	**3.4000e-004**	**0.0690**	**2.4500e-003**	**0.0715**	**0.0342**	**2.4500e-003**	**0.0367**	**0.0000**	**31.1492**	**31.1492**	**1.3100e-003**	**0.0000**	**31.1768**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	3.6300e-003	0.0157	0.1966	3.4000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	31.1491	31.1491	1.3100e-003	0.0000	31.1767
Total	**3.6300e-003**	**0.0157**	**0.1966**	**3.4000e-004**	**0.0690**	**4.8000e-004**	**0.0695**	**0.0342**	**4.8000e-004**	**0.0347**	**0.0000**	**31.1491**	**31.1491**	**1.3100e-003**	**0.0000**	**31.1767**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Architectural Coating - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.3100e-003	8.5600e-003	0.0180	3.0000e-005		2.0000e-004	2.0000e-004		2.0000e-004	2.0000e-004	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1771**	**8.5600e-003**	**0.0180**	**3.0000e-005**		**2.0000e-004**	**2.0000e-004**		**2.0000e-004**	**2.0000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	1.1758					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.0000e-004	1.2900e-003	0.0183	3.0000e-005		4.0000e-005	4.0000e-005		4.0000e-005	4.0000e-005	0.0000	2.5533	2.5533	1.0000e-004	0.0000	2.5554
Total	**1.1761**	**1.2900e-003**	**0.0183**	**3.0000e-005**		**4.0000e-005**	**4.0000e-005**		**4.0000e-005**	**4.0000e-005**	**0.0000**	**2.5533**	**2.5533**	**1.0000e-004**	**0.0000**	**2.5554**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Site Preparation - 2030

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0121	0.0653	0.0847	2.1000e-004		2.1100e-003	2.1100e-003		2.1100e-003	2.1100e-003	0.0000	20.4388	20.4388	9.9000e-004	0.0000	20.4595
Total	**0.0121**	**0.0653**	**0.0847**	**2.1000e-004**	**0.0903**	**2.1100e-003**	**0.0924**	**0.0497**	**2.1100e-003**	**0.0518**	**0.0000**	**20.4388**	**20.4388**	**9.9000e-004**	**0.0000**	**20.4595**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.3800e-003	0.0103	0.1062	2.1000e-004		3.2000e-004	3.2000e-004		3.2000e-004	3.2000e-004	0.0000	20.4387	20.4387	9.9000e-004	0.0000	20.4594
Total	**2.3800e-003**	**0.0103**	**0.1062**	**2.1000e-004**	**0.0903**	**3.2000e-004**	**0.0907**	**0.0497**	**3.2000e-004**	**0.0500**	**0.0000**	**20.4387**	**20.4387**	**9.9000e-004**	**0.0000**	**20.4594**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.552333	0.058808	0.184358	0.118913	0.029447	0.004459	0.013404	0.026791	0.001843	0.001224	0.006259	0.000436	0.001725

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Unmitigated	0.8808	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Consumer Products	0.8807					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	1.9000e-004	2.0000e-005	2.0600e-003	0.0000		1.0000e-005	1.0000e-005		1.0000e-005	1.0000e-005	0.0000	4.0300e-003	4.0300e-003	1.0000e-005	0.0000	4.2500e-003
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.8808**	**2.0000e-005**	**2.0600e-003**	**0.0000**		**1.0000e-005**	**1.0000e-005**		**1.0000e-005**	**1.0000e-005**	**0.0000**	**4.0300e-003**	**4.0300e-003**	**1.0000e-005**	**0.0000**	**4.2500e-003**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Peak with project info, 2018

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	3,270.00	1000sqft	18.30	3,270,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Designated Construction Size for Peak Scenario

Construction Phase - Project specific phasing

Off-road Equipment - Project specific

Off-road Equipment - Stanford Escondido Village

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Trips and VMT - Project-specific vendor and haul trips. Default worker trips. Site Prep and Grading 15 mi avg haul trip length

Demolition - Project specific

Grading - Project specific

Architectural Coating -

Vehicle Trips - not modeling operation here

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws.

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	12.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	131.00
tblConstructionPhase	NumDays	300.00	129.00

tblConstructionPhase	NumDays	300.00	261.00
tblConstructionPhase	NumDays	300.00	175.00
tblConstructionPhase	NumDays	20.00	44.00
tblConstructionPhase	NumDays	30.00	152.00
tblConstructionPhase	NumDays	20.00	86.00
tblConstructionPhase	NumDays	10.00	87.00
tblConstructionPhase	PhaseEndDate	3/3/2021	7/1/2020
tblConstructionPhase	PhaseEndDate	3/29/2019	12/31/2018
tblConstructionPhase	PhaseEndDate	1/30/2019	10/1/2018
tblConstructionPhase	PhaseEndDate	10/29/2020	12/31/2020
tblConstructionPhase	PhaseStartDate	9/2/2020	1/1/2020
tblConstructionPhase	PhaseStartDate	10/2/2018	7/4/2018
tblConstructionPhase	PhaseStartDate	7/3/2018	3/2/2018
tblConstructionPhase	PhaseStartDate	7/2/2020	9/3/2020
tblEnergyUse	LightingElect	4.41	0.00
tblEnergyUse	NT24E	7.84	0.00
tblEnergyUse	NT24NG	0.06	0.00
tblEnergyUse	T24E	7.46	0.00
tblEnergyUse	T24NG	17.16	0.00
tblGrading	MaterialExported	0.00	900,000.00
tblLandUse	LotAcreage	75.07	18.30
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	UsageHours	6.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91

tblProjectCharacteristics	OperationalYear	2014	2018
tblSolidWaste	SolidWasteGenerationRate	3,041.10	0.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripNumber	781.00	1,408.00
tblTripsAndVMT	HaulingTripNumber	0.00	69,600.00
tblTripsAndVMT	HaulingTripNumber	112,500.00	121,600.00
tblTripsAndVMT	HaulingTripNumber	0.00	10,320.00
tblTripsAndVMT	HaulingTripNumber	0.00	20,880.00
tblTripsAndVMT	HaulingTripNumber	0.00	1,310.00
tblTripsAndVMT	HaulingTripNumber	0.00	14,000.00
tblTripsAndVMT	HaulingTripNumber	0.00	8,600.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	581,189,355.94	0.00
tblWater	OutdoorWaterUseRate	356,212,831.06	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					

2018	2.3535	24.3059	27.0612	0.0739	2.1888	0.4731	2.6619	0.5805	0.4381	1.0186	0.0000	6,401.4238	6,401.4238	0.1638	0.0000	6,404.8637
2019	1.1763	8.9005	13.2218	0.0344	1.6593	0.2640	1.9233	0.4478	0.2429	0.6907	0.0000	2,728.8943	2,728.8943	0.1544	0.0000	2,732.1375
2020	17.8256	5.2520	9.6642	0.0273	1.3248	0.1367	1.4616	0.3574	0.1258	0.4833	0.0000	2,106.1603	2,106.1603	0.0817	0.0000	2,107.8760
Total	**21.3554**	**38.4585**	**49.9473**	**0.1356**	**5.1729**	**0.8738**	**6.0468**	**1.3858**	**0.8068**	**2.1926**	**0.0000**	**11,236.4784**	**11,236.4784**	**0.3999**	**0.0000**	**11,244.8772**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	2.0368	21.6075	27.1123	0.0739	2.1888	0.3023	2.4911	0.5805	0.2790	0.8595	0.0000	6,401.4234	6,401.4234	0.1638	0.0000	6,404.8633
2019	0.9129	5.7911	13.3165	0.0344	1.6593	0.0909	1.7502	0.4478	0.0841	0.5319	0.0000	2,728.8940	2,728.8940	0.1544	0.0000	2,732.1372
2020	17.7686	4.6779	9.6624	0.0273	1.3248	0.0940	1.4188	0.3574	0.0866	0.4440	0.0000	2,106.1602	2,106.1602	0.0817	0.0000	2,107.8758
Total	**20.7184**	**32.0765**	**50.0912**	**0.1356**	**5.1729**	**0.4871**	**5.6601**	**1.3858**	**0.4497**	**1.8355**	**0.0000**	**11,236.4775**	**11,236.4775**	**0.3999**	**0.0000**	**11,244.8763**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**2.98**	**16.59**	**-0.29**	**0.00**	**0.00**	**44.25**	**6.40**	**0.00**	**44.26**	**16.29**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Area	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2018	3/1/2018	5	44	
2	Site Preparation	Site Preparation	3/2/2018	7/2/2018	5	87	
3	Grading	Grading	3/2/2018	10/1/2018	5	152	
4	Building Construction 1	Building Construction	7/4/2018	12/31/2018	5	129	
5	Building Construction 2	Building Construction	1/1/2019	12/31/2019	5	261	
6	Building Construction 3	Building Construction	1/1/2020	9/1/2020	5	175	
7	Architectural Coating	Architectural Coating	1/1/2020	7/1/2020	5	131	No AC equipment
8	Paving	Paving	9/3/2020	12/31/2020	5	86	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 4,905,000; Non-Residential Outdoor: 1,635,000 (Architectural

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	0	0.00	174	0.41
Grading	Rubber Tired Dozers	0	0.00	255	0.40
Grading	Scrapers	0	0.00	361	0.48
Grading	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Cranes	3	7.00	226	0.29

Building Construction 1	Forklifts	4	8.00	89	0.20
Building Construction 1	Generator Sets	0	0.00	84	0.74
Building Construction 1	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Welders	4	8.00	46	0.45
Building Construction 2	Cranes	3	7.00	226	0.29
Building Construction 2	Forklifts	4	8.00	89	0.20
Building Construction 2	Generator Sets	0	0.00	84	0.74
Building Construction 2	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Building Construction 2	Welders	0	0.00	46	0.45
Architectural Coating	Air Compressors	0	0.00	78	0.48
Building Construction 3	Cranes	0	0.00	226	0.29
Building Construction 3	Forklifts	4	8.00	89	0.20
Building Construction 3	Generator Sets	0	0.00	84	0.74
Building Construction 3	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Building Construction 3	Welders	0	0.00	46	0.45
Paving	Pavers	1	8.00	125	0.42
Paving	Paving Equipment	1	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	1,408.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	4	10.00	0.00	69,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT
Grading	2	5.00	0.00	121,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT
Building Construction 1	11	1,046.00	285.00	10,320.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2	9	1,046.00	285.00	20,880.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	0	209.00	0.00	1,310.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 3	5	1,046.00	285.00	14,000.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	4	10.00	0.00	8,600.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Clean Paved Roads

3.2 Demolition - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0310	0.2956	0.3036	4.9000e-004		0.0160	0.0160		0.0152	0.0152	0.0000	43.7258	43.7258	0.0109	0.0000	43.9535
Total	**0.0310**	**0.2956**	**0.3036**	**4.9000e-004**	**0.0845**	**0.0160**	**0.1006**	**0.0128**	**0.0152**	**0.0280**	**0.0000**	**43.7258**	**43.7258**	**0.0109**	**0.0000**	**43.9535**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0129	0.1711	0.1472	5.3000e-004	0.0119	2.3900e-003	0.0143	3.2700e-003	2.2000e-003	5.4600e-003	0.0000	46.5952	46.5952	3.5000e-004	0.0000	46.6025
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6000e-004	9.3000e-004	8.9700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.6342	1.6342	8.0000e-005	0.0000	1.6359
Total	**0.0136**	**0.1720**	**0.1562**	**5.5000e-004**	**0.0139**	**2.4000e-003**	**0.0163**	**3.8000e-003**	**2.2100e-003**	**6.0100e-003**	**0.0000**	**48.2295**	**48.2295**	**4.3000e-004**	**0.0000**	**48.2384**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0157	0.1048	0.3471	4.9000e-004		6.4500e-003	6.4500e-003		6.4500e-003	6.4500e-003	0.0000	43.7257	43.7257	0.0109	0.0000	43.9535
Total	**0.0157**	**0.1048**	**0.3471**	**4.9000e-004**	**0.0845**	**6.4500e-003**	**0.0910**	**0.0128**	**6.4500e-003**	**0.0193**	**0.0000**	**43.7257**	**43.7257**	**0.0109**	**0.0000**	**43.9535**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0129	0.1711	0.1472	5.3000e-004	0.0119	2.3900e-003	0.0143	3.2700e-003	2.2000e-003	5.4600e-003	0.0000	46.5952	46.5952	3.5000e-004	0.0000	46.6025
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.6000e-004	9.3000e-004	8.9700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.6342	1.6342	8.0000e-005	0.0000	1.6359
Total	**0.0136**	**0.1720**	**0.1562**	**5.5000e-004**	**0.0139**	**2.4000e-003**	**0.0163**	**3.8000e-003**	**2.2100e-003**	**6.0100e-003**	**0.0000**	**48.2295**	**48.2295**	**4.3000e-004**	**0.0000**	**48.2384**

3.3 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0463	0.4576	0.4066	5.4000e-004		0.0324	0.0324		0.0298	0.0298	0.0000	49.3717	49.3717	0.0154	0.0000	49.6945
Total	**0.0463**	**0.4576**	**0.4066**	**5.4000e-004**	**0.0000**	**0.0324**	**0.0324**	**0.0000**	**0.0298**	**0.0298**	**0.0000**	**49.3717**	**49.3717**	**0.0154**	**0.0000**	**49.6945**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.5428	6.5152	6.7179	0.0197	0.4412	0.0889	0.5300	0.1212	0.0818	0.2029	0.0000	1,740.8018	1,740.8018	0.0133	0.0000	1,741.0809
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.8400e-003	0.0177	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	3.2314	3.2314	1.6000e-004	0.0000	3.2346
Total	**0.5441**	**6.5170**	**6.7357**	**0.0197**	**0.4451**	**0.0889**	**0.5340**	**0.1222**	**0.0818**	**0.2040**	**0.0000**	**1,744.0332**	**1,744.0332**	**0.0135**	**0.0000**	**1,744.3156**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Off-Road	6.6100e-003	0.0286	0.4075	5.4000e-004		8.8000e-004	8.8000e-004		8.8000e-004	8.8000e-004	0.0000	49.3717	49.3717	0.0154	0.0000	49.6944
Total	**6.6100e-003**	**0.0286**	**0.4075**	**5.4000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**49.3717**	**49.3717**	**0.0154**	**0.0000**	**49.6944**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.5428	6.5152	6.7179	0.0197	0.4412	0.0889	0.5300	0.1212	0.0818	0.2029	0.0000	1,740.8018	1,740.8018	0.0133	0.0000	1,741.0809
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.3000e-003	1.8400e-003	0.0177	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	3.2314	3.2314	1.6000e-004	0.0000	3.2346
Total	**0.5441**	**6.5170**	**6.7357**	**0.0197**	**0.4451**	**0.0889**	**0.5340**	**0.1222**	**0.0818**	**0.2040**	**0.0000**	**1,744.0332**	**1,744.0332**	**0.0135**	**0.0000**	**1,744.3156**

3.4 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0451	0.4825	0.5105	8.0000e-004		0.0234	0.0234		0.0215	0.0215	0.0000	73.4605	73.4605	0.0229	0.0000	73.9408
Total	**0.0451**	**0.4825**	**0.5105**	**8.0000e-004**	**0.0509**	**0.0234**	**0.0743**	**7.7100e-003**	**0.0215**	**0.0292**	**0.0000**	**73.4605**	**73.4605**	**0.0229**	**0.0000**	**73.9408**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.9484	11.3829	11.7371	0.0344	0.7707	0.1553	0.9260	0.2117	0.1428	0.3546	0.0000	3,041.4009	3,041.4009	0.0232	0.0000	3,041.8885
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	1.6000e-003	0.0155	4.0000e-005	3.4600e-003	3.0000e-005	3.4900e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.8228	2.8228	1.4000e-004	0.0000	2.8257
Total	**0.9495**	**11.3845**	**11.7526**	**0.0344**	**0.7742**	**0.1553**	**0.9295**	**0.2127**	**0.1429**	**0.3555**	**0.0000**	**3,044.2237**	**3,044.2237**	**0.0234**	**0.0000**	**3,044.7142**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.9000e-003	0.0429	0.6106	8.0000e-004		1.3200e-003	1.3200e-003		1.3200e-003	1.3200e-003	0.0000	73.4604	73.4604	0.0229	0.0000	73.9407
Total	**9.9000e-003**	**0.0429**	**0.6106**	**8.0000e-004**	**0.0509**	**1.3200e-003**	**0.0522**	**7.7100e-003**	**1.3200e-003**	**9.0300e-003**	**0.0000**	**73.4604**	**73.4604**	**0.0229**	**0.0000**	**73.9407**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	0.9484	11.3829	11.7371	0.0344	0.7707	0.1553	0.9260	0.2117	0.1428	0.3546	0.0000	3,041.4009	3,041.4009	0.0232	0.0000	3,041.8885
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.1400e-003	1.6000e-003	0.0155	4.0000e-005	3.4600e-003	3.0000e-005	3.4900e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.8228	2.8228	1.4000e-004	0.0000	2.8257
Total	**0.9495**	**11.3845**	**11.7526**	**0.0344**	**0.7742**	**0.1553**	**0.9295**	**0.2127**	**0.1429**	**0.3555**	**0.0000**	**3,044.2237**	**3,044.2237**	**0.0234**	**0.0000**	**3,044.7142**

3.5 Building Construction 1 - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2545	1.9700	1.2099	2.0100e-003		0.1106	0.1106		0.1041	0.1041	0.0000	171.8037	171.8037	0.0477	0.0000	172.8050
Total	**0.2545**	**1.9700**	**1.2099**	**2.0100e-003**		**0.1106**	**0.1106**		**0.1041**	**0.1041**	**0.0000**	**171.8037**	**171.8037**	**0.0477**	**0.0000**	**172.8050**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0945	1.2541	1.0792	3.8600e-003	0.0872	0.0175	0.1047	0.0240	0.0161	0.0400	0.0000	341.5219	341.5219	2.5400e-003	0.0000	341.5752
Vendor	0.1731	1.4877	2.1570	4.3600e-003	0.1187	0.0220	0.1407	0.0340	0.0202	0.0543	0.0000	383.8834	383.8834	2.9800e-003	0.0000	383.9460

Worker	0.2019	0.2849	2.7501	7.1100e-003	0.6143	4.5400e-003	0.6188	0.1634	4.2000e-003	0.1676	0.0000	501.1705	501.1705	0.0243	0.0000	501.6806
Total	**0.4695**	**3.0267**	**5.9863**	**0.0153**	**0.8201**	**0.0440**	**0.8642**	**0.2213**	**0.0405**	**0.2619**	**0.0000**	**1,226.5758**	**1,226.5758**	**0.0298**	**0.0000**	**1,227.2017**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0279	0.3310	1.1164	2.0100e-003		2.9700e-003	2.9700e-003		2.9700e-003	2.9700e-003	0.0000	171.8035	171.8035	0.0477	0.0000	172.8048
Total	**0.0279**	**0.3310**	**1.1164**	**2.0100e-003**		**2.9700e-003**	**2.9700e-003**		**2.9700e-003**	**2.9700e-003**	**0.0000**	**171.8035**	**171.8035**	**0.0477**	**0.0000**	**172.8048**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0945	1.2541	1.0792	3.8600e-003	0.0872	0.0175	0.1047	0.0240	0.0161	0.0400	0.0000	341.5219	341.5219	2.5400e-003	0.0000	341.5752
Vendor	0.1731	1.4877	2.1570	4.3600e-003	0.1187	0.0220	0.1407	0.0340	0.0202	0.0543	0.0000	383.8834	383.8834	2.9800e-003	0.0000	383.9460
Worker	0.2019	0.2849	2.7501	7.1100e-003	0.6143	4.5400e-003	0.6188	0.1634	4.2000e-003	0.1676	0.0000	501.1705	501.1705	0.0243	0.0000	501.6806
Total	**0.4695**	**3.0267**	**5.9863**	**0.0153**	**0.8201**	**0.0440**	**0.8642**	**0.2213**	**0.0405**	**0.2619**	**0.0000**	**1,226.5758**	**1,226.5758**	**0.0298**	**0.0000**	**1,227.2017**

3.6 Building Construction 2 - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.3056	3.2926	1.9178	3.4400e-003		0.1787	0.1787		0.1644	0.1644	0.0000	309.0452	309.0452	0.0978	0.0000	311.0986
Total	**0.3056**	**3.2926**	**1.9178**	**3.4400e-003**		**0.1787**	**0.1787**		**0.1644**	**0.1644**	**0.0000**	**309.0452**	**309.0452**	**0.0978**	**0.0000**	**311.0986**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1796	2.3359	2.1092	7.7900e-003	0.1764	0.0349	0.2113	0.0485	0.0321	0.0806	0.0000	679.1891	679.1891	5.1200e-003	0.0000	679.2965
Vendor	0.3177	2.7474	4.1377	8.8000e-003	0.2401	0.0413	0.2815	0.0688	0.0380	0.1069	0.0000	763.1872	763.1872	5.8800e-003	0.0000	763.3107
Worker	0.3733	0.5246	5.0572	0.0144	1.2428	8.9900e-003	1.2518	0.3305	8.3300e-003	0.3388	0.0000	977.4728	977.4728	0.0457	0.0000	978.4318
Total	**0.8707**	**5.6080**	**11.3041**	**0.0310**	**1.6593**	**0.0853**	**1.7446**	**0.4478**	**0.0785**	**0.5263**	**0.0000**	**2,419.8491**	**2,419.8491**	**0.0567**	**0.0000**	**2,421.0390**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Off-Road	0.0423	0.1832	2.0124	3.4400e-003		5.6400e-003	5.6400e-003		5.6400e-003	5.6400e-003	0.0000	309.0449	309.0449	0.0978	0.0000	311.0982
Total	**0.0423**	**0.1832**	**2.0124**	**3.4400e-003**		**5.6400e-003**	**5.6400e-003**		**5.6400e-003**	**5.6400e-003**	**0.0000**	**309.0449**	**309.0449**	**0.0978**	**0.0000**	**311.0982**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1796	2.3359	2.1092	7.7900e-003	0.1764	0.0349	0.2113	0.0485	0.0321	0.0806	0.0000	679.1891	679.1891	5.1200e-003	0.0000	679.2965
Vendor	0.3177	2.7474	4.1377	8.8000e-003	0.2401	0.0413	0.2815	0.0688	0.0380	0.1069	0.0000	763.1872	763.1872	5.8800e-003	0.0000	763.3107
Worker	0.3733	0.5246	5.0572	0.0144	1.2428	8.9900e-003	1.2518	0.3305	8.3300e-003	0.3388	0.0000	977.4728	977.4728	0.0457	0.0000	978.4318
Total	**0.8707**	**5.6080**	**11.3041**	**0.0310**	**1.6593**	**0.0853**	**1.7446**	**0.4478**	**0.0785**	**0.5263**	**0.0000**	**2,419.8491**	**2,419.8491**	**0.0567**	**0.0000**	**2,421.0390**

3.7 Building Construction 3 - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0664	0.6153	0.5876	7.7000e-004		0.0440	0.0440		0.0405	0.0405	0.0000	67.8922	67.8922	0.0220	0.0000	68.3534
Total	**0.0664**	**0.6153**	**0.5876**	**7.7000e-004**		**0.0440**	**0.0440**		**0.0405**	**0.0405**	**0.0000**	**67.8922**	**67.8922**	**0.0220**	**0.0000**	**68.3534**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1178	1.3512	1.3986	5.2200e-003	0.1183	0.0231	0.1414	0.0325	0.0212	0.0537	0.0000	445.0635	445.0635	3.4400e-003	0.0000	445.1357
Vendor	0.2006	1.5696	2.6892	5.8900e-003	0.1610	0.0248	0.1858	0.0462	0.0228	0.0690	0.0000	500.0109	500.0109	3.8200e-003	0.0000	500.0912
Worker	0.2329	0.3238	3.1265	9.6400e-003	0.8333	5.9600e-003	0.8393	0.2216	5.5300e-003	0.2271	0.0000	629.0534	629.0534	0.0288	0.0000	629.6576
Total	**0.5513**	**3.2445**	**7.2142**	**0.0208**	**1.1126**	**0.0538**	**1.1664**	**0.3002**	**0.0496**	**0.3498**	**0.0000**	**1,574.1278**	**1,574.1278**	**0.0360**	**0.0000**	**1,574.8845**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.5000e-003	0.0412	0.5859	7.7000e-004		1.2700e-003	1.2700e-003		1.2700e-003	1.2700e-003	0.0000	67.8922	67.8922	0.0220	0.0000	68.3533
Total	**9.5000e-003**	**0.0412**	**0.5859**	**7.7000e-004**		**1.2700e-003**	**1.2700e-003**		**1.2700e-003**	**1.2700e-003**	**0.0000**	**67.8922**	**67.8922**	**0.0220**	**0.0000**	**68.3533**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1178	1.3512	1.3986	5.2200e-003	0.1183	0.0231	0.1414	0.0325	0.0212	0.0537	0.0000	445.0635	445.0635	3.4400e-003	0.0000	445.1357
Vendor	0.2006	1.5696	2.6892	5.8900e-003	0.1610	0.0248	0.1858	0.0462	0.0228	0.0690	0.0000	500.0109	500.0109	3.8200e-003	0.0000	500.0912
Worker	0.2329	0.3238	3.1265	9.6400e-003	0.8333	5.9600e-003	0.8393	0.2216	5.5300e-003	0.2271	0.0000	629.0534	629.0534	0.0288	0.0000	629.6576
Total	**0.5513**	**3.2445**	**7.2142**	**0.0208**	**1.1126**	**0.0538**	**1.1664**	**0.3002**	**0.0496**	**0.3498**	**0.0000**	**1,574.1278**	**1,574.1278**	**0.0360**	**0.0000**	**1,574.8845**

3.8 Architectural Coating - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0110	0.1264	0.1309	4.9000e-004	0.0111	2.1600e-003	0.0132	3.0400e-003	1.9900e-003	5.0300e-003	0.0000	41.6452	41.6452	3.2000e-004	0.0000	41.6520
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0348	0.0484	0.4676	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.3000e-004	0.0340	0.0000	94.0882	94.0882	4.3000e-003	0.0000	94.1786
Total	**0.0459**	**0.1749**	**0.5985**	**1.9300e-003**	**0.1357**	**3.0500e-003**	**0.1388**	**0.0362**	**2.8200e-003**	**0.0390**	**0.0000**	**135.7335**	**135.7335**	**4.6200e-003**	**0.0000**	**135.8306**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0110	0.1264	0.1309	4.9000e-004	0.0111	2.1600e-003	0.0132	3.0400e-003	1.9900e-003	5.0300e-003	0.0000	41.6452	41.6452	3.2000e-004	0.0000	41.6520
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0348	0.0484	0.4676	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.3000e-004	0.0340	0.0000	94.0882	94.0882	4.3000e-003	0.0000	94.1786

Total	**0.0459**	**0.1749**	**0.5985**	**1.9300e-003**	**0.1357**	**3.0500e-003**	**0.1388**	**0.0362**	**2.8200e-003**	**0.0390**	**0.0000**	**135.7335**	**135.7335**	**4.6200e-003**	**0.0000**	**135.8306**

3.9 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.3859	0.3900	5.9000e-004		0.0216	0.0216		0.0199	0.0199	0.0000	52.0553	52.0553	0.0168	0.0000	52.4088
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0376**	**0.3859**	**0.3900**	**5.9000e-004**		**0.0216**	**0.0216**		**0.0199**	**0.0199**	**0.0000**	**52.0553**	**52.0553**	**0.0168**	**0.0000**	**52.4088**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0724	0.8300	0.8592	3.2100e-003	0.0727	0.0142	0.0868	0.0200	0.0131	0.0330	0.0000	273.3961	273.3961	2.1100e-003	0.0000	273.4405
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0900e-003	1.5200e-003	0.0147	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.9554	2.9554	1.4000e-004	0.0000	2.9582
Total	**0.0735**	**0.8315**	**0.8738**	**3.2600e-003**	**0.0766**	**0.0142**	**0.0908**	**0.0210**	**0.0131**	**0.0341**	**0.0000**	**276.3515**	**276.3515**	**2.2500e-003**	**0.0000**	**276.3987**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0376	0.3859	0.3900	5.9000e-004		0.0216	0.0216		0.0199	0.0199	0.0000	52.0552	52.0552	0.0168	0.0000	52.4088
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0376**	**0.3859**	**0.3900**	**5.9000e-004**		**0.0216**	**0.0216**		**0.0199**	**0.0199**	**0.0000**	**52.0552**	**52.0552**	**0.0168**	**0.0000**	**52.4088**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0724	0.8300	0.8592	3.2100e-003	0.0727	0.0142	0.0868	0.0200	0.0131	0.0330	0.0000	273.3961	273.3961	2.1100e-003	0.0000	273.4405
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0900e-003	1.5200e-003	0.0147	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.9554	2.9554	1.4000e-004	0.0000	2.9582
Total	**0.0735**	**0.8315**	**0.8738**	**3.2600e-003**	**0.0766**	**0.0142**	**0.0908**	**0.0210**	**0.0131**	**0.0341**	**0.0000**	**276.3515**	**276.3515**	**2.2500e-003**	**0.0000**	**276.3987**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Unmitigated	12.7739	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.9100e-003	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.9100e-003	2.9000e-004	0.0305	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.6000e-004	0.0000	0.0618
Total	**12.7739**	**2.9000e-004**	**0.0305**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.6000e-004**	**0.0000**	**0.0618**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000

Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Stanford Construction/Demolition, Peak with project info, 2023

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Office Building	3,270.00	1000sqft	18.30	3,270,000.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2023
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	434.91	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Actual most recent PGE emission factor

Land Use - Designated Construction Size for Peak Scenario

Construction Phase - Project specific phasing

Off-road Equipment - Project specific

Off-road Equipment - Stanford Escondido Village

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Off-road Equipment - Project specific

Trips and VMT - Project-specific vendor and haul trips. Default worker trips. Site Prep and Grading 15 mi avg haul trip length

Demolition - Project specific

Grading - Project specific

Architectural Coating -

Vehicle Trips - not modeling operation here

Vechicle Emission Factors -

Vechicle Emission Factors -

Vechicle Emission Factors -

Consumer Products - not modeling operations

Area Coating - not modeling operation

Landscape Equipment - not modeling operation

Energy Use - not modeling operation

Water And Wastewater - not modeling operation

Solid Waste - not modeling operation

Construction Off-road Equipment Mitigation - Tier 4 final for all equipment except pavers, paving equipment, rollers, and concrete/industrial saws.

Table Name	Column Name	Default Value	New Value
tblAreaCoating	ReapplicationRatePercent	10	0
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	5.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	12.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	20.00	131.00
tblConstructionPhase	NumDays	300.00	129.00

tblConstructionPhase	NumDays	300.00	261.00
tblConstructionPhase	NumDays	300.00	175.00
tblConstructionPhase	NumDays	20.00	44.00
tblConstructionPhase	NumDays	30.00	152.00
tblConstructionPhase	NumDays	20.00	86.00
tblConstructionPhase	NumDays	10.00	87.00
tblConstructionPhase	PhaseEndDate	3/4/2026	7/2/2025
tblConstructionPhase	PhaseEndDate	3/28/2024	12/31/2023
tblConstructionPhase	PhaseEndDate	9/1/2025	9/2/2025
tblConstructionPhase	PhaseEndDate	1/30/2024	10/1/2023
tblConstructionPhase	PhaseEndDate	10/30/2025	12/31/2025
tblConstructionPhase	PhaseEndDate	7/3/2023	7/2/2023
tblConstructionPhase	PhaseStartDate	9/3/2025	1/1/2025
tblConstructionPhase	PhaseStartDate	10/2/2023	7/4/2023
tblConstructionPhase	PhaseStartDate	12/31/2024	1/1/2025
tblConstructionPhase	PhaseStartDate	7/3/2023	3/2/2023
tblConstructionPhase	PhaseStartDate	7/3/2025	9/3/2025
tblConstructionPhase	PhaseStartDate	3/3/2023	3/2/2023
tblEnergyUse	LightingElect	4.41	0.00
tblEnergyUse	NT24E	7.84	0.00
tblEnergyUse	NT24NG	0.06	0.00
tblEnergyUse	T24E	7.46	0.00
tblEnergyUse	T24NG	17.16	0.00
tblGrading	MaterialExported	0.00	900,000.00
tblLandUse	LotAcreage	75.07	18.30
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00

tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	UsageHours	6.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00

tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	434.91
tblProjectCharacteristics	OperationalYear	2014	2023
tblSolidWaste	SolidWasteGenerationRate	3,041.10	0.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripLength	20.00	15.00
tblTripsAndVMT	HaulingTripNumber	781.00	1,408.00
tblTripsAndVMT	HaulingTripNumber	0.00	69,600.00
tblTripsAndVMT	HaulingTripNumber	112,500.00	121,600.00
tblTripsAndVMT	HaulingTripNumber	0.00	10,320.00
tblTripsAndVMT	HaulingTripNumber	0.00	20,880.00
tblTripsAndVMT	HaulingTripNumber	0.00	14,000.00
tblTripsAndVMT	HaulingTripNumber	0.00	1,310.00
tblTripsAndVMT	HaulingTripNumber	0.00	8,600.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblTripsAndVMT	VendorTripNumber	536.00	285.00
tblVehicleTrips	ST_TR	2.37	0.00
tblVehicleTrips	SU_TR	0.98	0.00
tblVehicleTrips	WD_TR	11.01	0.00
tblWater	IndoorWaterUseRate	581,189,355.94	0.00
tblWater	OutdoorWaterUseRate	356,212,831.06	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	1.7997	11.7924	23.5589	0.0733	2.1894	0.3538	2.5432	0.5807	0.3269	0.9076	0.0000	6,079.2749	6,079.2749	0.1509	0.0000	6,082.4435
2024	0.8833	4.9106	10.8381	0.0343	1.6596	0.1646	1.8242	0.4479	0.1515	0.5994	0.0000	2,586.1062	2,586.1062	0.1437	0.0000	2,589.1241
2025	17.6700	3.1649	8.2079	0.0272	1.3251	0.0979	1.4230	0.3575	0.0901	0.4477	0.0000	2,047.5664	2,047.5664	0.0746	0.0000	2,049.1334
Total	**20.3529**	**19.8679**	**42.6049**	**0.1348**	**5.1741**	**0.6163**	**5.7904**	**1.3862**	**0.5686**	**1.9547**	**0.0000**	**10,712.9476**	**10,712.9476**	**0.3692**	**0.0000**	**10,720.7010**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2023	1.6295	10.3541	23.8101	0.0733	2.1894	0.2735	2.4629	0.5807	0.2523	0.8331	0.0000	6,079.2745	6,079.2745	0.1509	0.0000	6,082.4431
2024	0.7323	3.1273	11.1504	0.0343	1.6596	0.0796	1.7392	0.4479	0.0737	0.5217	0.0000	2,586.1059	2,586.1059	0.1437	0.0000	2,589.1237
2025	17.6390	2.8174	8.2263	0.0272	1.3251	0.0797	1.4048	0.3575	0.0735	0.4310	0.0000	2,047.5663	2,047.5663	0.0746	0.0000	2,049.1333
Total	**20.0008**	**16.2988**	**43.1867**	**0.1348**	**5.1741**	**0.4328**	**5.6069**	**1.3862**	**0.3995**	**1.7857**	**0.0000**	**10,712.9467**	**10,712.9467**	**0.3692**	**0.0000**	**10,720.7001**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**1.73**	**17.96**	**-1.37**	**0.00**	**0.00**	**29.78**	**3.17**	**0.00**	**29.73**	**8.65**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	1/1/2023	3/2/2023	5	44	
2	Site Preparation	Site Preparation	3/2/2023	7/2/2023	5	87	
3	Grading	Grading	3/2/2023	10/1/2023	5	152	
4	Building Construction 1	Building Construction	7/4/2023	12/31/2023	5	129	
5	Building Construction 2	Building Construction	1/1/2024	12/30/2024	5	261	
6	Building Construction 3	Building Construction	1/1/2025	9/2/2025	5	175	
7	Architectural Coating	Architectural Coating	1/1/2025	7/2/2025	5	131	No AC equipment
8	Paving	Paving	9/3/2025	12/31/2025	5	86	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 4,905,000; Non-Residential Outdoor: 1,635,000 (Architectural

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Rubber Tired Dozers	0	0.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37

Grading	Excavators	2	8.00	162	0.38
Grading	Graders	0	0.00	174	0.41
Grading	Rubber Tired Dozers	0	0.00	255	0.40
Grading	Scrapers	0	0.00	361	0.48
Grading	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Cranes	3	7.00	226	0.29
Building Construction 1	Forklifts	4	8.00	89	0.20
Building Construction 1	Generator Sets	0	0.00	84	0.74
Building Construction 1	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction 1	Welders	4	8.00	46	0.45
Building Construction 2	Cranes	3	7.00	226	0.29
Building Construction 2	Forklifts	4	8.00	89	0.20
Building Construction 2	Generator Sets	0	0.00	84	0.74
Building Construction 2	Tractors/Loaders/Backhoes	2	7.00	97	0.37
Building Construction 2	Welders	0	0.00	46	0.45
Building Construction 3	Cranes	0	0.00	226	0.29
Building Construction 3	Forklifts	4	8.00	89	0.20
Building Construction 3	Generator Sets	0	0.00	84	0.74
Building Construction 3	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Building Construction 3	Welders	0	0.00	46	0.45
Architectural Coating	Air Compressors	0	0.00	78	0.48
Paving	Pavers	1	8.00	125	0.42
Paving	Paving Equipment	1	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	4	10.00	0.00	1,408.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	4	10.00	0.00	69,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT

Grading	2	5.00	0.00	121,600.00	12.40	7.30	15.00	LD_Mix	HDT_Mix	HHDT
Building Construction 1	11	1,046.00	285.00	10,320.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 2	9	1,046.00	285.00	20,880.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction 3	5	1,046.00	285.00	14,000.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	0	209.00	0.00	1,310.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	4	10.00	0.00	8,600.00	12.40	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Clean Paved Roads

3.2 Demolition - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0201	0.1617	0.3009	4.9000e-004		7.9500e-003	7.9500e-003		7.5400e-003	7.5400e-003	0.0000	42.5299	42.5299	0.0105	0.0000	42.7507
Total	**0.0201**	**0.1617**	**0.3009**	**4.9000e-004**	**0.0845**	**7.9500e-003**	**0.0925**	**0.0128**	**7.5400e-003**	**0.0203**	**0.0000**	**42.5299**	**42.5299**	**0.0105**	**0.0000**	**42.7507**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Hauling	0.0106	0.0780	0.1316	5.2000e-004	0.0119	2.2100e-003	0.0141	3.2700e-003	2.0400e-003	5.3000e-003	0.0000	44.4845	44.4845	3.2000e-004	0.0000	44.4913
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.7000e-004	6.4000e-004	6.1700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.4397	1.4397	6.0000e-005	0.0000	1.4409
Total	**0.0111**	**0.0787**	**0.1378**	**5.4000e-004**	**0.0139**	**2.2200e-003**	**0.0161**	**3.8000e-003**	**2.0500e-003**	**5.8500e-003**	**0.0000**	**45.9241**	**45.9241**	**3.8000e-004**	**0.0000**	**45.9322**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0845	0.0000	0.0845	0.0128	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0116	0.0755	0.3456	4.9000e-004		3.4000e-003	3.4000e-003		3.4000e-003	3.4000e-003	0.0000	42.5299	42.5299	0.0105	0.0000	42.7507
Total	**0.0116**	**0.0755**	**0.3456**	**4.9000e-004**	**0.0845**	**3.4000e-003**	**0.0879**	**0.0128**	**3.4000e-003**	**0.0162**	**0.0000**	**42.5299**	**42.5299**	**0.0105**	**0.0000**	**42.7507**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0106	0.0780	0.1316	5.2000e-004	0.0119	2.2100e-003	0.0141	3.2700e-003	2.0400e-003	5.3000e-003	0.0000	44.4845	44.4845	3.2000e-004	0.0000	44.4913
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.7000e-004	6.4000e-004	6.1700e-003	2.0000e-005	2.0000e-003	1.0000e-005	2.0200e-003	5.3000e-004	1.0000e-005	5.5000e-004	0.0000	1.4397	1.4397	6.0000e-005	0.0000	1.4409

Total	**0.0111**	**0.0787**	**0.1378**	**5.4000e-004**	**0.0139**	**2.2200e-003**	**0.0161**	**3.8000e-003**	**2.0500e-003**	**5.8500e-003**	**0.0000**	**45.9241**	**45.9241**	**3.8000e-004**	**0.0000**	**45.9322**

3.3 Site Preparation - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0263	0.2672	0.3883	5.4000e-004		0.0132	0.0132		0.0121	0.0121	0.0000	47.6039	47.6039	0.0154	0.0000	47.9272
Total	**0.0263**	**0.2672**	**0.3883**	**5.4000e-004**	**0.0000**	**0.0132**	**0.0132**	**0.0000**	**0.0121**	**0.0121**	**0.0000**	**47.6039**	**47.6039**	**0.0154**	**0.0000**	**47.9272**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.4403	3.0289	6.0110	0.0195	0.4413	0.0824	0.5237	0.1213	0.0758	0.1970	0.0000	1,661.9355	1,661.9355	0.0126	0.0000	1,662.1989
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	1.2600e-003	0.0122	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	2.8466	2.8466	1.2000e-004	0.0000	2.8491
Total	**0.4412**	**3.0301**	**6.0232**	**0.0196**	**0.4453**	**0.0824**	**0.5277**	**0.1223**	**0.0758**	**0.1981**	**0.0000**	**1,664.7821**	**1,664.7821**	**0.0127**	**0.0000**	**1,665.0480**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.6100e-003	0.0286	0.4075	5.4000e-004		8.8000e-004	8.8000e-004		8.8000e-004	8.8000e-004	0.0000	47.6038	47.6038	0.0154	0.0000	47.9272
Total	**6.6100e-003**	**0.0286**	**0.4075**	**5.4000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**8.8000e-004**	**8.8000e-004**	**0.0000**	**47.6038**	**47.6038**	**0.0154**	**0.0000**	**47.9272**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.4403	3.0289	6.0110	0.0195	0.4413	0.0824	0.5237	0.1213	0.0758	0.1970	0.0000	1,661.9355	1,661.9355	0.0126	0.0000	1,662.1989
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.3000e-004	1.2600e-003	0.0122	5.0000e-005	3.9600e-003	3.0000e-005	3.9900e-003	1.0500e-003	3.0000e-005	1.0800e-003	0.0000	2.8466	2.8466	1.2000e-004	0.0000	2.8491
Total	**0.4412**	**3.0301**	**6.0232**	**0.0196**	**0.4453**	**0.0824**	**0.5277**	**0.1223**	**0.0758**	**0.1981**	**0.0000**	**1,664.7821**	**1,664.7821**	**0.0127**	**0.0000**	**1,665.0480**

3.4 Grading - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					

Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0294	0.2414	0.5077	8.1000e-004		0.0118	0.0118		0.0109	0.0109	0.0000	70.7064	70.7064	0.0229	0.0000	71.1867
Total	**0.0294**	**0.2414**	**0.5077**	**8.1000e-004**	**0.0509**	**0.0118**	**0.0627**	**7.7100e-003**	**0.0109**	**0.0186**	**0.0000**	**70.7064**	**70.7064**	**0.0229**	**0.0000**	**71.1867**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.2000e-004	1.1000e-003	0.0107	4.0000e-005	3.4600e-003	2.0000e-005	3.4800e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.4867	2.4867	1.0000e-004	0.0000	2.4889
Hauling	0.7692	5.2918	10.5019	0.0341	0.7711	0.1439	0.9150	0.2118	0.1324	0.3442	0.0000	2,903.6114	2,903.6114	0.0219	0.0000	2,904.0716
Total	**0.7701**	**5.2929**	**10.5126**	**0.0341**	**0.7745**	**0.1439**	**0.9185**	**0.2128**	**0.1324**	**0.3452**	**0.0000**	**2,906.0981**	**2,906.0981**	**0.0220**	**0.0000**	**2,906.5605**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0509	0.0000	0.0509	7.7100e-003	0.0000	7.7100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	9.9000e-003	0.0429	0.6106	8.1000e-004		1.3200e-003	1.3200e-003		1.3200e-003	1.3200e-003	0.0000	70.7064	70.7064	0.0229	0.0000	71.1866
Total	**9.9000e-003**	**0.0429**	**0.6106**	**8.1000e-004**	**0.0509**	**1.3200e-003**	**0.0522**	**7.7100e-003**	**1.3200e-003**	**9.0300e-003**	**0.0000**	**70.7064**	**70.7064**	**0.0229**	**0.0000**	**71.1866**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.2000e-004	1.1000e-003	0.0107	4.0000e-005	3.4600e-003	2.0000e-005	3.4800e-003	9.2000e-004	2.0000e-005	9.4000e-004	0.0000	2.4867	2.4867	1.0000e-004	0.0000	2.4889
Hauling	0.7692	5.2918	10.5019	0.0341	0.7711	0.1439	0.9150	0.2118	0.1324	0.3442	0.0000	2,903.6114	2,903.6114	0.0219	0.0000	2,904.0716
Total	**0.7701**	**5.2929**	**10.5126**	**0.0341**	**0.7745**	**0.1439**	**0.9185**	**0.2128**	**0.1324**	**0.3452**	**0.0000**	**2,906.0981**	**2,906.0981**	**0.0220**	**0.0000**	**2,906.5605**

3.5 Building Construction 1 - 2023

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1503	1.2461	1.0321	2.0100e-003		0.0559	0.0559		0.0526	0.0526	0.0000	167.1836	167.1836	0.0437	0.0000	168.1005
Total	**0.1503**	**1.2461**	**1.0321**	**2.0100e-003**		**0.0559**	**0.0559**		**0.0526**	**0.0526**	**0.0000**	**167.1836**	**167.1836**	**0.0437**	**0.0000**	**168.1005**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0779	0.5718	0.9646	3.8200e-003	0.0872	0.0162	0.1034	0.0240	0.0149	0.0389	0.0000	326.0510	326.0510	2.3800e-003	0.0000	326.1010
Vendor	0.1283	0.7078	1.7987	4.3200e-003	0.1187	0.0158	0.1345	0.0341	0.0145	0.0486	0.0000	366.8964	366.8964	2.6600e-003	0.0000	366.9522
Worker	0.1449	0.1948	1.8931	7.1000e-003	0.6143	4.3700e-003	0.6186	0.1634	4.0500e-003	0.1674	0.0000	441.4994	441.4994	0.0183	0.0000	441.8845
Total	**0.3511**	**1.4744**	**4.6563**	**0.0152**	**0.8202**	**0.0364**	**0.8566**	**0.2214**	**0.0335**	**0.2549**	**0.0000**	**1,134.4468**	**1,134.4468**	**0.0234**	**0.0000**	**1,134.9377**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0279	0.3310	1.1164	2.0100e-003		2.9700e-003	2.9700e-003		2.9700e-003	2.9700e-003	0.0000	167.1834	167.1834	0.0437	0.0000	168.1003
Total	**0.0279**	**0.3310**	**1.1164**	**2.0100e-003**		**2.9700e-003**	**2.9700e-003**		**2.9700e-003**	**2.9700e-003**	**0.0000**	**167.1834**	**167.1834**	**0.0437**	**0.0000**	**168.1003**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0779	0.5718	0.9646	3.8200e-003	0.0872	0.0162	0.1034	0.0240	0.0149	0.0389	0.0000	326.0510	326.0510	2.3800e-003	0.0000	326.1010

Vendor	0.1283	0.7078	1.7987	4.3200e-003	0.1187	0.0158	0.1345	0.0341	0.0145	0.0486	0.0000	366.8964	366.8964	2.6600e-003	0.0000	366.9522
Worker	0.1449	0.1948	1.8931	7.1000e-003	0.6143	4.3700e-003	0.6186	0.1634	4.0500e-003	0.1674	0.0000	441.4994	441.4994	0.0183	0.0000	441.8845
Total	**0.3511**	**1.4744**	**4.6563**	**0.0152**	**0.8202**	**0.0364**	**0.8566**	**0.2214**	**0.0335**	**0.2549**	**0.0000**	**1,134.4468**	**1,134.4468**	**0.0234**	**0.0000**	**1,134.9377**

3.6 Building Construction 2 - 2024

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1932	1.9664	1.7001	3.4400e-003		0.0907	0.0907		0.0834	0.0834	0.0000	302.5199	302.5199	0.0978	0.0000	304.5745
Total	**0.1932**	**1.9664**	**1.7001**	**3.4400e-003**		**0.0907**	**0.0907**		**0.0834**	**0.0834**	**0.0000**	**302.5199**	**302.5199**	**0.0978**	**0.0000**	**304.5745**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1570	1.1519	1.9426	7.7400e-003	0.1765	0.0330	0.2095	0.0485	0.0304	0.0788	0.0000	659.8892	659.8892	4.8300e-003	0.0000	659.9906
Vendor	0.2548	1.4205	3.5747	8.7400e-003	0.2403	0.0321	0.2724	0.0689	0.0296	0.0985	0.0000	742.6052	742.6052	5.4000e-003	0.0000	742.7187
Worker	0.2782	0.3718	3.6208	0.0144	1.2428	8.8300e-003	1.2517	0.3305	8.1900e-003	0.3387	0.0000	881.0920	881.0920	0.0356	0.0000	881.8402
Total	**0.6900**	**2.9442**	**9.1380**	**0.0309**	**1.6596**	**0.0740**	**1.7336**	**0.4479**	**0.0681**	**0.5160**	**0.0000**	**2,283.5864**	**2,283.5864**	**0.0459**	**0.0000**	**2,284.5496**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0423	0.1832	2.0124	3.4400e-003		5.6400e-003	5.6400e-003		5.6400e-003	5.6400e-003	0.0000	302.5195	302.5195	0.0978	0.0000	304.5742
Total	**0.0423**	**0.1832**	**2.0124**	**3.4400e-003**		**5.6400e-003**	**5.6400e-003**		**5.6400e-003**	**5.6400e-003**	**0.0000**	**302.5195**	**302.5195**	**0.0978**	**0.0000**	**304.5742**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1570	1.1519	1.9426	7.7400e-003	0.1765	0.0330	0.2095	0.0485	0.0304	0.0788	0.0000	659.8892	659.8892	4.8300e-003	0.0000	659.9906
Vendor	0.2548	1.4205	3.5747	8.7400e-003	0.2403	0.0321	0.2724	0.0689	0.0296	0.0985	0.0000	742.6052	742.6052	5.4000e-003	0.0000	742.7187
Worker	0.2782	0.3718	3.6208	0.0144	1.2428	8.8300e-003	1.2517	0.3305	8.1900e-003	0.3387	0.0000	881.0920	881.0920	0.0356	0.0000	881.8402
Total	**0.6900**	**2.9442**	**9.1380**	**0.0309**	**1.6596**	**0.0740**	**1.7336**	**0.4479**	**0.0681**	**0.5160**	**0.0000**	**2,283.5864**	**2,283.5864**	**0.0459**	**0.0000**	**2,284.5496**

3.7 Building Construction 3 - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0405	0.3887	0.5675	7.7000e-004		0.0195	0.0195		0.0179	0.0179	0.0000	67.9817	67.9817	0.0220	0.0000	68.4434
Total	**0.0405**	**0.3887**	**0.5675**	**7.7000e-004**		**0.0195**	**0.0195**		**0.0179**	**0.0179**	**0.0000**	**67.9817**	**67.9817**	**0.0220**	**0.0000**	**68.4434**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1050	0.7694	1.2992	5.1900e-003	0.1183	0.0222	0.1406	0.0325	0.0204	0.0530	0.0000	442.5620	442.5620	3.2500e-003	0.0000	442.6303
Vendor	0.1686	0.9459	2.3681	5.8600e-003	0.1612	0.0217	0.1828	0.0462	0.0199	0.0662	0.0000	498.1131	498.1131	3.6400e-003	0.0000	498.1895
Worker	0.1780	0.2366	2.3105	9.6400e-003	0.8333	5.9400e-003	0.8392	0.2216	5.5100e-003	0.2271	0.0000	583.5749	583.5749	0.0231	0.0000	584.0591
Total	**0.4515**	**1.9519**	**5.9779**	**0.0207**	**1.1128**	**0.0498**	**1.1626**	**0.3003**	**0.0459**	**0.3462**	**0.0000**	**1,524.2500**	**1,524.2500**	**0.0300**	**0.0000**	**1,524.8789**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.5000e-003	0.0412	0.5859	7.7000e-004		1.2700e-003	1.2700e-003		1.2700e-003	1.2700e-003	0.0000	67.9816	67.9816	0.0220	0.0000	68.4433

Total	**9.5000e-003**	**0.0412**	**0.5859**	**7.7000e-004**		**1.2700e-003**	**1.2700e-003**		**1.2700e-003**	**1.2700e-003**	**0.0000**	**67.9816**	**67.9816**	**0.0220**	**0.0000**	**68.4433**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.1050	0.7694	1.2992	5.1900e-003	0.1183	0.0222	0.1406	0.0325	0.0204	0.0530	0.0000	442.5620	442.5620	3.2500e-003	0.0000	442.6303
Vendor	0.1686	0.9459	2.3681	5.8600e-003	0.1612	0.0217	0.1828	0.0462	0.0199	0.0662	0.0000	498.1131	498.1131	3.6400e-003	0.0000	498.1895
Worker	0.1780	0.2366	2.3105	9.6400e-003	0.8333	5.9400e-003	0.8392	0.2216	5.5100e-003	0.2271	0.0000	583.5749	583.5749	0.0231	0.0000	584.0591
Total	**0.4515**	**1.9519**	**5.9779**	**0.0207**	**1.1128**	**0.0498**	**1.1626**	**0.3003**	**0.0459**	**0.3462**	**0.0000**	**1,524.2500**	**1,524.2500**	**0.0300**	**0.0000**	**1,524.8789**

3.8 Architectural Coating - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	9.8200e-003	0.0720	0.1216	4.9000e-004	0.0111	2.0800e-003	0.0132	3.0400e-003	1.9100e-003	4.9600e-003	0.0000	41.4112	41.4112	3.0000e-004	0.0000	41.4176
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0266	0.0354	0.3456	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.2000e-004	0.0340	0.0000	87.2860	87.2860	3.4500e-003	0.0000	87.3584
Total	**0.0364**	**0.1074**	**0.4672**	**1.9300e-003**	**0.1357**	**2.9700e-003**	**0.1387**	**0.0362**	**2.7300e-003**	**0.0389**	**0.0000**	**128.6971**	**128.6971**	**3.7500e-003**	**0.0000**	**128.7759**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	17.0510					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**17.0510**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e

Category	tons/yr										MT/yr					
Hauling	9.8200e-003	0.0720	0.1216	4.9000e-004	0.0111	2.0800e-003	0.0132	3.0400e-003	1.9100e-003	4.9600e-003	0.0000	41.4112	41.4112	3.0000e-004	0.0000	41.4176
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0266	0.0354	0.3456	1.4400e-003	0.1246	8.9000e-004	0.1255	0.0332	8.2000e-004	0.0340	0.0000	87.2860	87.2860	3.4500e-003	0.0000	87.3584
Total	**0.0364**	**0.1074**	**0.4672**	**1.9300e-003**	**0.1357**	**2.9700e-003**	**0.1387**	**0.0362**	**2.7300e-003**	**0.0389**	**0.0000**	**128.6971**	**128.6971**	**3.7500e-003**	**0.0000**	**128.7759**

3.9 Paving - 2025

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0252	0.2431	0.3864	5.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	52.0364	52.0364	0.0168	0.0000	52.3898
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0252**	**0.2431**	**0.3864**	**5.9000e-004**		**0.0120**	**0.0120**		**0.0110**	**0.0110**	**0.0000**	**52.0364**	**52.0364**	**0.0168**	**0.0000**	**52.3898**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0645	0.4727	0.7981	3.1900e-003	0.0727	0.0137	0.0864	0.0200	0.0126	0.0325	0.0000	271.8595	271.8595	2.0000e-003	0.0000	271.9015
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Worker	8.4000e-004	1.1100e-003	0.0109	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.7417	2.7417	1.1000e-004	0.0000	2.7440
Total	**0.0653**	**0.4738**	**0.8090**	**3.2400e-003**	**0.0766**	**0.0137**	**0.0903**	**0.0210**	**0.0126**	**0.0336**	**0.0000**	**274.6012**	**274.6012**	**2.1100e-003**	**0.0000**	**274.6455**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0252	0.2431	0.3864	5.9000e-004		0.0120	0.0120		0.0110	0.0110	0.0000	52.0363	52.0363	0.0168	0.0000	52.3897
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0252**	**0.2431**	**0.3864**	**5.9000e-004**		**0.0120**	**0.0120**		**0.0110**	**0.0110**	**0.0000**	**52.0363**	**52.0363**	**0.0168**	**0.0000**	**52.3897**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0645	0.4727	0.7981	3.1900e-003	0.0727	0.0137	0.0864	0.0200	0.0126	0.0325	0.0000	271.8595	271.8595	2.0000e-003	0.0000	271.9015
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.4000e-004	1.1100e-003	0.0109	5.0000e-005	3.9200e-003	3.0000e-005	3.9400e-003	1.0400e-003	3.0000e-005	1.0700e-003	0.0000	2.7417	2.7417	1.1000e-004	0.0000	2.7440
Total	**0.0653**	**0.4738**	**0.8090**	**3.2400e-003**	**0.0766**	**0.0137**	**0.0903**	**0.0210**	**0.0126**	**0.0336**	**0.0000**	**274.6012**	**274.6012**	**2.1100e-003**	**0.0000**	**274.6455**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Office Building	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Office Building	9.50	7.30	7.30	33.00	48.00	19.00	77	19	4

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.551461	0.058468	0.185554	0.123211	0.029507	0.004440	0.012712	0.023230	0.001775	0.001270	0.006089	0.000516	0.001766

5.0 Energy Detail

4.4 Fleet Mix

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Office Building	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Unmitigated	12.7738	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.7800e-003	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	12.7710					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	2.7800e-003	2.7000e-004	0.0300	0.0000		1.1000e-004	1.1000e-004		1.1000e-004	1.1000e-004	0.0000	0.0584	0.0584	1.5000e-004	0.0000	0.0617
Total	**12.7738**	**2.7000e-004**	**0.0300**	**0.0000**		**1.1000e-004**	**1.1000e-004**		**1.1000e-004**	**1.1000e-004**	**0.0000**	**0.0584**	**0.0584**	**1.5000e-004**	**0.0000**	**0.0617**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Office Building	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			

Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Office Building	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

APPENDIX C
RAMBOLL ENVIRON MOBILE EMISSIONS CALCULATIONS
(provided electronically)

APPENDIX D
CONSTRUCTION HEALTH RISK ASSESSMENT SCREENING TOOL

Prepared for
Ramboll Environ US Corporation
San Francisco, California

Project Number
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APPENDIX D
STANFORD 2018 GENERAL USE PERMIT: CONSTRUCTION HRA SCREENING TOOL
STANFORD UNIVERSITY
STANFORD, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Air Dispersion Model
AQ	Air Quality
ASFs	Age Sensitivity Factors
BAAQMD	Bay Area Air Quality Management District
CalEEMod®	California Emissions Estimator Model
CEQA	California Environmental Quality Act
DPM	Diesel Particulate Matter
EVGR	Escondido Village Graduate Residences
GHG	Greenhouse Gas
GUP	General Use Permit
HRA	Health Risk Assessment
IFinh	intake factor for inhalation
OEHHA	Office of Environmental Health Hazard Assessment
$PM_{2.5}$	Particulate Matter, 2.5 micrometers or less
REL	Reference Exposure Level
SCAQMD	South Coast Air Quality Management District
SRDT	Solar Radiation/Delta-T
TOG	Total Organic Gas
USEPA	United States Environmental Protection Agency
$\mu g/m^3$	Micrograms Per Cubic Meter

1. INTRODUCTION

This section describes the methodology used to develop the construction HRA screening tool developed for use with future construction projects on the Stanford University land covered by the General Use Permit (GUP). Ramboll Environ has developed a set of criteria that future construction projects must meet in order to “screen out” of conducting a full Health Risk Assessment (HRA), meaning the project would be below health risk thresholds if all criteria are met. Criteria were developed using conservative assumptions of emissions and exposure parameters for theoretical project sites. By assuring the same standards of construction as our model, smaller future projects can be screened out of a full health risk assessment because they will comply with Bay Area Air Quality Management District (BAAQMD) risk thresholds. Without knowing the shape and size of future projects, Ramboll Environ modelled various generic, theoretical construction sites. Two approaches were taken: (1) one model mimicking a very large construction project to set an upper bound on a large project size and (2) three much smaller, scaled down versions of the large model to allow very small projects to be constructed nearer to sensitive receptors than a larger project. The four theoretical construction site models represented 3,270,000; 540,000; 180,000; and 45,000 square feet of building construction. The methods and assumptions used for completing the air dispersion modeling and health risk assessment for these generic, theoretical construction sites informing the construction HRA screening criteria are described in the following sections.

2. REGULATORY BACKGROUND

The BAAQMD California Environmental Quality Act (CEQA) Guidelines ("Guidelines") provide recommended procedures for evaluating potential air quality (AQ) and greenhouse gas (GHG) impacts, which include, among other requirements:

1. Evaluation of cancer risk/non-cancer impacts and Particulate Matter, 2.5 micrometers or less ($PM_{2.5}$) concentrations for construction emissions on sensitive populations.

Ramboll Environ compared the results of health risk analyses to the BAAQMD 2011 CEQA significance threshold for excess lifetime cancer risk. The BAAQMD 2011 CEQA single source thresholds are:

- An excess lifetime cancer risk level of more than 10 in one million;
- A noncancer chronic HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$).

In this analysis, given that source of emissions is diesel construction equipment engines, if cancer risk from diesel particulate matter (DPM) and diesel total organic gas (TOG) is below the threshold, then noncancer acute and chronic HI and $PM_{2.5}$ incremental increase will also be below the threshold[1]. For this reason, we only evaluated excess lifetime cancer risk.

[1] Ramboll Environ conducted a conservative quantitative analysis of $PM_{2.5}$ concentrations for the largest project size confirming that $PM_{2.5}$ concentrations are below thresholds in all locations, including locations close to the theoretical project where cancer risk was above thresholds.

3. DISPERSION MODELING METHODOLOGY

This section describes the estimation of DPM and diesel TOG air concentrations at the locations of sensitive receptors surrounding the generic theoretical construction sites. Ramboll Environ performed refined air dispersion modeling using the United States Environmental Protection Agency's (USEPA's) American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD) (version 15181), with local meteorological data to determine DPM and diesel TOG concentrations for potentially exposed individuals. These concentrations are used to assess the potential human health risk as described in the risk assessment methodology section below.

3.1 Meteorological Data

Ramboll Environ used meteorological data collected on-site at Stanford and processed by the BAAQMD. The most recent one-year period available in model ready format was used (March, 2009 through February, 2010).[2] The meteorological dataset utilizing the solar radiation/delta-T (SRDT) method to estimate the stable boundary layer was used as it incorporates local temperature data in lieu of offsite cloud cover data and ceiling observations. When processing the meteorological data for use in AERMOD, the BAAQMD used the most recent version of AERMET (v15181).

3.2 Terrain

Ramboll Environ assumed flat terrain surrounding the sites since the topography depends on the specific location of the project, which is unknown. In test runs, the addition of terrain reduced the maximum dispersion factor so the no-elevation assumption is considered a conservative one, and will lead to an overestimate of risks from the theoretical project.

3.3 Generic Theoretical Project Shapes

Large Project Methodology

Without knowing the specific shape and location of future construction projects, Ramboll Environ modeled emissions dispersion for five generic project shapes, all with identical project area, referred to as Shapes 1-5. Two of the five project shapes were modeled with a "notch" missing in order to mimic a project wrapping around an existing building. Projects that wrap around existing buildings have the potential for high health impacts within the notch (depending on the wind speed and direction in relation to the notch).

The dispersion factors were compared across all shapes to determine which orientation and shapes result in the highest impacts near the shape boundaries. The two most conservative project shapes with regards to emissions dispersion (Shapes 2 and 4) were then further refined in the model. Shapes 2 and 4 were scaled up in size to match the approximate area (18.3 acres) of one of the largest construction projects to recently occur at Stanford, the Escondido Village Graduate Residences (EVGR). The large project model therefore reflects a density of about 180,000 square feet of development per acre of construction site.

Smaller Projects Methodology

[2] The 2015 OEHHA Guidelines (OEHHA, 2015) cite USEPA Guidance which allows the use of one year of on-site meteorological data, versus five years of off-site meteorological data.

In addition to modeling generic large project shapes, Ramboll Environ modeled three squares with areas of 3, 1, and 0.25 acres to represent smaller-sized projects of 540,000; 180,000; and 45,000 square feet of building construction. Similar to the large project, these small project models maintain the conservative density assumption of 180,000 square feet of development per acre of construction site.

3.4 Emission Rates

Large Project Methodology

Total off-road and on-road emissions from construction equipment were estimated using methodologies consistent with CalEEMod® 2013.2.2 (California Emissions Estimator Model). The equipment usage was based on a real construction equipment fleet estimated for the EVGR project. CalEEMod® 2013.2.2 was developed by Ramboll Environ in collaboration with the South Coast Air Quality Management District (SCAQMD) for use in developing emission inventories suitable for CEQA analysis. The model is publically available and employs widely accepted calculation methodologies for emission estimates combined with appropriate default data if site-specific information is not available. As a standard condition of approval, Stanford would be required to use Final Tier 4 standard construction equipment (except for chainsaws and paving phase equipment) so emissions were estimated using those Tier-specific assumptions (or fleet-average engines for chainsaws and paving phase equipment). Off-road equipment is listed in **Table D-1** and on-road equipment is listed in **Table D-2**. Equipment and construction phasing are based on a real Stanford proposed construction project, as noted above. DPM emissions for off-road and on-road equipment are listed in **Tables D-3a and D-4a**, respectively, and Diesel TOG emissions for off-road and on-road equipment are listed in **Tables D-3b and D-4b**, respectively. Since it would be speculative to assume the breakdown of off-site hauling traffic on various haul routes with different campus entrances for future construction projects, 0.5 miles of each off-site haul trip was conservatively added to on-site emissions. While sensitive receptors may be located near hauling routes, they would not be impacted more than sensitive receptors located near both construction haul routes near the site and off-road construction activity (onsite emissions).

Generic models (using Shapes 2 and 4) conservatively assume a project length of two years instead of the nearly three-year length that is typical for a project of the same size. This approach will result in higher estimated risks, because the sensitive receptors for the shorter period would be assumed to have higher breathing rates because the project falls completely within the age category with the highest breathing rates used in a health risk assessment (see Section 4.1 below). The amount of material exported and square footage of land use were set as upper limits in the screening criteria to restrict emissions from exceeding quantities emitted in our model with unusually high levels of excavation or a project where very tall buildings are constructed.

Smaller Projects Methodology

The smaller models estimated emissions by scaling down the large project emissions by size. Equipment was scaled in terms of number of equipment hours, not by number of whole equipment units. For example, since the large project represented 3,270,000 square feet of building construction, total emissions (i.e. equipment hours) for the 180,000 square foot project were scaled down by 180,000/3,270,000. Alternatively, total emissions for the 540,000 square foot project were scaled down by 540,000/3,270,000. As described above,

emissions were still conservatively estimated to occur within a two year duration. Limits on material exported were also scaled down by size to be included in the screening criteria.

3.5 Dispersion Model Setup

DPM and diesel TOG annual average air concentrations were estimated using the annual average dispersion factors calculated from the model and multiplying them by the respective annual average emissions from the construction equipment (off-road and on-road). Model source parameters are listed in **Table D-5**. The simulated dispersion of the construction operations were given a unit emissions rate (1 gram per second [g/s]) to calculate dispersion factors for each source-receptor combination.

The following equation was used to estimate the annual concentrations:

$$\text{Average Concentration} = \left(Q_{annual} \times \left(\frac{\chi}{Q} \right)_{annual} \right)_i$$

Where:

Q	=	emission rate of DPM or diesel TOG (g/s)
$\left(\frac{\chi}{Q} \right)$	=	dispersion factor (µg/m^3)/(g/s)
i	=	construction volume source

The modeled air concentrations were then used to evaluate risks as described in the following risk assessment methodology section.

4. RISK ASSESSMENT METHODOLOGY

4.1 Exposure Assumptions

The exposure parameters used in this HRA were developed for each sensitive receptor type based on parameters recommended by BAAQMD (BAAQMD, 2016) and the new Office of Environmental Health Hazard Assessment (OEHHA) Guidance, released in March, 2015 ("2015 OEHHA Guidance") (OEHHA, 2015).

The following types of sensitive populations were evaluated in this assessment (for both large and small project sizes): child residents, adult residents, and children in childcare. The population-specific exposure parameters used in this analysis are presented in **Table D-6**. All populations were assumed to be possible at all locations.

California Environmental Protection Agency (Cal/EPA) and the 2015 OEHHA Guidance recommend applying an adjustment factor to the annual average concentration modeled assuming continuous emissions (i.e., 24 hours per day, 7 days per week, and 365 days per year), when the actual emissions are less than 24 hours per day and exposures are concurrent with emissions activities occurring at the project site. (Cal/EPA, 2003, OEHHA, 2015) Residents (including both adult and child residents) living on campus are assumed to be present 24 hours per day, 7 days per week. This assumption is consistent with the modeled annual average air concentration, thus the annual average concentration need not be adjusted.

Childcare locations are assumed to be present during construction activities which occur 9 hours per day, during weekdays only. As this assumption is not consistent with the modeled annual average air concentration (24 hours per day, 365 days per year), a modeling adjustment factor[3] (MAF) of 3.7 (equal to [24 hours/9 hours] x [7 days/5 days]) was applied to the annual average concentration to align with the source operating schedule.

HRAs conducted using 2015 OEHHA Guidance utilize a number of standard "default" exposure assumptions when calculating cancer risk and non-cancer hazard. These exposure assumptions are conservative, in that they lead to calculated potential health effects that likely overestimate the impacts of a project's emissions. This has been acknowledged by OEHHA when they noted that the use of conservative assumptions in risk assessment is intended to produce a hypothetical estimate of risk that does not underestimate risks and that can be viewed as an upper-bound estimate. Examples of these conservative exposure assumptions include the following:

- Residential occupancy: Residents (including both adult and child residents) living on campus are assumed to be present 24 hours per day, 7 days per week instead of the average time spent at home of 85% for ages less than 2 years, 72% for ages 2 to <16 years, and 73% for ages 16 and above.
- Child receptor: For locations where a child may live, exposure is assumed to begin at age 0 (newborn) as this is the most conservative scenario for a 2-year construction project. Children are assumed to be ten times more susceptible to carcinogens than adults from age 0 to age 2 and three times more susceptible from age 2 to 16. Therefore, should

[3] Referred to as "worker adjustment factor (WAF)" in the 2015 OEHHA Guidance.

adults be present at these locations or should children begin exposure at a later age, potential risks would be lower than those presented in this assessment.

- Outdoor exposure: Modeling and health risk calculations are performed assuming that all potential receptors are breathing outdoor air for the entire exposure period. In many cases, receptors will be located indoors where there could be reductions in potential pollutant levels.

4.2 Toxicity Assumptions

The cancer toxicity data for DPM, chronic reference exposure level (REL) for DPM, and acute RELs for diesel TOG components are summarized in **Table D-7**.

The estimated excess lifetime cancer risks for each evaluated sensitive receptor type were adjusted by Age Sensitivity Factors (ASFs), when appropriate, as recommended by BAAQMD (BAAQMD, 2016) and as discussed in the 2015 OEHHA Guidance. This approach accounts for an "anticipated special sensitivity to carcinogens" of infants and children. The applicable ASFs used in this analysis are summarized in **Table D-6**, and are incorporated within the intake factor for inhalation ("IFinh") discussed in Section 4.3.1 below.

4.3 Risk Characterization

4.3.1 Estimation of Cancer Risks

Carcinogenic risks are estimated as the incremental probability that an individual will develop cancer over a lifetime as a result of exposure to potential carcinogens.

The following equation was used to calculate excess lifetime cancer risk:

$$\text{Cancer Risk}_i = C_i \times CF \times IFinh \times CPF_i$$

Where:

$Risk_i$	=	Lifetime Excess Cancer Risk from exposure to $chemical_i$
C_i	=	Annual Average Air Concentration for $chemical_i$ ($\mu g/m^3$)
CF	=	Conversion Factor (mg/1000 µg)
IFinh	=	Intake Factor for Inhalation (m^3/kg-day)
CPF_i	=	Cancer Potency Factor for $chemical_i$ ($[mg/kg\text{-}day]^{-1}$)

The estimated risk is expressed as a unitless probability.

4.3.2 Risk Assessment Results

The results of this HRA for sensitive populations potentially exposed to DPM and diesel TOG emissions from construction equipment were compared to the BAAQMD's thresholds of 10-in-one-million for cancer risk (BAAQMD, 2011).

The maximum cancer risk was evaluated as a function of distance for the two most conservative generic large project shapes, the three smaller project shapes, and for all receptor types for all four project sizes. This allows for a screening distance for specific receptor types for future construction projects. **Table D-8** shows the maximum cancer risk as a function of distance using the large project methodology outlined in previous sections of this appendix. **Tables D-9 through D-11** show the maximum cancer risk as a function of distance for the medium, small, and very small square models, respectively, for various receptor types. Results presented in **Tables D-8 through D-11** were used to determine the

following criteria for the construction screening tool for future large and small construction projects.

5. SCREENING CRITERIA

Generalized HRA models were used to develop four lists of criteria, for large- and small-sized projects, that would allow Stanford to screen out of future construction HRA analyses since the project would not exceed BAAQMD thresholds if all of the following criteria are met within the appropriate project size category:

For Large-Sized Projects:

1. The project must be less than 3,270,000 square feet of building and/or parking structure area
2. The project must have less than 900,000 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment[4]
4. The nearest receptors must meet the following criteria:
    a. The nearest childcare facility is farther than 140 meters from the project boundary
    b. The nearest residence housing children is farther than 50 meters from the project boundary
    c. The nearest adult resident is farther than 10 meters from the project boundary[5]

For Medium-Sized Projects:

1. The project must be less than 540,000 square feet of building and/or parking structure area
2. The project must have less than 150,000 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment
4. The nearest receptors must meet the following criteria:
    a. The nearest childcare facility is farther than 50 meters from the project boundary
    b. The nearest resident is farther than 10 meters from the project boundary

For Small-Sized Projects:

1. The project must be less than 180,000 square feet of building and/or parking structure area
2. The project must have less than 50,000 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment
    a. The nearest childcare facility is farther than 30 meters from the project boundary
    b. The nearest resident is farther than 10 meters from the project boundary

[4] Ramboll Environ understands that not all construction equipment are available with Tier 4 Final engines. In this model, using default-tier chainsaws and paving phase equipment (and Tier 4 Final for everything else) yielded 94% of total equipment horsepower hours (hp-hrs) with Tier 4 engines. Therefore, the project must have greater than 94% of total equipment hp-hrs with Tier 4 engines to meet this condition. This applies to large, medium, small, and very small sized projects.

[5] This criteria applies to all project size categories. Due to the 10 meter by 10 meter resolution of the model, all models assume that construction projects will allow a 10 meter buffer from the project fence line where no person resides.

For Very Small-Sized Projects:

1. The project must be less than 45,000 square feet of building and/or parking structure area
2. The project must have less than 12,500 cubic yards of debris/soil exported
3. The project must commit to using all available Tier 4 Final construction equipment
4. The nearest receptors must meet the following criteria:
   a. The nearest resident or childcare is farther than 10 meters from the project boundary[6,7]

[6] No receptor was found to exceed the 10 in a million cancer risk but the model assumes a 10-meter buffer separating the project fence line and the nearest receptor.

[7] If Stanford wishes to construct within the 10 meter buffer under this set of criteria and still screen out of a health risk analysis, construction activities using diesel equipment cannot occur when children are present (meaning work must occur during off-hours and/or weekends).

REFERENCES

Bay Area Air Quality Management District (BAAQMD). 2016. BAAQMD Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines. January.

BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. May.

Cal/EPA. 2003. Air Toxics Hot Spots Program Risk Assessment Guidelines. August.

OEHHA. 2015. Guidance Manual for Preparation of Health Risk Assessments. February. South Coast Air Quality Management District (SCAQMD). 2008. Final Localized Significance Threshold Methodology. July.

Table D-1
Construction, Off-road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Construction Year	Construction Start	Construction End	Equipment	Quantity	Tier	Usage Hours per Day	Horsepower	Load Factor	Construction Days per Year
Demolition	2016	10/1/2016	12/1/2016	Concrete/Industrial Saws	1	Fleet average	8	81	0.73	44
				Excavators	3	Tier 4	8	162	0.38	44
Site Preparation	2016	12/1/2016	12/31/2016	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.37	22
	2016	1/1/2017	3/31/2017	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.37	65
Grading	2016	12/1/2016	12/31/2016	Excavators	2	Tier 4	8	162	0.38	22
	2017	1/1/2017	7/1/2017	Excavators	2	Tier 4	8	162	0.38	130
Building Constructio	2017	4/1/2017	12/31/2017	Cranes	3	Tier 4	7	226	0.29	195
				Forklifts	4	Tier 4	8	89	0.20	195
				Welders	4	Tier 4	8	46	0.45	195
	2018	1/1/2018	12/31/2018	Cranes	3	Tier 4	7	226	0.29	65
				Forklifts	4	Tier 4	8	89	0.20	261
				Tractors/Loaders/Backhoes	2	Tier 4	8	97	0.37	261
	2019	1/1/2019	6/1/2019	Forklifts	4	Tier 4	8	89	0.20	109
				Tractors/Loaders/Backhoes	1	Tier 4	8	97	0.37	109
Architectural Coating	2018	6/1/2018	12/1/2018	*no equipment*						
Paving	2019	6/1/2019	9/30/2019	Pavers	1	Fleet average	8	125	0.42	86
				Paving Equipment	1	Fleet average	8	130	0.36	86
				Rollers	2	Fleet average	8	80	0.38	86

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Table D-2
Construction, On-road Vehicles
Stanford Construction HRA Screening
Stanford, CA

Phase	Trip Type	Number of Round Trips per Day	Number of Vehicles	Total Construction Days
Demolition	Hauling	16	10	44
Site Preparation	Hauling	400	20	87
Grading	Hauling	400	50	152
Building Construction	Vendor	143	143	565
	Hauling	40	20	
Architectural Coating	Hauling	5	5	131
Paving	Hauling	50	20	86

Vendor trips use CalEEMod default activity assumptions.

Note: Worker trips are not considered in this analysis due to their minimal contribution to DPM emissions and since workers may park off-site.

Table D-3a
Diesel PM Emissions from Off-road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Construction Year[1]	Construction Start[1]	Construction End[1]	Equipment[1]	Quantity[1]	Tier[1]	Usage Hours per Day[2]	Horsepower[2]	PM_{10} Emission Factor (g/bhp-hr)[2]	Load Factor[2]	Construction Days per Period	PM_{10} Emissions (lbs/day)	PM_{10} Emissions (tons/year)
Demolition	2016	10/1/2016	12/1/2016	Concrete/Industrial Saws	1	Fleet Average	8	81	0.33	0.73	44	0.35	7.64E-03
				Excavators	3	Tier 4	8	162	0.01	0.38	44	0.03	5.73E-04
Site Preparation	2016	12/1/2016	12/31/2016	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.01	0.37	22	0.02	2.23E-04
	2017	1/1/2017	3/31/2017	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.01	0.37	65	0.02	6.58E-04
Grading	2016	12/1/2016	12/31/2016	Excavators	2	Tier 4	8	162	0.01	0.38	22	0.02	1.91E-04
	2017	1/1/2017	7/1/2017	Excavators	2	Tier 4	8	162	0.01	0.38	130	0.02	1.13E-03
Building Construction	2017	4/1/2017	12/31/2017	Cranes	3	Tier 4	7	226	0.01	0.29	195	0.02	2.37E-03
				Forklifts	4	Tier 4	8	89	0.01	0.20	195	0.01	9.79E-04
				Welders	4	Tier 4	8	46	0.01	0.45	195	0.01	1.14E-03
	2018	1/1/2018	12/31/2018	Cranes	3	Tier 4	7	226	0.01	0.29	65	0.02	7.89E-04
				Forklifts	4	Tier 4	8	89	0.01	0.20	261	0.01	1.31E-03
				Tractors/Loaders/Backhoes	2	Tier 4	8	97	0.01	0.37	261	0.01	1.32E-03
	2019	1/1/2019	6/1/2019	Forklifts	4	Tier 4	8	89	0.01	0.20	109	0.01	5.48E-04
				Tractors/Loaders/Backhoes	1	Tier 4	8	97	0.01	0.37	109	0.01	2.76E-04
Paving	2019	6/1/2019	9/30/2019	Pavers	1	Fleet Average	8	125	0.16	0.42	86	0.15	6.33E-03
				Paving Equipment	1	Fleet Average	8	130	0.13	0.36	86	0.11	4.74E-03
				Rollers	2	Fleet Average	8	80	0.27	0.38	86	0.29	1.27E-02
												Total	**0.04**

Notes:

1. The construction schedule, equipment, and Tier level were provided by Stanford.
2. Usage hours per day, horsepower, load factor, and emission factors are based on CalEEMod® 2013.2.2 defaults.

Abbreviations:

bhp-hr - brake-horsepower-hour
CalEEMod - California Emissions Estimator Model
g - gram
lbs - pounds
PM_{10} - Particulate Matter 10 microns or less

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Table D-3b
Diesel TOG Emissions from Off-road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Construction Year[1]	Construction Start[1]	Construction End[1]	Equipment[1]	Quantity[1]	Tier[1]	Usage Hours per Day[2]	Horsepower[2]	TOG Emission Factor (g/bhp-hr)[2]	Load Factor[2]	Construction Days per Period	TOG Emissions (lbs/day)	TOG Emissions (tons/year)
Demolition	2016	10/1/2016	12/1/2016	Concrete/Industrial Saws	1	Fleet Average	8	81	6.24	0.73	44	6.50	1.43E-01
				Excavators	3	Tier 4	8	162	0.06	0.38	44	0.20	4.30E-03
Site Preparation	2016	12/1/2016	12/31/2016	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.06	0.37	22	0.15	1.67E-03
	2017	1/1/2017	3/31/2017	Tractors/Loaders/Backhoes	4	Tier 4	8	97	0.06	0.37	65	0.15	4.94E-03
Grading	2016	12/1/2016	12/31/2016	Excavators	2	Tier 4	8	162	0.06	0.38	22	0.13	1.43E-03
	2017	1/1/2017	7/1/2017	Excavators	2	Tier 4	8	162	0.06	0.38	130	0.13	8.47E-03
Building Construction	2017	4/1/2017	12/31/2017	Cranes	3	Tier 4	7	226	0.06	0.29	195	0.18	1.78E-02
				Forklifts	4	Tier 4	8	89	0.06	0.20	195	0.08	7.35E-03
				Welders	4	Tier 4	8	46	0.12	0.45	195	0.18	1.71E-02
	2018	1/1/2018	12/31/2018	Cranes	3	Tier 4	7	226	0.06	0.29	65	0.18	5.92E-03
				Forklifts	4	Tier 4	8	89	0.06	0.20	261	0.08	9.83E-03
				Tractors/Loaders/Backhoes	2	Tier 4	8	97	0.06	0.37	261	0.08	9.91E-03
	2019	1/1/2019	6/1/2019	Forklifts	4	Tier 4	8	89	0.06	0.20	109	0.08	4.11E-03
				Tractors/Loaders/Backhoes	1	Tier 4	8	97	0.06	0.37	109	0.04	2.07E-03
Paving	2019	6/1/2019	9/30/2019	Pavers	1	Fleet Average	8	125	0.36	0.42	86	0.33	1.42E-02
				Paving Equipment	1	Fleet Average	8	130	0.30	0.36	86	0.25	1.07E-02
				Rollers	2	Fleet Average	8	80	0.50	0.38	86	0.54	2.32E-02
												Total	**0.29**

Notes:

1. The construction schedule, equipment, and Tier level were provided by Stanford.
2. Usage hours per day, horsepower, load factor, and emission factors are based on CalEEMod® 2013.2.2 defaults.

Abbreviations:

bhp-hr - brake-horsepower-hour
g - gram
lbs - pounds
TOG - total organic gas

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Table D-4a
Diesel PM Emissions from On-Road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Year	Trip Type	Number of One-Way Trips per Day[1]	Number of Vehicles[2]	On-Site Trip Length (miles)[3]	Construction Days per Year	PM_{10} Emission Factors[4]		PM_{10} Emissions	PM_{10} Emissions
							(g/mile)	(g/vehicle/day)	(lbs/day)	(tons/year)
Demolition	2016	Hauling	32	10	0.5	44	6.86E-02	2.05E-01	6.95E-03	1.53E-04
Site Preparation	2016	Hauling	800	20	0.5	22	6.86E-02	2.05E-01	6.96E-02	7.65E-04
	2017	Hauling	800	20	0.5	65	4.14E-02	1.39E-01	4.26E-02	1.39E-03
Grading	2016	Hauling	800	50	0.5	22	6.86E-02	2.05E-01	8.32E-02	9.15E-04
	2017	Hauling	800	50	0.5	130	4.14E-02	1.39E-01	5.18E-02	3.37E-03
Building Construction	2017	Vendor	285	143	0.5	195	4.14E-02	1.39E-01	5.65E-02	5.51E-03
		Hauling	80	20	0.5	195	4.14E-02	1.39E-01	9.76E-03	9.52E-04
	2018	Vendor	285	143	0.5	261	2.71E-02	1.01E-01	4.01E-02	5.24E-03
		Hauling	80	20	0.5	261	2.71E-02	1.01E-01	6.83E-03	8.91E-04
	2019	Vendor	285	143	0.5	109	2.48E-02	8.95E-02	3.59E-02	1.96E-03
		Hauling	80	20	0.5	109	2.48E-02	8.95E-02	6.13E-03	3.34E-04
Architectural Coating	2018	Hauling	10	5	0.5	131	2.71E-02	1.01E-01	1.41E-03	9.22E-05
Paving	2019	Hauling	100	20	0.5	86	2.48E-02	8.95E-02	6.68E-03	2.87E-04
									Total	**0.022**

Notes:

1. The number of hauling trips was provided by Stanford. Vendor trips use CalEEMod® 2013.2.2 default activity assumptions. Worker trips are not considered in this analysis due to their minimal contribution to DPM emissions and since workers may park off-site.
2. The number of haul trucks were provided by Stanford. For vendor trips, each round trip was conservatively assumed to be a new vehicle.
3. The Project site is approximately 0.3 miles long. Therefore, a one-way trip length of 0.5 miles was conservatively assumed for evaluating on-site emissions. Additionally, 0.5 miles of each off-site haul trip was conservatively added to on-site impacts.
4. Emission factors were derived from EMFAC2014 for Santa Clara County and calendar years 2016 - 2019. Consistent with CalEEMod® 2013.2.2 options, vendor and hauling trucks are all conservatively assumed to be HHD diesel trucks.

Abbreviations:

g - gram

lbs - pounds

PM_{10} - Particulate Matter 10 microns or less

HHD - heavy-heavy duty

CalEEMod - California Emissions Estimator Model

Table D-4b
Diesel TOG Emissions from On-Road Equipment
Stanford Construction HRA Screening
Stanford, CA

Phase	Year	Trip Type	Number of One-Way Trips per Day[1]	Number of Vehicles[2]	On-Site Trip Length (miles)[3]	Construction Days per Year	TOG Emission Factors[4]		TOG Emissions	TOG Emissions
							(g/mile)	(g/vehicle/day)	(lb/day)	(ton/year)
Demolition	2016	Hauling	32	10	0.5	44	3.13E-01	3.06E+00	7.85E-02	1.73E-03
Site Preparation	2016	Hauling	800	20	0.5	22	3.13E-01	3.06E+00	4.11E-01	4.52E-03
	2017	Hauling	800	20	0.5	65	2.54E-01	2.72E+00	3.44E-01	1.12E-02
Grading	2016	Hauling	800	50	0.5	22	3.13E-01	3.06E+00	6.13E-01	6.74E-03
	2017	Hauling	800	50	0.5	130	2.54E-01	2.72E+00	5.24E-01	3.41E-02
Building Construction	2017	Vendor	285	143	0.5	195	2.54E-01	2.72E+00	9.34E-01	9.11E-02
		Hauling	80	20	0.5	195	2.54E-01	2.72E+00	1.42E-01	1.39E-02
	2018	Vendor	285	143	0.5	261	2.24E-01	2.49E+00	8.51E-01	1.11E-01
		Hauling	80	20	0.5	261	2.24E-01	2.49E+00	1.29E-01	1.69E-02
	2019	Vendor	285	143	0.5	109	2.18E-01	2.37E+00	8.12E-01	4.43E-02
		Hauling	80	20	0.5	109	2.18E-01	2.37E+00	1.24E-01	6.74E-03
Architectural Coating	2018	Hauling	10	5	0.5	131	2.24E-01	2.49E+00	2.99E-02	1.96E-03
Paving	2019	Hauling	100	20	0.5	86	2.18E-01	2.37E+00	1.28E-01	5.52E-03
									Total	**0.35**

Notes:

1. The number of hauling trips was provided by Stanford. Vendor trips use CalEEMod® 2013.2.2 default activity assumptions. Worker trips are not considered in this analysis due to their minimal contribution to DPM emissions and since workers may park off-site.
2. The number of haul trucks were provided by Stanford. For vendor trips, each round trip was conservatively assumed to be a new vehicle.
3. The Project site is approximately 0.3 miles long. Therefore, a one-way trip length of 0.5 miles was conservatively assumed for evaluating on-site emissions. Additionally, 0.5 miles of each off-site haul trip was conservatively added to on-site impacts.
4. Emission factors were derived from EMFAC2014 for Santa Clara County and calendar years 2016 - 2019. Consistent with CalEEMod® 2013.2.2 options, vendor and hauling trucks are all conservatively assumed to be HHD diesel trucks.

Abbreviations:

CalEEMod - California Emissions Estimator Model
g - gram
HHD - heavy-heavy duty
lbs - pounds
TOG - total organic gas

Table D-5
Model Source Parameters
Stanford Construction HRA Screening
Stanford, CA

Pathway	Description	Selection	Notes
Control	Averaging Time	Period average	
	Urban Population	78,212	Based on 2010 census (Stanford and Palo Alto)
	Model Version	AERMOD v15181	
Source	Spacing	10 m x 10 m	LST Guidance for sites >5 acres
	Release Height[1]	0 m	0 m for all construction phases
	Initial Vertical Dimension (IVD)	1.4 m	LST Guidance
	Initial Lateral Dimension (ILD)	4.65 m	Length of side (10 m) divided by 2.15, per AERMOD User's Guide.
	Variable Emission Factor	8 am - 5 pm construction	
Receptors	Receptor Height[1]	0 m	
	Grid	10 m spacing within 1 km of boundary	
Meteorology	Surface Data	Stanford onsite data processed by BAAQMD using AERMET 15181, 3/2009-2/2010	
	Upper Air	Oakland	
	Station Elevation	37.5 m	

Notes:

1. Guidance for Preparation of Health Risk Assessments (OEHHA, 2015) recommends using a receptor height from 0 meters to 1.8 meters. 0 meters was chosen for this analysis to account for the lower breathing zone of a potential child receptor. Additionally, while the release height of emission sources is often above grade, a release height of 0 was conservatively used here to account for sources that may be below grade (such as excavation activity). This combination of receptor and release height results in the shortest distance between the release point and the receptor, therefore representing a conservative analysis.

Abbreviations:

AERMOD - American Meteorological Society/Environmental Protection Agency Regulatory Model

BAAQMD - Bay Area Air Quality Management District

m - meter

South Coast Air Quality Management District

USEPA - United States Environmental Protection Agency

Sources:

SCAQMD. 2008. Final Localized Significance Threshold Methodology. July. ["LST Guidance"]

USEPA. 2004. User's Guide for the AMS/EPA Regulatory Model - AERMOD. September. ["AERMOD User's Guide"]

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

Table D-6
Exposure Parameters (2015 OEHHA Guidance)
Stanford Construction HRA Screening
Stanford, CA

Exposure Parameters	Receptor Type				Details
	Child Resident	Childcare		Adult Resident	
Starting Age	0	6 weeks	2	16	The 0-2 age group was used in this analysis because, for the 2-year-long project evaluated, the 0-2 age group has the highest, most conservative daily breathing rate. The earliest age at the childcare is assumed to be 6 weeks, based on review of nearby Stanford childcare websites.
Construction Length	2 yrs or less	2 yrs or less		2 yrs or less	
8-hr Breathing Rate (L/kg-8-hr)	N/A	1,200	640	N/A	8-hr breathing rate is from the 2015 OEHHA Guidance, Table 5.8. These values represent the 95th percentile breathing rates for moderate intensity activities for children age 0-2 and 2-9, respectively. BAAQMD recommends a default exposure using the 8-hour breathing rate for children age 2-16 for school exposures, but allows the "use of breathing rates for other age ranges that are tailored to the ages of the children in the specific school under evaluation."
1-hr Breathing Rate (L/kg-hr)	N/A	150	80	N/A	1-hr Breathing Rate = 8-hr Breathing Rate / 8 hrs
Exposure Time ET (hrs/day)	N/A	10	10	N/A	ET is conservatively estimated as 10 hours, because the childcares are open longer than a standard work day. The extrapolation to 10 hours per day is a conservative approach to account for childcare facilities where children may be present for 10 instead of 8 hours (typical school/workplace).
Daily Breathing Rate DBR (L/kg-day) [L/kg-10hr for childcare]	1,090	1,500	800	261	**Resident:** Daily Breathing Rate is the 95th percentile breathing rate for ages 0-2 from the 2015 OEHHA Guidance. **Childcare:** Daily Breathing Rate = 1 hr Breathing Rate x Exposure Time **Student Resident:** Daily Breathing Rate is the 80th percentile breathing rate for ages 16-30 from the 2015 OEHHA Guidance.
Exposure Frequency EF (day/year)	350	245	245	350	**Resident and Student Resident:** Assumes 350 days per year, consistent with the January 2016 BAAQMD guidance. **Childcare:** Assumes attendance 5 days per week, 49 weeks per year (245 days). In comparison, the January 2016 BAAQMD HRA guidelines recommend 250 days per year for workers (5 days per week, 50 weeks per year). This difference of 5 days on the inhalation factor is insignificant (2%).
Exposure Duration ED (year)	2.00	1.88	0.12	2.00	This analysis is based on a worst-case 2 year construction period. Since the starting age at childcare is 6 weeks, the time up until age 2 is in the 0-2 age bin, while the final 6 weeks of the 2 years exposure is in the age bin 2-9.
Conversion Factor CF (m^3/L)	0.001	0.001	0.001	0.001	
Averaging Time AT (days)	25,550	25,550	25,550	25,550	Averaging time is the assumed lifetime of the person over which this risk is distributed (70 years).
Fraction of Time at Home FAH (unitless)	1	N/A	N/A	1	FAH reflects default values from OEHHA 2015. Since residents may work at Stanford (e.g., within 1 km of the Project site), fraction of time spent at home was set to 1 for all receptor types.
Age Sensitivity Factor ASF (unitless)	10	10	3	1	ASF is 10 for ages 0-2, 3 for ages 2-16, and 1 for ages 16+, consistent with January 2016 BAAQMD guidance.
Model Adjustment Factor MAF (unitless)	1	3.7	3.7	1	MAF is used to reconcile the AERMOD modeled annual average dispersion factor with the actual construction hours to account for accurate exposure for people who are not present all day year-round. Construction will occur 5 days per week, 9 hours per day, so the MAF is 7/5 x 24/9 for the childcare.
Discount Factor DF (unitless)	1	0.9	0.9	1	DF adjusts the exposure to account for the period of construction emissions compared to the period of time the receptor is present so as not to count exposure for hours when construction does not occur. Construction occurs 9 hours per day, while the childcare child is assumed to be present 10 hours per day, therefore the DF for childcare = 9/10.
Inhalation Factor IF_inh	0.2986	0.9108	0.0089	0.0072	**Resident and Student Resident:** IF_inh = DBR x EF x ED x CF x FAH x ASF x MAF x DF / AT **Childcare:** IF_inh = DBR [L/kg-10hr] x ET [10hr/day] x EF x ED x CF x FAH x ASF x MAF x DF / AT Total IF_inh for childcare risk calculations is the sum of the IF_inh for the two age bins.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
HRA - health risk assessment
OEHHA - Office of Environmental Health Hazard Assessment
hr - hour
kg - kilogram
m^3 - cubic meter
L - liter

Sources:

BAAQMD. 2016. Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines. January. http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/workshops/2016/reg-2-5/hra-guidelines_clean_jan_2016-pdf.pdf?la=en

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February. https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf

Table D-7
Speciation and Cancer Potency Factor
Stanford Construction HRA Screening
Stanford, CA

Source	Chemical[1]		CAS Number	Speciation	Cancer Potency Factor (CPF)
				[unitless]	[mg/kg-day]$^{-1}$
Off-Road and On-Road Construction Emissions (Diesel equipment and vehicles)	Diesel PM	Diesel PM	9901	1	1.1

Notes:

1. DPM is used as a surrogate measure of carcinogen exposure for the mixture of chemicals that make up diesel exhaust as a whole, including diesel TOG.

Abbreviations:

Cal/EPA - California Environmental Protection Agency
CAS - Chemical Abstract Number
CPF - cancer potency factor
DPM - diesel particulate matter
kg - kilogram
mg - milligram
OEHHA - Office of Environmental Health Hazard Assessment
PM - particulate matter
TOG - total organic gas

Sources:

Cal/EPA. 2015. OEHHA/ARB Consolidated Table of Approved Risk Assessment Health Values. May.

Table D-8
Maximum Cancer Risk by Receptor Population and Large Project Model Type (3,270,000 sq ft) as a Function of Distance from Project Fenceline
Stanford Construction HRA Screening
Stanford, CA

	Childcare				Child Resident				Adult Resident			
Distance from Construction Project Boundary (m)	Square Polygon[1]	Notched Polygon[2]	EVGR - No Elevation[3]	EVGR - Original[4]	Square Polygon[1]	Notched Polygon[2]	EVGR - No Elevation[3]	EVGR - Original[4]	Square Polygon[1]	Notched Polygon[2]	EVGR - No Elevation[3]	EVGR - Original[4]
10	46.3	60.9	50.8	28.8	15.0	19.8	16.5	8.5	0.4	0.5	0.4	0.4
20	33.4	46.5	45.1	25.7	10.8	15.1	14.6	7.6	0.3	0.4	0.4	0.3
30	26.9	37.2	34.2	20.0	8.7	12.1	11.1	5.9	0.2	0.3	0.3	0.3
40	22.8	31.7	29.8	17.5	7.4	10.3	9.7	5.1	0.2	0.2	0.2	0.2
50	19.8	28.4	24.2	14.3	6.4	9.2	7.9	4.2	0.2	0.2	0.2	0.2
60	17.5	16.3	15.8	9.3	5.7	5.3	5.1	2.7	0.1	0.1	0.1	0.1
70	15.6	13.8	15.5	9.1	5.1	4.5	5.0	2.7	0.1	0.1	0.1	0.1
80	14.0	11.7	12.7	7.5	4.6	3.8	4.1	2.2	0.1	0.1	0.1	0.1
90	12.7	10.8	10.8	6.4	4.1	3.5	3.5	1.9	0.1	0.1	0.1	0.1
100	11.6	10.0	9.3	5.4	3.8	3.2	3.0	1.6	0.1	0.1	0.1	0.1
120	10.6	8.7	9.3	5.5	3.4	2.8	3.0	1.6	0.1	0.1	0.1	0.1
140	9.0	7.5	7.8	4.6	2.9	2.4	2.5	1.3	0.1	0.1	0.1	0.1
160	7.7	6.6	6.1	3.6	2.5	2.1	2.0	1.0	0.1	0.1	0.0	0.0
180	6.7	5.8	5.2	3.1	2.2	1.9	1.7	0.9	0.1	0.0	0.0	0.0
200	5.9	5.2	4.5	2.6	1.9	1.7	1.5	0.8	0.0	0.0	0.0	0.0
250	5.2	4.6	4.1	2.4	1.7	1.5	1.3	0.7	0.0	0.0	0.0	0.0
300	3.9	3.6	3.0	1.7	1.3	1.2	1.0	0.5	0.0	0.0	0.0	0.0

Notes:

1. This is a square polygon with the same project area and square footage (3,270,000 square feet) as the original EVGR project area. Total emissions from the entire EVGR project were compressed into a two-year time period when estimating the emission rates. Dispersion factors were modeled assuming zero elevation (since elevation and location of future projects are unknown).
2. This is a square polygon with a notch removed on the south side of the project. The notch is 1/9th the size of the square but the project area still matches the orginal EVGR project area. Total emissions from the entire EVGR project were compressed into a two-year time period when estimating the emission rates. Dispersion factors were modeled assuming zero elevation (since we don't know the location of projects to come).
3. This is the exact EVGR model but with zero elevation for dispersion modeling to match the other hypothetical project shapes (and since we don't know the location of future projects). Total emissions from the entire EVGR project were compressed into a two-year time period to match the conservative hypothetical project models listed above.
4. This is the exact same EVGR cancer risk (same project length and emission rates, dispersion factors with elevation, same inhalation factors) except that all receptors were assumed to be a specific receptor population (either childcare, resident, or student resident).
5. Inhalation factors for the Square Polygon, Notched Polygon, and EVGR – No Elevation scenarios are based on the 2015 OEHHA guidance for 2 years of exposure. The inhalation factors for the EVGR – Original use 3 years of exposure.

Abbreviations:

EVGR - Escondido Village Graduate Residences
HRA - health risk assessment
m - meter
OEHHA - Office of Environmental Health Hazard Assessment
sqft - square feet

Table D-9

Maximum Cancer Risk by Receptor Population for a 540,000 Square Foot Construction Project as a Function of Distance from Project Fenceline

Stanford Construction HRA Screening

Stanford, CA

	3-Acre Square Polygon[1]		
Distance from Construction Project Boundary (m)	Childcare	Child Resident	Adult Resident
10	27	8.6	0.21
20	19	6.2	0.15
30	14	4.5	0.11
40	11	3.5	0.084
50	8.8	2.9	0.069
60	7.4	2.4	0.057
70	6.3	2.0	0.049
80	5.6	1.8	0.044
90	5.1	1.7	0.040
100	4.3	1.4	0.033
120	3.6	1.2	0.028
140	2.9	0.95	0.023
160	2.5	0.83	0.020
180	2.0	0.64	0.015
200	1.7	0.54	0.013
250	1.5	0.49	0.012
300	1.1	0.34	0.0082

Notes:

1. This is a square polygon with an area of 3 acres that represents emissions from 540,000 square feet of construction. Total emissions from the entire EVGR project were compressed into a two-year time period and then scaled down by project size (approximately 3/18th of the total emissions) when estimating the emission rates. Dispersion factors were modeled assuming flat terrain.

Abbreviations:

EVGR - Escondido Village Graduate Residences
HRA - health risk assessment
m - meter

Table D-10

Maximum Cancer Risk by Receptor Population for a 180,000 Square Foot Construction Project as a Function of Distance from Project Fenceline

Stanford Construction HRA Screening

Stanford, CA

	1-Acre Square Polygon[1]		
Distance from Construction Project Boundary (m)	Childcare	Child Resident	Adult Resident
10	18	5.8	0.14
20	13	4.3	0.10
30	8.7	2.8	0.068
40	6.3	2.1	0.049
50	4.9	1.6	0.038
60	3.9	1.3	0.031
70	3.2	1.1	0.025
80	2.7	0.88	0.021
90	2.3	0.75	0.018
100	2.0	0.64	0.015
120	1.7	0.56	0.013
140	1.3	0.43	0.010
160	1.1	0.34	0.0082
180	0.86	0.28	0.0067
200	0.71	0.23	0.0055
250	0.60	0.19	0.0046
300	0.41	0.13	0.0032

Notes:

1. This is a square polygon with an area of 1 acre that represents emissions from 180,000 square feet of construction. Total emissions from the entire EVGR project were compressed into a two-year time period and then scaled down by project size (approximately 1/18th of the total emissions) when estimating the emission rates. Dispersion factors were modeled assuming flat terrain.

Abbreviations:

EVGR - Escondido Village Graduate Residences
HRA - health risk assessment
m - meter

Table D-11

Maximum Cancer Risk by Receptor Population for a 45,000 Square Foot Construction Project as a Function of Distance from Project Fenceline

Stanford Construction HRA Screening

Stanford, CA

	0.25-Acre Square Polygon[1]		
Distance from Construction Project Boundary (m)	Childcare	Child Resident	Adult Resident
10	9.2	3.0	0.072
20	6.9	2.2	0.053
30	3.3	1.1	0.026
40	2.2	0.72	0.017
50	1.6	0.53	0.013
60	1.3	0.42	0.010
70	1.1	0.34	0.0082
80	0.88	0.28	0.0068
90	0.73	0.24	0.0057
100	0.62	0.20	0.0048
120	0.53	0.17	0.0042
140	0.41	0.13	0.0032
160	0.30	0.10	0.0023
180	0.24	0.079	0.0019
200	0.20	0.065	0.0016
250	0.17	0.054	0.0013
300	0.11	0.037	8.8E-04

Notes:

1. This is a square polygon with an area of 0.25 acre that represents emissions from 45,000 square feet of construction. Total emissions from the entire EVGR project were compressed into a two-year time period and then scaled down by project size (approximately 1/72th of the total emissions) when estimating the emission rates. Dispersion factors were modeled assuming flat terrain.

Abbreviations:

EVGR - Escondido Village Graduate Residences
HRA - health risk assessment
m - meter

APPENDIX E
LABORATORY HEALTH RISK ESTIMATION

LABORATORY RISK ESTIMATION

This section describes the methodology and results of the laboratory health risk estimation conducted by Ramboll Environ for use with future laboratory operations on the Stanford University land covered by the General Use Permit (GUP). Without knowing the exact chemicals that will be used in the future laboratory operations or the locations of the laboratories where each chemical would be used, Ramboll Environ conservatively estimated the impacts resulting from the release of all chemicals used in Stanford labs from one fume hood on campus located in the ChemBio building. Based on this conservative analysis, even if different chemicals are used in the future or quantities increase beyond those accounted for, associated cancer risk, and acute and chronic hazards would still be expected to be below what is estimated here. The methods and assumptions used for completing the analysis for this conservative case are described in the following sections.

The BAAQMD California Environmental Quality Act (CEQA) Guidelines ("Guidelines") provide recommended procedures for evaluating potential toxic air contaminant (TAC) impacts, which include, among other requirements:

1. Evaluation of cancer risk/non-cancer impacts and $PM_{2.5}$ concentrations for construction emissions on sensitive offsite populations.

Ramboll Environ compared the results of health risk analyses to the BAAQMD 2011 CEQA significance threshold for excess lifetime cancer risk. The BAAQMD 2011 CEQA single source thresholds are:

- Non-compliance with a qualified Community Risk Reduction Plan (CRRP)
- An excess lifetime cancer risk level of more than 10 in one million;
- A noncancer chronic HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$).

Laboratory chemical inventories did not include any sources emitting $PM_{2.5}$ so the incremental increase in the annual average $PM_{2.5}$ was not evaluated. In addition, there is no CRRP with jurisdiction over the Stanford campus, so compliance with a CRRP was not evaluated.

1. ESTIMATION OF AIR CONCENTRATIONS

This section describes the estimation of air concentrations of toxic air contaminants (TACs) at locations surrounding the ChemBio building on campus. The ChemBio building was selected as a representative laboratory for air dispersion modelling because of its typically high chemical usage. Ramboll Environ estimated concentrations using the United States Environmental Protection Agency's (USEPA's) American Meteorological Society/Environmental Protection Agency regulatory air dispersion model (AERMOD) (version 15181), with representative meteorological data. These concentrations are used to assess the potential human health impacts as described in the risk assessment methodology section below.

1.1 Meteorological Data

Ramboll Environ used meteorological data collected on-site at Stanford and processed by the BAAQMD. The most recent one-year period available in model ready format was used (March 2009 through February 2010). The meteorological dataset utilizing the solar radiation/delta-T (SRDT) method to estimate the stable boundary layer was used as it incorporates local temperature data in lieu of offsite cloud cover data and ceiling observations. When processing the meteorological data for use in AERMOD, the BAAQMD used the most recent version of AERMET (v15181).

1.2 Terrain

Ramboll Environ assumed flat terrain surrounding the sites since the topography depends on the specific location of the project, which is unknown. The removal of terrain features in the dispersion model increased the maximum dispersion factor so the no-elevation assumption is considered a conservative one.

1.3 Emission Rates

The methods used to estimate the total laboratory emissions from Stanford are discussed in Section 1.3.4 in the Air Quality Technical Appendix. The total TAC emissions for each chemical are multiplied the anticipated increase in academic building square footage during the length of the Project (approximately 22%), which is used as a proxy for estimating projected increase in chemical use. It was assumed that the incremental increase of the laboratory chemicals were all used in the ChemBio building and would therefore be emitted from the ChemBio fume hoods. This is a very conservative assumption, since in reality, these chemicals would be used over a many buildings and their emissions would therefore not be as concentrated in one area.

Emissions in pounds per year are shown in **Table E-1**. Emissions were then converted to grams per second emission rates assuming emissions are evenly distributed throughout the year; these are also shown in **Table E-1**.

Emissions were modeled using the unit emissions rate method, such that each source had a unit emission rate (i.e., 1 gram per second [g/s] for point sources), and the model estimated dispersion factors (with units of microgram per cubic meter [$\mu g/m^3$]/[g/s]).

1.4 Sources Evaluated

Without knowing the exact chemicals that will be used in the future laboratory operations or the locations of the laboratories where each chemical would be used, Ramboll Environ modeled one point source to represent fume hoods in the ChemBio building. Building specific information, such as dimensions of length and width, were provided by Stanford. A single stack was modelled in the center of a building with the same length and width dimensions as the ChemBio building. Information on source parameters used in the model can be found in **Table E-2.**

1.5 Dispersion Model Setup

TAC annual average air concentrations were estimated using the annual average dispersion factors calculated from the model and multiplying them by the respective annual average emissions from the laboratory chemical use. Model source parameters are listed in **Table E-2**.

The following equation was used to estimate the annual concentrations:

$$\text{Average Concentration} = \left(Q_{annual\ or\ \max\ 1\text{–}hr} \times \left(\frac{\chi}{Q} \right)_{annual\ or\ \max\ 1\text{–}hr} \right)_i$$

Where:

Q	=	emission rate of chemical (g/s)
$\left(\frac{\chi}{Q}\right)$	=	unit dispersion factor (µg/m^3)/(g/s)
i	=	point source

The modeled air concentrations were then used to evaluate risks as described in the following risk assessment methodology section.

2. RISK ASSESSMENT METHODOLOGY

2.1 Exposure Assumptions

The exposure parameters used in this HRA screening assume a residential receptor type based on parameters recommended by BAAQMD (BAAQMD, 2016) and the new OEHHA Guidance, released in March, 2015 ("2015 OEHHA Guidance") (OEHHA, 2015). While BAAQMD is not yet requiring the use of the 2015 OEHHA Guidance, this HRA relies on such Guidance as it includes refinements of the assumptions and methodologies relating to children.

The exposure parameters used in this analysis are presented in **Table E-3**.

HRAs conducted using 2015 OEHHA Guidance utilize a number of standard "default" exposure assumptions when calculating cancer risk and non-cancer hazard. These exposure assumptions are conservative, in that they lead to calculated potential health effects that likely overestimate the impacts of a project's emissions (laboratory emissions in this case). This has been acknowledged by OEHHA when they noted that the use of conservative assumptions in risk assessment is intended to produce a hypothetical estimate of risk that does not underestimate risks and that can be viewed as an upper-bound estimate of impacts. Examples of these conservative exposure assumptions include the following:

- Residential occupancy: Residents (including both adult and child residents) living on campus are assumed to be present 24 hours per day, 7 days per week instead of the average time spent at home of 85% for ages less than 2 years, 72% for ages 2 to <16 years, and 73% for ages 16 and above.
- Child receptor: For locations where a child may live, exposure is assumed to begin at the third trimester as this is the most conservative scenario. Children are assumed to be ten times more susceptible to carcinogens than adults from the third trimester in utero to age 2 and three times more susceptible from age 2 to 16. Therefore, should adults be present at these locations or should children begin exposure at a later age, potential risks would be even lower than those presented in this assessment.
- Outdoor exposure: Modeling and health risk calculations are performed assuming that all potential receptors are breathing outdoor air for the entire exposure period. In many cases, receptors will be located indoors where there could be reductions in potential pollutant levels.

2.1.1 Toxicity Assumptions

The cancer potency factors, chronic reference exposure levels (RELs) and acute RELs for TACs emitted in laboratories are summarized in **Table E-1.**

The estimated excess lifetime cancer risks for each evaluated sensitive receptor type were adjusted by Age Sensitivity Factors (ASFs), when appropriate, as recommended by BAAQMD (BAAQMD, 2016) and as discussed in the 2015 OEHHA Guidance. This approach accounts for an "anticipated special sensitivity to carcinogens" of infants and children. The applicable ASFs used in this analysis are summarized in **Table E-4**, and are incorporated within the intake factor for inhalation ("IFinh") discussed in Section 2.2.1 below.

2.2 Risk Characterization

2.2.1 Estimation of Cancer Risks

Carcinogenic risks are estimated as the incremental probability that an individual will develop cancer over a lifetime as a result of exposure to potential carcinogens.

The following equation was used to calculate excess lifetime cancer risk:

$$\text{Cancer Risk}_i = C_i \times CF \times IFinh \times CPF_i \times ASF$$

Where:

$Risk_i$	=	Lifetime Excess Cancer Risk from exposure to $chemical_i$
C_i	=	Annual Average Air Concentration for $chemical_i$ ($\mu g/m^3$)
CF	=	Conversion Factor (mg/µg)
IFinh	=	Intake Factor for Inhalation (m^3/kg-day)
CPF_i	=	Cancer Potency Factor for $chemical_i$ ($[mg/kg\text{-}day]^{-1}$)
ASF	=	Age Sensitivity Factor (unitless)

The estimated risk is expressed as a unitless probability.

2.2.2 Estimation of Chronic HI

When evaluating chronic non-cancer effects due to chemical exposures, a hazard quotient (HQ) is established for each constituent. The following equation was used to calculate an inhalation HQ:

$$\text{Chronic HQ}_i = C_i / REL_i$$

Where:

Chronic HQ_i	=	Chronic Hazard Quotient from exposure to $chemical_i$
C_i	=	Annual Average air concentration for $chemical_i$ ($\mu g/m^3$)
REL_i	=	Chronic non-cancer Reference Exposure Level for $chemical_i$ ($\mu g/m^3$)

To evaluate the potential for adverse non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals that affect the same target organ are summed yielding a HI. The HI is thus estimated as follows:

$$HI_{(eyes)} = \sum HQ_{substance1\ (eyes)} + HQ_{substance2\ (eyes)}$$

As a conservative assessment, all HQs were summed for comparison to the threshold, regardless of target organ.

Chronic RELs are developed so as to represent the level "at or below which no adverse health impacts are anticipated following long-term exposure. Long-term exposure for these purposes has been defined as 12% of a lifetime, or about eight years for humans." (OEHHA, 2015) The estimated HI is expressed as a unitless metric.

2.2.3 Estimation of Acute HI

The potential for acute effects was evaluated by comparing the one-hour maximum concentrations with the corresponding acute RELs. The following equation was used to calculate acute HQ:

$$\text{Acute } HQ_i = C_i / REL_i$$

Where:

Acute HQ_i	=	Acute Hazard Quotient from exposure to $chemical_i$
C_i	=	One-hour Maximum air concentration for $chemical_i$ ($\mu g/m^3$)
REL_i	=	Acute non-cancer Reference Exposure Level for $chemical_i$ ($\mu g/m^3$)

HQs were then summed to obtain a target organ-specific HI as follows:

$$HI_{(eyes)} = \sum HQ_{substance\,1\,(eyes)} + HQ_{substance2\ \ (eyes)}$$

As a conservative assessment, all HQs were summed for comparison to the threshold, regardless of target organ.

Acute RELs, are developed so as to represent "an exposure that is not likely to cause adverse health effects in a human population, including sensitive subgroups, exposed to that concentration … for the specified exposure duration on an intermittent basis" (OEHHA, 2015) The estimated HI is expressed as a unitless metric.

2.3 Risk Assessment Results

The results of this HRA for sensitive populations potentially exposed to TAC emissions from laboratory fume hoods were compared to the BAAQMD's thresholds of 10-in-one-million for cancer risk and 1 for chronic HI and acute HI (BAAQMD, 2011).

Incremental increase in cancer risk for a maximally exposed resident is 4.5 in one million (with a threshold of 10 in one million). Acute and chronic hazard indices (HIs) were increased by 0.03 and 0.01, respectively, below the BAAQMD significance threshold of 1. Project incremental increase in cancer risks and non-cancer chronic and acute HIs are all well below BAAQMD thresholds, even with conservative assumptions of all emissions occurring from one stack with sensitive resident receptors surrounding the source. Therefore, impacts are less than significant from laboratory TAC emissions.

REFERENCES

Bay Area Air Quality Management District (BAAQMD). 2016. BAAQMD Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines. January.

BAAQMD. 2011. California Environmental Quality Act Air Quality Guidelines. May.

OEHHA. 2015. Guidance Manual for Preparation of Health Risk Assessments. February. South Coast Air Quality Management District (SCAQMD). 2008. Final Localized Significance Threshold Methodology. July.

ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Air Dispersion Model
ASFs	Age Sensitivity Factors
BAAQMD	Bay Area Air Quality Management District
CARE	Community Air Risk Evaluation
CEQA	California Environmental Quality Act
g/s	Gram Per Second
GUP	General Use Permit
HHRA:	Human Health Risk Assessment
HI:	Hazard Indices
HQ	Hazard Quotient
IFinh	Intake Factor for Inhalation
OEHHA	Office of Environmental Health Hazard Assessment
REL	Reference Exposure Levels
$PM_{2.5}$	Particulate Matter, 2.5 Micrometers Or Less
SRDT	Solar Radiation/Delta-T
TAC	Potential Toxic Air Contaminant
USEPA	United States Environmental Protection Agency
$\mu g/m^3$	Micrograms Per Cubic Meter

Table E-1
Fall 2035 TAC Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Scaling for Fall 2035[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	TAC Emission Rate [g/s]	Cancer Potency Factor (CPF)[6] [mg/kg-day]$^{-1}$	Chronic Reference Exposure Level (REL)[6] [µg/m^3]	Acute Reference Exposure Level (REL)[6] [µg/m^3]
1,1,1-Trichloroethane	71-55-6	195	22%	5%	45	6.5E-04			
1,1,2-Trichloroethane	79-00-5	30	22%	5%	3.3	4.7E-05	0.057		
1,2-Dichloroethane	107-06-2	245	22%	5%			0.072		
1,3-Butadiene	106-99-0	101	22%	100%	234	0.0034	0.60	7.0E-05	1.2E-04
1,4-Dichlorobenzene	106-46-7	15	22%	1%	0.65	9.4E-06	0.040	4.9E-09	
1,4-Dioxane	123-91-1	166	22%	5%	65	9.3E-04	0.027	1.3E-07	7.5E-06
2,4,6-Trichlorophenol	88-06-2	2.9	22%	1%	0.098	1.4E-06	0.070		
2-Chlorophenol	95-57-8	6.0	22%	5%	0.78	1.1E-05			
2-Nitropropane	79-46-9	25	22%	5%	0.42	6.1E-06			
Acetaldehyde	75-07-0	35	22%	5%			0.010		
Acetone	67-64-1	5,583	22%	100%	128,476	1.8			
Acetonitrile	75-05-8	0,930	22%	5%	0,411	0.0059			
Acrylamide	79-06-1	42	22%	1%	3.7	5.4E-05	4.5		
Acrylonitrile	107-13-1	78	22%	5%			1.0		
Ammonia	7664-41-7	156	22%	100%	635	0.0091			
Arsenic and inorganic compounds	7440-38-2	35	22%	1%	0.87	1.2E-05	12	3.5E-04	0.0015
Benzene	71-43-2	1,307	22%	5%	538	0.0077	0.10	0.0011	0.0069
Beryllium	7440-41-7	0.15	22%	1%	0.0027	3.9E-08	8.4	2.3E-06	
Bromine and compounds	7726-95-6	12	22%	5%	4	5.7E-05			
Butane	106-97-8	21	22%	100%	123	0.0018			
Butyraldhyde	123-72-8	198	22%	5%	42	6.1E-04			
Cadmium and compounds	7440-43-9	105	22%	1%	4.01	5.8E-05	15	0.0012	
Carbon disulfide	75-15-0	41	22%	5%	13	1.9E-04			
Carbon tetrachloride	56-23-5	278	22%	5%	111	0.0016	0.15	1.7E-05	2.0E-05
Chlorine	7782-50-5	1	22%	100%	2	2.5E-05			
Chlorobenzene	108-90-7	0,314	22%	5%	78	0.0011			
Chloroform	67-66-3	1,795	22%	5%	0,853	0.012	0.019	1.7E-05	0.0020
Chloromethane	74-87-3	57	22%	100%	76	0.0011			
Cresol	1319-77-3	102	22%	1%					
Diethyl ether	60-29-7	4,857	22%	5%	2,189	0.031			
Dimethyl formamide	68-12-2	0,859	22%	5%	0,390	0.0056			
Dimethyl sulfate	77-78-1	104	22%	5%	30	4.3E-04			
Epichlorohydrin	106-89-8	343.0	22%	5%	40.03	5.8E-04	0.080	8.0E-05	1.1E-05
Ethanol	64-17-5	1,012	22%	5%	0,483	0.0069			
Ethyl acetate	141-78-6	5,291	22%	5%	2,391	0.034			
Ethyl benzene	100-41-4	29	22%	5%	4.7	6.8E-05	0.0087	1.4E-08	
Ethyl diazoacetate	623-73-4	6.4	22%	5%					
Ethylene dibromide	106-93-4	7.4	22%	5%	1.3	1.8E-05	0.25	9.5E-06	
Ethylene glycol	107-21-1	0,391	22%	5%	185	0.0027			
Ethylene glycol butyl ether	111-76-2	55	22%	5%					
Ethylene glycol ethyl ether	110-80-5	54	22%	5%	11	1.6E-04			
Ethylene glycol methyl ether	109-86-4	579	22%	5%	228	0.0033			
Ethylene oxide	75-21-8	2.9	22%	100%			0.31		
Formaldehyde	50-00-0	32	22%	5%	2	2.6E-05	0.021	1.2E-06	1.2E-05

RAMBOLL ENVIRON

Table E-1
Fall 2035 TAC Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Scaling for Fall 2035[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	TAC Emission Rate [g/s]	Cancer Potency Factor (CPF)[6] [mg/kg-day]$^{-1}$	Chronic Reference Exposure Level (REL)[6] [µg/m^3]	Acute Reference Exposure Level (REL)[6] [µg/m^3]
Glutaraldehyde	111-30-8	31	22%	5%	13	1.8E-04			
Hexachlorobenzene	118-74-1	1.3	22%	1%	0.017	2.5E-07	1.8		
Hexanal	66-25-1	2	22%	5%	0.3	4.0E-06			
Hexavalent chromium	18540-29-9	590	22%	1%	43	6.2E-04		0.0013	
Hydrazine	302-01-2	88	22%	5%	29.5	4.2E-04	17	8.8E-04	
Hydrogen chloride	7647-01-0	299	22%	5%	143	0.0021			
Hydrogen fluoride	7664-39-3	29	22%	100%	44	6.4E-04			
Hydrogen sulfide	7783-06-4	4.9	22%	100%	8.6	1.2E-04			
Isopentane	78-78-4	9	22%	5%	3	5.0E-05			
Isopropyl alcohol	67-63-0	1,938	22%	100%	23,791	0.34			
Lead and compounds	7439-92-1	165	22%	1%	5.7	8.2E-05	0.042		
Maleic anhydride	108-31-6	36	22%	1%	1.9	2.7E-05			
Manganese and compounds	7439-96-5	276	22%	1%	10.68	1.5E-04			
Mercury and inorganic compounds	7439-97-6	1135	22%	5%	373	0.0054			
Methanol	67-56-1	1,257	22%	5%	0,597	0.0086			
Methyl bromide	74-83-9	109	22%	100%	216	0.0031			
Methyl ethyl ketone	78-93-3	59	22%	5%	19	2.7E-04			
Methyl methacrylate	80-62-6	43	22%	5%	12.2	1.8E-04			
Methylene chloride	75-09-2	6,823	22%	20%	12,674	0.18	0.0035	1.9E-04	3.2E-04
Naphthalene	91-20-3	18	22%	1%	1	1.8E-05	0.12	8.5E-07	
n-Heptane	142-82-5	1,284	22%	5%	548	0.0079			
n-Hexane	110-54-3	2,195	22%	5%	1,013	0.015			
Nickel and compounds	7440-02-0	238	22%	1%	12.09	1.7E-04	0.91	0.0052	0.021
Nitric acid	7697-37-2	412	22%	5%	192	0.0028			
Nitrobenzene	98-95-3	222	22%	5%	46	6.6E-04			
n-Methylpyrollidone	872-50-4	0,454	22%	5%	185	0.0027			
Octane	111-65-9	6	22%	5%	2	2.9E-05			
Osmium tetroxide	20816-12-0	15.00	22%	1%	0.763	1.1E-05			
Pentachlorophenol	87-86-5	2.9	22%	1%	0.20	2.9E-06	0.018		
Pentane	109-66-0	0,924	22%	5%	0,377	0.0054			
Phenol	108-95-2	145	22%	5%	61	8.8E-04			
Phosgene	75-44-5	0.32	22%	100%					
Phosphoric acid	7664-38-2	221	22%	5%	105	0.0015			
Propylene oxide	75-56-9	59	22%	5%			0.013		
Pyridine	110-86-1	0,412	22%	5%	185	0.0027			
Sodium hydroxide	1310-73-2	0,566	22%	1%	54	7.7E-04			
Styrene	100-42-5	45	22%	5%	11	1.5E-04			
t-Butyl alcohol	75-65-0	111	22%	5%	46	6.6E-04			
tert-Butylbenzene	98-06-6	28	22%	5%	4.0	5.7E-05			
Tetrachloroethylene	127-18-4	29	22%	5%	6	8.2E-05	0.021	9.8E-07	1.0E-07
Tetrahydrofuran	109-99-9	1,856	22%	5%	0,807	0.012			
Toluene	108-88-3	1,012	22%	5%	0,479	0.0069		9.5E-06	4.5E-06
Trichloroethylene	79-01-6	119	22%	5%	36	5.2E-04	0.0070	3.6E-07	
Trichlorotrifluroethane	76-13-1	51	22%	5%	11.1	1.6E-04			

Table E-1
Fall 2035 TAC Emissions - Laboratories
Stanford University
Stanford, California

Chemical	CAS-number	Representative Lab Estimated Usage[1] [lbs/year]	Scaling for Fall 2035[2]	Emission Factor[3]	TAC Emissions[4,5] [lbs/year]	TAC Emission Rate [g/s]	Cancer Potency Factor (CPF)[6] [mg/kg-day]$^{-1}$	Chronic Reference Exposure Level (REL)[6] [µg/m^3]	Acute Reference Exposure Level (REL)[6] [µg/m^3]
Triethylamine	121-44-8	0,424	22%	5%	185	0.0027		5.5E-06	2.3E-05
Valeraldehyde	110-62-3	12	22%	5%	1.5	2.1E-05			
Vinyl chloride	75-01-4	132	22%	100%	232	0.0033	0.27		4.5E-07
Xylenes	1330-20-7	0,496	22%	5%	217	0.0031		1.9E-06	3.4E-06
Zinc and compounds	7440-66-6	625	22%	1%	50	7.2E-04			
Total for Fall 2035					**180,525**				

Notes:

1. Baseline usage is from Stanford's laboratory chemical inventories. Data is used when available from the 2001 ChemBio HHRA, then the Lokey Laboratory, then the Shriram Center, the Mudd (Seeley G) Chemistry, and the Environment and Energy buildings.

   Assumption: Estimated Usage = Inventory Quantity x 1.1 for archival chemicals (ethylene dibromide and hexachlorobenzene)

   Estimated Usage = Inventory Quantity x 1.1 x 12 for all other chemicals

2. Scaling for Fall 2035 is based on the increase in academic square footage expected from full buildout of the 2000 GUP to full buildout of the 2018 GUP, with the assumption that the increase in laboratory space is proportional to the increase in overall academic space.

3. Emission factors represent what percentage of the mass usage of the chemical is emissted into the air. When available, chemical emission factors from the *Stanford ChemBio Human Health Risk Assessment* (ENVIRON 2001) were used. When unavailable, Ramboll Environ made the following assumptions:

   Emission Factor for Gases = 100%
   Emission Factor for Liquids = 5%
   Emission Factor for Solids/Metals = 1%
   Emission Factor for Methylene Chloride = 20%

4. Emissions are calculated by the representative lab estimated usage normalized by fume hoods, multiplied by total fume hoods on campus with the chemical, then multiplied by the emission factor.

5. TACs include those regulated by BAAQMD Regulation 2-5, chemicals frequently used in laboratory operations, and chemicals evaluated in past studies and health risk assessments.

6. The cancer potency factors, chronic reference levels, and acute reference levels were obtained from the proposed BAAQMD Regulation 2-5 Table 2-5-1 (January 2016).

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CAS - Chemical Abstracts Service
CPF - Cancer Potency Factor
g - gram
GUP - General Use Permit
HHRA - Human Health Risk Assessment
kg - kilogram
m^3 - cubic meter
mg - miligram
REL - Reference Exposure Level
s - second
TAC - Toxic Air Contaminant
µg - microgram

Table E-2
Operational Modeling Parameters
Stanford University
Stanford, CA

Source[1]	Source Type	Number of Sources	Stack Height Above Grade	Stack Temperature	Stack Velocity	Stack Diameter
			[m]	[K]	[m/s]	[m]
Laboratory	Point	1	25.8	293	22.7	1.37

Notes:

1. All emissions were assumed to be emitted from one fume hood in the Stanford ChemBio building. Parameters from the Human Health Risk Assessment (HHRA) conducted by ENVIRON in 2001 for the Stanford ChemBio facilities were used for air dispersion modeling in AERMOD.

Abbreviations:

AERMOD - AERMIC (AMS/EPA Regulatory Model Improvement Committee) Model

HHRA - Human Health Risk Assessment

K - Kelvin

m - meter

m/s - meters per second

Table E-3
Exposure Parameters
Stanford University
Stanford, CA

Receptor Type	Period	Receptor Age Group	Exposure Parameters					
			Daily Breathing Rate (DBR)[1] [L/kg-day]	Exposure Duration (ED)[2] [years]	Fraction of Time at Home (FAH)[3] [unitless]	Exposure Frequency (EF)[4] [days/year]	Averaging Time (AT) [years]	Intake Factor, Inhalation (IF_{inh}) [m^3/kg-day]
Resident	Operation (Laboratories)	3rd Trimester	361	0.25	1	350	25550	0.0012
		Age 0-<2 Years	1090	2				0.030
		Age 2-<16 Years	745	14				0.14
		Age 16-30 Years	335	14				0.064

Notes:

1. Daily breathing rates reflect default breathing rates from OEHHA 2015, 95th percentile for all years.
2. The exposure duration for operation reflects the default residential exposure duration from OEHHA 2015.
3. Fraction of time spent at home is conservatively assumed to be 1 (i.e. 24 hours/day).
4. Exposure frequency reflects default exposure frequency from OEHHA 2015.

Calculation:

IF_{inh} = DBR * FAH * EF * ED * CF / AT

CF = 0.001 (m^3/L)

Abbreviations:

AT - average timing
DBR - daily breathing rate
ED - exposure duration
EF - exposure frequency
FAH - fraction of time at home
IF - intake factor
kg - kilogram
L - liter
m^3 - cubic meter
OEHHA - Office of Environmental Health Hazard Assessment

Reference:

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

Table E-4
Age Sensitivity Factors
Stanford University
Stanford, CA

Receptor Age Group	Age Sensitivity Factor (ASF)[1]
3rd Trimester	10
Age 0-<2 Years	10
Age 2-<16 Years	3
Age 16-30 Years	1

Notes:

1. Based on OEHHA 2015.

Abbreviations:

ASF - Age sensitivity factor

OEHHA - Office of Environmental Health Hazard Assessment

Reference:

OEHHA. 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. February.

APPENDIX CAP

Storm Drainage Detention Capacity Summary – Annual Report #16

STORM DRAINAGE DETENTION CAPACITY SUMMARY - ANNUAL REPORT #16

Projects that require storm water runoff mitigation (projects under construction by the end of each reporting period)

			Watershed		
Project	**Date Submitted**	**Date Approved**	**San Francisquito Final Plan**	**Matadero Final Plan**	**Notes**
9/1/00 - 8/31/01Annual Report #1					
Lomita Mall	2/23/01	5/10/01		(10,750)	
Serra/ECR Detention Basin	2/23/01	5/10/01		(9,037,829)	(10,293,083) SF for 100 yr. Basin, (9,037,829) SF for 10 yr. Basin - Revised 4/30/03 based on April 16, 2002 revision 2 to County
Sandstone Sculpture	2/23/01	5/10/01		2,400	
Student Services Bldg.	3/1/01	6/14/01		(11,400)	
Band Trailer	3/7/01	8/9/01		4,940	
EV Studio 5 and 6	3/9/01	6/14/01		17,424	
Encina Tennis Courts	6/18/01	8/9/01		(5,536)	
Net change 9/1/00 - 8/31/01			**0**	**(9,040,751)**	
Balance Available			**0**	**(9,040,751)**	
9/1/01 - 8/31/02 Annual Report #2					
Rugby Pavillion	10/26/01	12/13/01		10,635	
Replacement Child Care	2/6/02	3/14/02		768	
EV Parking Spaces	2/8/02	4/11/02		28,314	
Serra St. Reconfiguration	3/8/02	4/11/02		(1,307)	
Arrillaga Family Rec. Center	4/5/02			(27,405)	
Arguello Parking Lot	4/19/02	6/13/02		(1,742)	
Cowell Parking Lot Expansion	4/19/02	6/13/02		45,738	
Net change9/1/01 - 8/31/02			**0**	**55,001**	
Balance Available			**0**	**(8,985,750)**	
9/1/02 - 8/31/03 Annual Report #3					
Carnegie, Global Ecology Center Ph 1	8/2/02	10/10/02	9,180		
Maples Pavilion Addition	12/3/02	12/13/03		18,200	
EV Maintenance Yard	12/9/02			2,178	
Campus Dr/ Galvez Intersection	8/13/03	8/25/03		(1,640)	
ECH (communications hub)			2,547		
Campus Dr. Median	5/20/03	6/19/03		(4,350)	
Golf Course Reconfiguration & bridges	1/31/03	4/10/03	14,100		
Stock Farm/Sand Hill Detention Basin - Phase I	5/8/03	10/1/03	(405,108)		(405,108) SF for 100 yr. Basin (minimum area) - Revised 9/19/03 based on June 23, 2003 revision 2 to County
Net change9/1/02 - 8/31/03			**(379,281)**	**14,388**	
Balance Available			**(379,281)**	**(8,971,362)**	

STORM DRAINAGE DETENTION CAPACITY SUMMARY - ANNUAL REPORT #16

Projects that require storm water runoff mitigation (projects under construction by the end of each reporting period)

			Watershed		
Project	**Date Submitted**	**Date Approved**	**San Francisquito Final Plan**	**Matadero Final Plan**	**Notes**
9/1/03 - 8/31/04 Annual Report #4					
EPGY	9/11/2003	9/11/2003	8,815		
Serra Street Drainage Barrier (SPE)	7/20/2004	8/23/2004		(1,168)	
Varian	4/26/04			13,740	
Taube Tennis Practice bleachers	7/29/04			2,477	
Net change 9/1/03 - 8/31/04			**8,815**	**15,049**	
Balance Available			**(370,466)**	**(8,956,313)**	
9/1/04 - 8/31/05 Annual Report #5					
Barnum Family Center	1/21/05	7/14/05		(550)	
Casa Zapata RF Unit Replace	1/27/05	5/4/05		939	
Munger Graduate Housing	5/6/05			(6,000)	
Parking Structure 6				78,700	
Old Union Surge - Serra	7/5/05	8/11/05		(1,489)	
Net change 9/1/04 - 8/31/05			**0**	**71,600**	
Balance Available			**(370,466)**	**(8,884,713)**	
9/1/05 - 8/31/06 Annual Report #6					
Stadium renovation	5/25/05	9/23/2005		(61,420)	
BCSC Addition	5/17/2008	9/13/2007		(6,755)	
Campus Drive Realignment				4,377	
Munger Phase I Road Improvement				(1,300)	
Net change 9/1/05 - 8/31/06			**0**	**(65,098)**	
Balance Available			**(370,466)**	**(8,949,811)**	
9/1/06 - 8/31/07 Annual Report #7					
Hillel House				9,858	
Learning and Knowledge Center - Loading Dock	5/21/07			(4,356)	
Stanford Childcare Center	3/21/07	6/14/07		11,398	
Learning and Knowledge Center-Building	5/21/07		(10,454)		
SCRA	7/10/07			11,833	
Stanford Daily	7/26/07		525		
Track Bleacher Addition (Includes North Track Bleacher)	9/27/06	11/9/06		1,812	
Stanford Institute of Econ Policy Research (Includes Mem Aud Loading Ramp)	7/7/07			(8,278)	
Oak Road Parking Lot	8/27/07		64,469		
Environment and Energy	12/16/05	2/9/06	(21,229)		
Net change 9/1/06 - 8/31/07			**33,311**	**22,267**	
Balance Available			**(337,155)**	**(8,927,544)**	

STORM DRAINAGE DETENTION CAPACITY SUMMARY - ANNUAL REPORT #16

Projects that require storm water runoff mitigation (projects under construction by the end of each reporting period)

			Watershed		
Project	**Date Submitted**	**Date Approved**	**San Francisquito Final Plan**	**Matadero Final Plan**	**Notes**
9/1/07 - 8/31/08 Annual Report #8					
SEQ2 - SOEC & Nano	9/24/2007	10/8/2007	(39,204)		
Practice Gym	5/8/2008	6/12/2008		7,352	
SIM1			(14,098)		
Automotive Innovation Facility	7/17/2008		32,317		
Stanford Avenue Housing	6/6/2008			117,612	
Graduate School Of Business, Knight Management Center	12/5/2007	6/5/2008		(137,800)	
Campus Drive West Realignment	11/7/2007	12/13/2007	(3,991)		
Olmstead Staff Rental Housing	8/11/2008			51,607	
Net change 9/1/07- 8/31/08			**(24,976)**	**38,771**	
Balance Available			**(362,131)**	**(8,888,773)**	
9/1/08 - 8/31/09 Annual Report #9					
Sand Hill Restrooms	10/20/2008	12/11/2008	1,217		
Golf Course Practice Field Water Tank	4/20/2009	6/11/2009	2,111		
Golf Course Practice Field Trailer	1/29/2009	4/9/2009	432		
Law School Building	2/25/09	5/14/09		16,800	
BioEngineering/Chemical Engineering	5/15/09				
Concert Hall	2/19/09			96,600	
Net change 9/1/08- 8/31/09			**3,760**	**113,400**	
Balance Available			**(358,371)**	**(8,775,373)**	
9/1/09 - 8/31/10 Annual Report #10					
Madera Child Care 2	2/11/10	4/8/10		4,533	
East Campus Dining Commons	2/26/10	5/13/10		(13,682)	
Soccer Bleachers	5/26/10	6/25/10		8,298	
Bob Housing	8/24/10			(399)	
Casa Italiana	8/24/10			1,272	
Storey House	8/24/10			(726)	
Net change 9/1/09- 8/31/10			**0**	**(704)**	
Balance Available			**(358,371)**	**(8,776,077)**	
9/1/10 - 8/31/11 Annual Report #11					
West Campus Recreation Center	1/4/2011	6/3/2011	90,452		
Terman Demo	1/21/2011	8/11/2011	(35,395)		
BioE/ChemE resubmittal	3/3/11	5/12/11	11,241		
Net change 9/1/10- 8/31/11			**66,298**	**0**	
Balance Available			**(292,073)**	**(8,776,077)**	

STORM DRAINAGE DETENTION CAPACITY SUMMARY - ANNUAL REPORT #16

Projects that require storm water runoff mitigation (projects under construction by the end of each reporting period)

			Watershed		
Project	**Date Submitted**	**Date Approved**	**San Francisquito Final Plan**	**Matadero Final Plan**	**Notes**
9/1/11 - 8/31/12 Annual Report #12					
Satellite Research Animal Facility	9/6/11	11/10/11	32,370		
Arrillaga Family Sports Center Addition	12/8/11	2/9/12		28,500	Under Construction
Anatomy demolition	12/5/11	1/3/12		(34,867)	
Cagan Soccer locker rooms	12/21/11	2/9/12		3,345	
Arguello Recreation Field	3/1/12	5/11/12		7,834	
Cypress Annex demo	5/19/11	7/20/11	(960)		
Galvez Parking lot	3/20/12	5/31/12		168,577	
Central Process Steam building	5/11/12	8/9/12	2,960		
Quonset hut demolition	5/7/12	5/9/12	(3,760)		
Net change 9/1/11- 8/31/12			**30,610**	**173,389**	
Balance Available			**(261,463)**	**(8,602,688)**	
9/1/12 - 8/31/13 Annual Report #13					
Anderson Collection at Stanford	2/17/2012	7/19/2012		16,575	Construction completed 5/14
Replacement Central Energy Facility*	6/1/2012	9/13/2012	219,542		Under construction (Expec. compl. 3/31/2015)
Heat Exchanger 4	6/21/2013	11/19/2013		225	Construction completed 11/19/13.
EV Comstock Graduate Housing	7/7/12	11/8/12		15,091	Under construction (Expec. compl. 9/14) (Bldgs 1-4 completed; Commons Building expec. compl. 9/30/14)
Grounds Trailer Demolition	8/15/12	9/12/12		(722)	Demolished 9/12
Parking Lot at Lasuen and Roth	9/14/12	11/8/12		6,846	Completed 6/13
McMurtry Art - Art History	11/20/12	2/14/13		28,623	Under construction (Expec. compl. 4/16)
Field Hockey Bleachers	12/15/12	3/14/13		(5,685)	Completed 4/14.
Windhover Contemplative center	2/11/13	4/11/13		(4,650)	Under construction (Expec. compl. 9/30/14)
Acorn Parking Lot	6/3/13	7/12/13		4,500	Completed 2/14.
520/524 Renovation	6/14/13	8/8/13		(1,695)	Under construction (Expec. compl. 11/16/14)
Net change 9/1/12- 8/31/13			**219,542**	**59,108**	
Balance Available			**(41,921)**	**(8,543,580)**	
9/1/13 - 8/31/14 Annual Report #14					
Stanford Sand Volleyball Courts	5/6/13	7/18/13		18,248	Completed 5/14.
Northwest Data Center and Communications Hub	5/10/13	7/18/13	11,652		Construction completed 8/14 (Substantial completion)
Manzanita Park Residence Hall	5/17/13	10/10/13		11,773	Under construction (Expec. compl. Summer 2015)
408 Panama	7/15/13	10/10/13		25,985	Under construction (Expec. compl. 12/31/2015)
Roble Gymnasium Renovation	12/23/13	3/6/14	370		Under construction (Expec. compl. 1/15/16)
Field Conservation Facility	1/14/14	5/1/14	1,389		Under construction (Expec. compl. 9/14)
LPCH Steam Plant	10/8/13	1/9/14	3,800		Anticipated completion 3/25/15.
Durand	12/27/13	2/6/14		3	Completed 9/14
Mars	12/27/13	2/6/14		(442)	Completed 9/14
Roth	12/27/13	6/12/14		1,340	Completed 9/14
Sigma Nu	12/27/13	2/6/14		(1,226)	Completed 9/14
Demo Godzilla	4/10/14	4/18/14	(11,435)		Demolition completed 5/14.
Toyon-Branner Boiler	6/18/13	7/22/13		522	Building Permit received 5/14. Completed 10/14
Net change 9/1/13- 8/31/14			**5,776**	**56,203**	
Balance Available			**(36,145)**	**(8,487,377)**	

STORM DRAINAGE DETENTION CAPACITY SUMMARY - ANNUAL REPORT #16

Projects that require storm water runoff mitigation (projects under construction by the end of each reporting period)

			Watershed		
Project	**Date Submitted**	**Date Approved**	**San Francisquito Final Plan**	**Matadero Final Plan**	**Notes**
9/1/14 - 8/31/15 Annual Report #15					
Science Teaching and Learning Center - Old Chemistry Project	9/17/13	11/14/13		7,984	Under construction, expec. compl. 9/16
Stanford Perimeter Trail	10/15/13	12/11/14	4,407	79,455	Under construction, expec. compl. 12/15
Sunken Diamond New Entry/Locker Room Expansio	11/14/13	3/6/14		2,465	Under construction, expec. compl. 1/16
Cagan Soccer Field Bleacher Lockers	12/5/13	4/3/14		3,002	Completed 7/15.
Maples Pavilion Addition	12/5/13	1/30/14		1,135	Completed 4/15.
Softball Field House	1/16/14	5/4/14		5,101	Completed 6/15.
Phi Kappa Psi	12/27/13	2/6/14		1,236	Construction completed 08/15
Lasuen	12/27/13	9/4/15		340	Awaiting planning approval
Kairos	12/27/13	2/6/14		283	Construction completed 08/15
La Maison Francaise (French House)	12/27/13	9/4/15		1,120	Awaiting planning approval
717 Dolores	12/27/13	9/4/15		1,051	Awaiting planning approval
Football Stadium New Locker Room	12/23/13	4/3/14		3,122	Under construction (expec. compl. 9/11/15).
Stanford Parking Structure 10 (PS-10)	3/12/2014; 8/26/14	7/3/2014; modification approved 10/30/14	18,670		Under construction, expec. compl. 10/16
GSB Residences	5/19/14	7/31/14		(19,375)	Under construction, expec. compl. 6/16
New Residences at Lagunita Court	6/10/14	9/4/14	(10,111)	(17,518)	Under construction, expec. Compl. 8/16. Framing likely complete April 2016.
Meyer Library Demolition	6/30/14	9/4/14		(64,000)	Demolition complete, site restoration expec. compl. 12/15.
Regional Storm Water Treatment Facility	7/21/204	1/26/15		0	Under construction, expec. compl. 12/15
End Station 3 Infrastructure and Code Upgrades	8/4/14	11/13/14	742		Under construction, expec. compl. 4/16
Net change 9/1/14- 8/31/15			**13,708**	**5,401**	
Balance Available			**(22,437)**	**(8,481,976)**	

STORM DRAINAGE DETENTION CAPACITY SUMMARY - ANNUAL REPORT #16

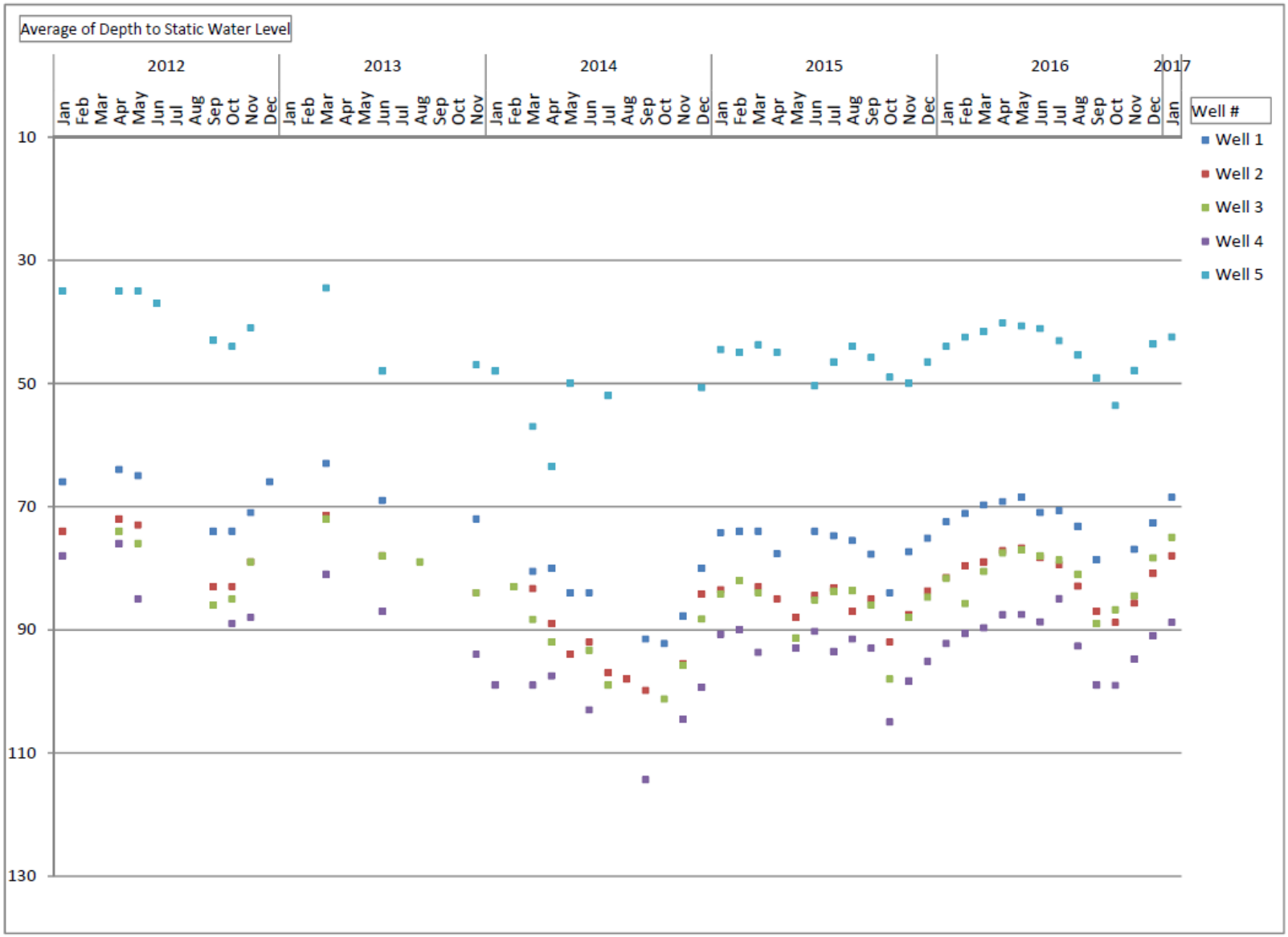
Projects that require storm water runoff mitigation (projects under construction by the end of each reporting period)

			Watershed		
Project	**Date Submitted**	**Date Approved**	**San Francisquito Final Plan**	**Matadero Final Plan**	**Notes**
9/1/15 - 8/31/16 Annual Report #16					
West Campus Detention Basin	11/12/14	3/5/15	(2,535,192)		About 58.2 acres of detention capacity will be added to the San Francisquito Creek watershed with the completion of the West Campus Detention Basin around Dec 2015. This number might change slightly, will be verifying as-built documentation.
Golf Tenth Tee Improvements	6/19/2014; resubmitted 9/8/14	10/30/14	15,356		
Golf Learning Center	8/28/2014; major mod. 8/12/15	10/30/2014; major mod. 10/29/2015	13,744		
Demolition of Cummings Art Center and Constructio	3/3/15	6/4/15		4,827	
Regional Loading Dock Expansion	8/24/15	12/3/15		(2,470)	
Demolition of HEPL Powerhouse	5/27/15	9/17/15	(4,554)		This is an estimate, no civil eng. calculations.
La Maison Francaise (French House)	12/27/13	9/4/15		1,120	
717 Dolores	12/27/13	9/4/15		1,051	
Lomita/Roth Parking Lot and Lomita Road	3/5/15	4/30/15		(3,173)	
Galvez and Serra St Parking Lot	orig. submission date 9/9/2015, resubmission date 12/10/15	2/4/16		2,763	
Earth Sciences Courtyard Infill	9/9/15	1/7/16	200		Prior to the project, nothing drained to earth except 4 small planters totaling 200 sf.
Kingscote Gardens Renovation	11/12/15	3/30/16		(3,512)	
Encina Commons Temporary Boiler Installation	original submission date; modification submitted 4/7/16	original 11/19/2015; modification 5/9/16		0	
Palo Lot	11/23/15	2/2/16	0		
Bass Biology Building (incl. future demo of Herrin Hall and Herrin Lab and 315 Campus Drive modulars)	11/2/15	1/7/16		(1,968)	
Demolition of Ice Plant / Ice Storage Facility (for ChI	9/15/14	4/15/15		0	All impervious part of ChEM-H & SNI project. Demo of Cogen is also factored into calculations for ChEM-H & SNI.
Galvez Roundabout	11/19/15	3/3/16		(3,032)	Based on civil eng. calcs.
PS-5 Solar Canopy	12/11/15	2/4/16	0		
Via Ortega South	12/7/15	3/3/16		(6,181)	Based on the site drawings, it appears that the project was almost entirely within the Matadero Creek watershed.
Campus Gas Station	8/1/16	Demo complete by 9/2/2016		(22,500)	
315 Campus Drive modulars	3/22/16	4/22/16		0	Bass Biology calculations accounted for 315 Campus Drive in its existing conditions.
Net change 9/1/15- 8/31/16			**(2,510,446)**	**(33,075)**	
Balance Available			**(2,532,883)**	**(8,515,051)**	

APPENDIX GWL

Stanford Historical Groundwater Levels

SUMMARY OF HISTORICAL GROUNDWATER LEVELS AT EACH OF STANFORD GROUNDWATER WELLS



87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	*feet*	*feet*		*87*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Mar-47	137.5			-50.5	
Apr-47	138			-51	
May-47	142			-55	
Jun-47	149			-62	
Jul-47	152			-65	
Aug-47	153			-66	
Sep-47	157			-70	
Oct-47	157			-70	
Nov-47	154			-67	
Dec-47	150			-63	
Jan-48	141	147		-54	-60
Feb-48		145			-58
Mar-48	139	147		-52	-60
Apr-48		146			-59
May-48	148	148		-61	-61
Jun-48	148	153		-61	-66
Jul-48	153			-66	
Aug-48	157			-70	
Sep-48	159			-72	
Oct-48		165			-78
Nov-48	160			-73	
Dec-48	148	157		-61	-70
Jan-49		153			-66
Feb-49		151			-64
Mar-49	142	150		-55	-63
Apr-49		146			-59
May-49		147			-60
Jun-49	146	149		-59	-62
Jul-49		157			-70
Aug-49		164			-77
Sep-49		168			-81
Oct-49		172			-85
Nov-49		172			-85
Dec-49	158	163		-71	-76
Jan-50		162			-75
Feb-50		161			-74
Mar-50	149	158		-62	-71
Apr-50	148	154		-61	-67
May-50		154			-67
Jun-50	150	156		-63	-69
Jul-50	155	160		-68	-73
Aug-50	157	164		-70	-77
Sep-50		169			-82
Oct-50		173			-86
Nov-50	161	170		-74	-83
Dec-50	161	167		-74	-80
Jan-51	154	164		-67	-77

87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	*feet*	*feet*	*87*		
Date	**Well Stand**	**Levels Run**	**Well Stand Elev**	**Levels Run Elev**	
Feb-51		158		-71	
Mar-51		157		-70	
Apr-51		158		-71	
May-51		158.5		-71.5	
Jun-51		164		-77	
Jul-51		171		-84	
Aug-51		178		-91	
Sep-51	174	180	-87	-93	
Oct-51	172	181	-85	-94	
Nov-51		178		-91	
Dec-51		177		-90	
Jan-52		175		-88	
Feb-52		168		-81	
Mar-52		160		-73	
Nov-53	167		-80		
May-54		162		-75	
Jun-54	160		-73		
Jul-54		170		-83	
Aug-54		178		-91	
Sep-54		180		-93	
Oct-54		185		-98	
Nov-54		180		-93	
Dec-54		178		-91	
Jan-55		176		-89	
Feb-55		174		-87	
Mar-55		170		-83	
Apr-55		168		-81	
May-55		175		-88	
Jun-55		178		-91	
Jul-55		184		-97	
Aug-55		188		-101	
Sep-55		188		-101	
Oct-55	180		-93		
Nov-55	182		-95		
Dec-55	178	190	-91	-103	
Jan-56		185		-98	
Feb-56	168		-81		
Mar-56	165	172	-78	-85	
Apr-56	162		-75		
May-56	165		-78		
Jun-56	168	180	-81	-93	
Jul-56		188		-101	
Aug-56		192		-105	
Sep-56	182	192	-95	-105	
Oct-56	182		-95		
Nov-56	182		-95		
Dec-56		190		-103	

87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	*feet*	*feet*		*87*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Jan-57	178			-91	
Feb-57	175			-88	
Mar-57		185			-98
Apr-57	175	183		-88	-96
May-57		183			-96
Jun-57		185			-98
Jul-57		187			-100
Aug-57		190			-103
Sep-57		192			-105
Oct-57		190			-103
Nov-57		187			-100
Dec-57		185			-98
Jan-58		182			-95
Feb-58		180			-93
Mar-58		174			-87
Apr-58		172			-85
May-58		175			-88
Jun-58		175			-88
Jul-58		185			-98
Aug-58		187			-100
Sep-58		190			-103
Oct-58		192			-105
Nov-58		192			-105
Dec-58		192			-105
Jan-59		191			-104
Feb-59		189			-102
Mar-59	176	187		-89	-100
Apr-59	178			-91	
Apr-60		197			-110
May-60		198			-111
Jun-60		204			-117
Jul-60		204			-117
Aug-60		204			-117
Sep-60		205			-118
Oct-60		205			-118
Nov-60		207			-120
Dec-60		207			-120
Jan-61		205			-118
Feb-61		206			-119
Mar-61	197	207		-110	-120
Apr-61		207			-120
May-61		207			-120
Jun-61		212			-125
Jul-61		212			-125
Aug-61		204			-117
Sep-61	210	212		-123	-125
Oct-61		212			-125

87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	*feet*	*feet*	*87*		
Date	**Well Stand**	**Levels Run**	**Well Stand Elev**	**Levels Run Elev**	
Nov-61		212		-125	
Apr-62	212	212	-125	-125	
May-62		212		-125	
Jun-62		212		-125	
Jul-62		212		-125	
Aug-62		212		-125	
Sep-62		200		-113	
Nov-62	190		-103		
Dec-62	190		-103		
Jan-63		190		-103	
Feb-63	182	190	-95	-103	
Mar-63		190		-103	
Apr-63	170		-83		
May-63	185	176	-98	-89	
Jun-63	164	173	-77	-86	
Jul-63	163	173	-76	-86	
Aug-63	163	173	-76	-86	
Sep-63	155	173	-68	-86	
Oct-63	155	165	-68	-78	
Nov-63	155	165	-68	-78	
Dec-63	150	160	-63	-73	
Jan-64	150	160	-63	-73	
Feb-64	144	160	-57	-73	
Mar-64	144	151	-57	-64	
Apr-64	144	150	-57	-63	
May-64	150	150	-63	-63	
Jun-64	144	148	-57	-61	
Jul-64	144	150	-57	-63	
Aug-64	144	152	-57	-65	
Sep-64	143	153	-56	-66	
Oct-64	145	154	-58	-67	
Dec-64	142	150	-55	-63	
Jan-65	135	146	-48	-59	
Feb-65		144		-57	
Mar-65		139		-52	
Apr-65	131	138	-44	-51	
May-65	128	131	-41	-44	
Jun-65	130	137	-43	-50	
Jul-65	132	137	-45	-50	
Aug-65	132	141	-45	-54	
Sep-65	135	140	-48	-53	
Oct-65	135	140	-48	-53	
Nov-65	132	142	-45	-55	
Dec-65	132	137	-45	-50	
Jan-66	125	135	-38	-48	
Feb-66	125	135	-38	-48	
Mar-66	120	128	-33	-41	

87	*NGVD 1929*	*Measurements from top of sounding hole to water*		
Well 1	*feet*	*feet*	*87*	

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Apr-66	120	128	-33	-41
May-66	122	129	-35	-42
Jun-66	122	134	-35	-47
Jul-66	126	135	-39	-48
Aug-66	127	135	-40	-48
Sep-66	127	195	-40	-108
Oct-66	134	141	-47	-54
Nov-66	134	141	-47	-54
Dec-66	128	135	-41	-48
Jan-67	125	132	-38	-45
Feb-67	125	132	-38	-45
Mar-67	118	130	-31	-43
Apr-67	115	120	-28	-33
May-67	115	120	-28	-33
Jun-67	115	124	-28	-37
Jul-67	115	124	-28	-37
Aug-67	120	128	-33	-41
Sep-67	120	127	-33	-40
Oct-67	122	126	-35	-39
Nov-67	122	130	-35	-43
Dec-67	122	132	-35	-45
Jan-68	118	124	-31	-37
Feb-68	115	122	-28	-35
Mar-68	115		-28	
Apr-68	115	118	-28	-31
May-68	115	120	-28	-33
Jun-68	115	121	-28	-34
Jul-68	120	125	-33	-38
Aug-68	120	126	-33	-39
Sep-68	122	130	-35	-43
Oct-68	125	131	-38	-44
Nov-68	120		-33	
Dec-68	119		-32	
Jan-69	120	121	-33	-34
Feb-69	110	118	-23	-31
Mar-69	105	110	-18	-23
Apr-69	105	110	-18	-23
May-69	105	110	-18	-23
Jun-69		110		-23
Jul-69		109		-22
Aug-69		114		-27
Sep-69		116		-29
Nov-69		115		-28
Dec-69		115		-28
Feb-70		112		-25
Mar-70		110		-23
Jul-70		110		-23

87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	***feet***	***feet***		***87***	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Nov-70	105	114		-18	-27
Mar-71		100			-13
Jul-71		150			-63
Jan-80	66			21	
Feb-80	65			22	
Mar-80	64.5			22.5	
Sep-80	66			21	
Dec-80	64			23	
Feb-81	64			23	
Apr-81	64			23	
May-81	65	68		22	19
Jan-82	68			19	
Mar-82	61			26	
Apr-82	59.5			27.5	
May-82	59			28	
Jun-82	62			25	
Dec-82	62			25	
Mar-83	53	57		34	30
Apr-83	53			34	
May-83	55	58		32	29
Jul-83	58	60		29	27
Sep-83	56			31	
Oct-83	55			32	
Feb-84	53			34	
Mar-84	53	57		34	30
Apr-84	55			32	
Jun-84	57			30	
Oct-84	60			27	
Mar-85	58	62		29	25
Apr-85	57.5	62.5		29.5	24.5
May-85	59.5	64		27.5	23
Jun-85	61	65		26	22
Oct-85	65			22	
Nov-85	64			23	
Dec-85	63	67		24	20
Feb-86	61			26	
Mar-86	61			26	
Apr-86	58			29	
May-86	57.5			29.5	
Jun-86	59			28	
Jul-86	59			28	
Aug-86	59			28	
Nov-86	61			26	
Dec-86	62			25	
Feb-87	60.5			26.5	
Mar-87	61			26	
Apr-87	61	65		26	22

87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	*feet*	*feet*		*87*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Jun-87	61			26	
Jul-87	62.5			24.5	
Aug-87	65			22	
Oct-87	65			22	
Nov-87	65			22	
Dec-87	65			22	
Jan-88	63			24	
Feb-88	63			24	
Apr-88	67.5			19.5	
May-88	69	79		18	8
Jun-88		78.5			8.5
Jul-88		86			1
Aug-88		100.5			-13.5
Sep-88	100.5	103		-13.5	-16
Oct-88	102			-15	
Nov-88	86	106.5		1	-19.5
Dec-88	94			-7	
Jan-89		95.5			-8.5
Mar-89	81.5	93		5.5	-6
May-89	82	95		5	-8
Dec-89	76.5			10.5	
Jan-90	76			11	
Mar-90	83.5	88.5		3.5	-1.5
Apr-90		92.5			-5.5
Jun-90		96			-9
Aug-90	84			3	
Nov-90	85	93		2	-6
Dec-90		91			-4
Jan-91		93.5			-6.5
Feb-91		98.5			-11.5
Mar-91		96			-9
Apr-91		96.5			-9.5
May-91		95			-8
Aug-91	83			4	
Oct-91	81			6	
Feb-92	80.5			6.5	
Apr-92	74			13	
Jun-92	79			8	
Sep-92	78.5			8.5	
Nov-92	77.5			9.5	
Dec-92		84			3
Mar-93	71			16	
May-93	73			14	
Aug-93	73.5			13.5	
Oct-93	74			13	
Nov-93	56			31	
Mar-94	69			18	

87	*NGVD 1929*	*Measurements from top of sounding hole to water*		
Well 1	***feet***	***feet***	***87***	

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Jun-94	70.5	78	16.5	9
Aug-94	74.5		12.5	
Nov-94		87		0
Jan-95	72		15	
Apr-96	61		26	
Jun-96	62.5		24.5	
Jul-97		95.5		-8.5
Aug-97				
Sep-97				
Oct-97		81		6
Jan-01	73		14	
Feb-01	72		15	
Mar-01	68		19	
Jul-01	87		0	
Jan-01	77		10	
Feb-01	72		15	
Mar-01	70		17	
Apr-01	70	80	17	7
May-02	62		25	
Jun-02	71		16	
Jul-02	77.5		9.5	
Oct-02	78		9	
Dec-03	66		21	
Mar-04	62		25	
May-04	63	63.5	24	23.5
Sep-04	74		13	
Apr-05	60		27	
Jul-05	62		25	
Aug-05	63.5		23.5	
Oct-05	65		22	
Jan-06	63		24	
May-06	55.5	61.5	31.5	25.5
Jun-06	57.5	62.5	29.5	24.5
Nov-06		62.5		24.5
Jan-07		62		25
May-07	61	66	26	21
Jul-07		95		-8
Sep-07	63	89	24	-2
May-08	66		21	
Jun-08	65		22	
Jul-08	79		8	
Aug-08	80		7	
Sep-08	83		4	
Dec-08	84		3	
Feb-09	58		29	
Mar-09	69		18	
Apr-09	66		21	

87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	*feet*	*feet*		*87*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Apr-09		58			29
Jun-09	71			16	
Sep-09	77			10	
Oct-09	74			13	
Dec-09	69			18	
Dec-09	69			18	
Jan-10	68			19	
Mar-10	68			19	
Jun-10		74			13
Jun-10	68			19	
Jul-10	71			16	
Sep-10	69			18	
Oct-10	69			18	
Oct-10	68			19	
Sep-10	69			18	
Nov-10	68			19	
Dec-10	69			18	
Feb-11	63			24	
Mar-11	63			24	
Jun-11	70			17	
Jul-11	70			17	
Oct-11	66			21	
Dec-11	64			23	
Nov-10	68			19	
Dec-10	69			18	
Feb-11	63			24	
Mar-11	63			24	
Jun-11	70			17	
Jul-11	70			17	
Oct-11	66			21	
Dec-11	64			23	
Jan-12	66			21	
Apr-12	64			23	
May-12	65			22	
Sep-12	74			13	
Oct-12	74			13	
Nov-12	71			16	
Dec-12	66			21	
Dec-12	66			21	
Nov-12	71			16	
Dec-12	66			21	
Mar-13	63			24	
Jun-13	69			18	
Nov-13	72			15	
Nov-12	71			16	
Dec-12	66			21	
Mar-13	63			24	

87	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 1	*feet*	*feet*		*87*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Jun-13	69			18	
Nov-13	72			15	
Mar-14	80			7	
Mar-14	80			7	
Mar-14		85			2
Mar-14	80			7	
Mar-14	82			5	
Apr-14		84			3
Apr-14		84			3
Apr-14	80			7	
May-14	84			3	
May-14	84			3	
May-14		90			-3
May-14		89			-2
Jun-14	84			3	
Jun-14	84			3	
Jul-14		94			-7
Aug-14		95			-8
Aug-14		95			-8
Aug-14		98			-11
Aug-14					
Sep-14	92			-5	
Sep-14	97	97		-10	-10
Sep-14	98	98		-11	-11
Sep-14	98	98		-11	-11
Sep-14	91			-4	
Oct-14	93			-6	
Oct-14	92			-5	
Oct-14	92			-5	
Oct-14	92			-5	
Nov-14	93			-6	
Nov-14	86			1	
Nov-14	84			3	
Nov-14	93			-6	
Nov-14		95			-8
Nov-14	88			-1	
Nov-14	95			-8	
Nov-14	92			-5	
Dec-14	84			3	
Dec-14	83			4	
Dec-14	79			8	
Dec-14	74			13	
Jan-15	74			13	
Jan-15	75			12	
Jan-15	74			13	
Jan-15	74			13	
Feb-15	75			12	

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Mar-47	130			-37.2	
Apr-47	130	142		-37.2	-49.2
May-47	133	142.5		-40.2	-49.7
Jun-47		147			-54.2
Jul-47	152			-59.2	
Aug-47		156			-63.2
Sep-47		159			-66.2
Oct-47		160			-67.2
Nov-47		147			-54.2
Dec-47		144			-51.2
Jan-48	139	141		-46.2	-48.2
Feb-48	138	148		-45.2	-55.2
Mar-48		154			-61.2
Apr-48	140	153.5		-47.2	-60.7
May-48	145	153		-52.2	-60.2
Jun-48		155			-62.2
Jul-48	149	170		-56.2	-77.2
Aug-48		178			-85.2
Sep-48		179			-86.2
Oct-48	155	176		-62.2	-83.2
Nov-48	154			-61.2	
Dec-48	151			-58.2	
Jan-49	147			-54.2	
Feb-49	145			-52.2	
Mar-49	143.5			-50.7	
Apr-49	140			-47.2	
May-49	140	150		-47.2	-57.2
Jun-49	145			-52.2	
Jul-49	150.5			-57.7	
Aug-49	154	173.5		-61.2	-80.7
Sep-49		178			-85.2
Oct-49	165.5	180		-72.7	-87.2
Nov-49	166.5	181		-73.7	-88.2
Dec-49	160			-67.2	
Jan-50	155.5			-62.7	
Feb-50	155			-62.2	
Mar-50	152			-59.2	
Apr-50	148			-55.2	
May-50	148			-55.2	
Jun-50	151.5			-58.7	
Jul-50	153	168		-60.2	-75.2
Aug-50	151			-58.2	
Sep-50	162			-69.2	
Oct-50	167	177		-74.2	-84.2
Nov-50	162	175		-69.2	-82.2
Dec-50	159	173		-66.2	-80.2
Jan-51		167			-74.2
Feb-51	154	164		-61.2	-71.2
Mar-51	153			-60.2	

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Apr-51	151			-58.2	
May-51	151.5			-58.7	
Jun-51	164.5			-71.7	
Jul-51	165			-72.2	
Aug-51	168			-75.2	
Sep-51	171			-78.2	
Oct-51	175	184		-82.2	-91.2
Nov-51	175	182		-82.2	-89.2
Dec-51		176			-83.2
Jan-52		175			-82.2
Feb-52		168			-75.2
Mar-52		162			-69.2
Aug-52	165			-72.2	
Sep-52	168			-75.2	
Oct-52	168			-75.2	
Nov-52	168	180		-75.2	-87.2
Dec-52	167			-74.2	
Jan-53	163			-70.2	
Feb-53	160			-67.2	
Mar-53	158			-65.2	
Apr-53	155			-62.2	
May-53	155			-62.2	
Jun-53	168			-75.2	
Jul-53	163			-70.2	
Aug-53	168			-75.2	
Sep-53		180			-87.2
Oct-53	175			-82.2	
Nov-53	172	190		-79.2	-97.2
Dec-53	172			-79.2	
Jan-54	178			-85.2	
Feb-54	176			-83.2	
Mar-54	178			-85.2	
Apr-54	175			-82.2	
May-54		190			-97.2
Oct-56	190			-97.2	
Nov-56	188			-95.2	
Dec-56					
Jan-57	185			-92.2	
Feb-57	184			-91.2	
Mar-57	182			-89.2	
Apr-57	180			-87.2	
May-57	180			-87.2	
Sep-57	185			-92.2	
May-58	176			-83.2	
Jun-58	205			-112.2	
Jul-58	181	193		-88.2	-100.2
Sep-58	182			-89.2	
Oct-58	185			-92.2	
Nov-58	172	180		-79.2	-87.2

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Dec-58	180			-87.2	
Jan-59	176			-83.2	
Feb-59	172			-79.2	
Mar-59	184	199		-91.2	-106.2
Apr-59	160			-67.2	
Sep-59	195			-102.2	
Oct-59	195			-102.2	
Nov-59	195			-102.2	
Dec-59	195			-102.2	
Jan-60		199			-106.2
Mar-60	198	214		-105.2	-121.2
Apr-60	198	214		-105.2	-121.2
Mar-61	209	227		-116.2	-134.2
Sep-61	209	227		-116.2	-134.2
Apr-62	213	227		-120.2	-134.2
May-62	209	227		-116.2	-134.2
Jul-62	213	235		-120.2	-142.2
Aug-62	210			-117.2	
Sep-62	214	227		-121.2	-134.2
Oct-62	205			-112.2	
Nov-62	195			-102.2	
Dec-62	190			-97.2	
Jan-63	188			-95.2	
Feb-63	185			-92.2	
Mar-63	180			-87.2	
Apr-63	175	185		-82.2	-92.2
May-63	172	187		-79.2	-94.2
Jun-63	172			-79.2	
Jul-63	173	185		-80.2	-92.2
Aug-63	168	177		-75.2	-84.2
Sep-63	168	177		-75.2	-84.2
Oct-63	165			-72.2	
Nov-63	165			-72.2	
Dec-63	160			-67.2	
Jan-64	158			-65.2	
Feb-64	158			-65.2	
Mar-64	154	172		-61.2	-79.2
Apr-64	150	165		-57.2	-72.2
May-64	150	165		-57.2	-72.2
Jun-64	150	164		-57.2	-71.2
Jul-64	150	164		-57.2	-71.2
Aug-64	154	170		-61.2	-77.2
Sep-64	152			-59.2	
Oct-64	154			-61.2	
Nov-64	152			-59.2	
Dec-64	152	174		-59.2	-81.2
Jan-65	152	167		-59.2	-74.2
Feb-65	148			-55.2	
Mar-65	146			-53.2	

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Apr-65	143			-50.2	
May-65	142	155		-49.2	-62.2
Jun-65	142	156		-49.2	-63.2
Jul-65		158			-65.2
Aug-65		159			-66.2
Sep-65		167			-74.2
Oct-65		164			-71.2
Nov-65		160			-67.2
Dec-65	140	160		-47.2	-67.2
Jan-66	140	155		-47.2	-62.2
Feb-66	140	152		-47.2	-59.2
Mar-66	135	146		-42.2	-53.2
Apr-66	133	145		-40.2	-52.2
May-66		150			-57.2
Jun-66		151			-58.2
Jul-66		151			-58.2
Aug-66		150			-57.2
Sep-66		156			-63.2
Oct-66		160			-67.2
Nov-66	140.5	153		-47.7	-60.2
Dec-66	138	148.5		-45.2	-55.7
Jan-67		145			-52.2
Feb-67		145			-52.2
Mar-67		140			-47.2
Apr-67		139			-46.2
May-67	124	135		-31.2	-42.2
Jun-67	126.5	137		-33.7	-44.2
Jul-67		140			-47.2
Aug-67	132	142		-39.2	-49.2
Sep-67	126	142		-33.2	-49.2
Oct-67		142			-49.2
Nov-67	132	140.75		-39.2	-47.95
Dec-67	129	139		-36.2	-46.2
Jan-68	129	138		-36.2	-45.2
Feb-68		138			-45.2
Mar-68	129	136		-36.2	-43.2
Apr-68	129	136		-36.2	-43.2
May-68		134			-41.2
Jun-68		137			-44.2
Jul-68		140			-47.2
Aug-68		142			-49.2
Sep-68		144			-51.2
Oct-68		165			-72.2
Nov-68	132	144		-39.2	-51.2
Dec-68	132	139		-39.2	-46.2
Jan-69	130	132		-37.2	-39.2
Feb-69		132			-39.2
Mar-69	114	132		-21.2	-39.2
Jun-69		120			-27.2

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Aug-69		128			-35.2
Nov-69	115	126		-22.2	-33.2
Dec-69	115	126		-22.2	-33.2
Jan-70	115	122		-22.2	-29.2
Feb-70		122			-29.2
Mar-70		120			-27.2
May-70		120			-27.2
Jun-70		121			-28.2
Jul-70		120			-27.2
Oct-70		125			-32.2
Nov-70		125			-32.2
Dec-70		125			-32.2
Mar-71	108	118		-15.2	-25.2
May-71		116			-23.2
Jul-71		119			-26.2
Aug-71		120			-27.2
Oct-71		125			-32.2
Nov-71	110	124		-17.2	-31.2
Feb-72		120			-27.2
Mar-72		120			-27.2
Jun-72		124			-31.2
Mar-85	66	74		26.8	18.8
Apr-85	67	74		25.8	18.8
May-85	69	76		23.8	16.8
Jun-85	70	78		22.8	14.8
Oct-85	74			18.8	
Nov-85	73			19.8	
Dec-85	73	80		19.8	12.8
Feb-86	70.5			22.3	
Mar-86	70			22.8	
Apr-86	69			23.8	
May-86	68			24.8	
Jun-86	69			23.8	
Jul-86					
Aug-86	69			23.8	
Nov-86	71			21.8	
Dec-86	71			21.8	
Feb-87	70			22.8	
Mar-87					
Apr-87	70			22.8	
May-87					
Jun-87	71			21.8	
Jul-87	72			20.8	
Aug-87	73			19.8	
Oct-87	75			17.8	
Nov-87	75			17.8	
Dec-87	75			17.8	
Jan-88	72			20.8	
Feb-88	73			19.8	

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Mar-88	73			19.8	
Apr-88		85			7.8
May-88		86.5			6.3
Jun-88		90			2.8
Jul-88		98			-5.2
Aug-88		108			-15.2
Sep-88		116			-23.2
Oct-88		119			-26.2
Nov-88	101	112.5		-8.2	-19.7
Dec-88	96.5			-3.7	
Mar-89	90	106		2.8	-13.2
May-89	91	106		1.8	-13.2
Dec-89	84.5			8.3	
Jan-90	85	95		7.8	-2.2
Mar-90		101			-8.2
Apr-90		103.5			-10.7
Jun-90		107			-14.2
Aug-90	92.5			0.3	
Feb-91		107			-14.2
Mar-91	96			-3.2	
May-91	95.5			-2.7	
Aug-91	91			1.8	
Oct-91	90			2.8	
Feb-92	84.5			8.3	
Jun-92		95.5			-2.7
Jul-92					
Aug-92	85.5			7.3	
Sep-92	86			6.8	
Nov-92	86			6.8	
Dec-92		96			-3.2
Mar-93	79			13.8	
May-93	75.5			17.3	
Aug-93	96			-3.2	
Oct-93	82.5			10.3	
Nov-93	81			11.8	
Jan-95	80			12.8	
Apr-96	69			23.8	
Jun-97	74			18.8	
Oct-97	82			10.8	
May-98	74			18.8	
Jun-02	80	88.5		12.8	4.3
Jul-02	78			14.8	
Oct-03	78			14.8	
Dec-03	73.5			19.3	
Mar-04		70			22.8
May-04	72	80		20.8	12.8
Sep-04	83			9.8	
Feb-05	67.5			25.3	
Jul-05	70			22.8	

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Aug-05	71.5			21.3	
Nov-05	73	85		19.8	7.8
Jan-06	71			21.8	
May-06	62	72		30.8	20.8
Jun-06	67	77.5		25.8	15.3
Aug-06		82			10.8
Nov-06		82			10.8
Jan-07		73			19.8
May-07	75	85		17.8	7.8
Jul-07	75	97		17.8	-4.2
Aug-07	96.5	105		-3.7	-12.2
Oct-07	90	108		2.8	-15.2
May-08	66			26.8	
Jul-08	77			15.8	
Oct-08	88			4.8	
Dec-08	84			8.8	
Dec-09	79			13.8	
Feb-09	78.5			14.3	
Mar-09	77			15.8	
Apr-09	75			17.8	
Apr-09	77			15.8	
Jun-09	80			12.8	
Sep-09	85			7.8	
Oct-09	84			8.8	
Dec-09	77			15.8	
Dec-09	77			15.8	
Jan-10	77			15.8	
Feb-10	73			19.8	
Mar-10	69			23.8	
Jun-10		84			8.8
Jun-10	77			15.8	
Jul-10	79			13.8	
Sep-10	77			15.8	
Oct-10	77			15.8	
Nov-10	76			16.8	
Dec-10	78			14.8	
Nov-10	76			16.8	
Dec-10	78			14.8	
Feb-11	72			20.8	
Mar-11	70			22.8	
Jun-11	69			23.8	
Jul-11	70			22.8	
Oct-11	75			17.8	
Dec-11	72			20.8	
Nov-10	76			16.8	
Dec-10	78			14.8	
Feb-11	72			20.8	
Mar-11	70			22.8	
Jun-11	69			23.8	

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	*Well Stand*	*Levels Run*		*92.8*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Jul-11	70			22.8	
Oct-11	75			17.8	
Dec-11	72			20.8	
Jan-12	74			18.8	
Apr-12	72			20.8	
May-12	73			19.8	
Jun-12		85			7.8
Sep-12	83			9.8	
Oct-12	83			9.8	
Nov-12	79			13.8	
Nov-12	79			13.8	
Nov-12	79			13.8	
Nov-12	79			13.8	
Mar-13	71.5			21.3	
Jun-13	78			14.8	
Nov-13	84			8.8	
Mar-14	80			12.8	
Mar-14		97			-4.2
Mar-14	80			12.8	
Mar-14		85			7.8
Mar-14		97			-4.2
Mar-14		97			-4.2
Mar-14		97			-4.2
Mar-14	90			2.8	
Apr-14	89			3.8	
Apr-14		101			-8.2
May-14	93			-0.2	
May-14	95			-2.2	
Jun-14	92			0.8	
Jun-14	92			0.8	
Jun-14	92			0.8	
Jul-14	97			-4.2	
Aug-14	98			-5.2	
Aug-14		110			-17.2
Sep-14	99			-6.2	
Sep-14		109			-16.2
Sep-14		109			-16.2
Sep-14	100.5			-7.7	
Sep-14	100			-7.2	
Sep-14		109			-16.2
Sep-14		109			-16.2
Oct-14		109			-16.2
Oct-14		110			-17.2
Oct-14		109			-16.2
Oct-14		110			-17.2
Oct-14		109			-16.2
Oct-14		110			-17.2
Oct-14		110			-17.2
Oct-14		110			-17.2

92.8	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 2	***Well Stand***	***Levels Run***		***92.8***	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Oct-14		110			-17.2
Oct-14		110			-17.2
Oct-14		110			-17.2
Oct-14		110			-17.2
Nov-14	100			-7.2	
Nov-14	96			-3.2	
Nov-14	93			-0.2	
Nov-14		105			-12.2
Nov-14		106			-13.2
Nov-14	96			-3.2	
Nov-14	96			-3.2	
Nov-14	92			0.8	
Dec-14	90			2.8	
Dec-14	82			10.8	
Dec-14	80			12.8	
Dec-14	85			7.8	
Jan-15	84			8.8	
Jan-15	84			8.8	
Jan-15	83			9.8	
Jan-15	83			9.8	
Feb-15	82			10.8	

95	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 3R	*Well Stand*	*Levels Run*		*95*	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Apr-59	185.5	196.5		-90.5	
Sep-59	200	219		-105	-124
Oct-59	202	222		-107	-127
Nov-59	203			-108	
Dec-59	200			-105	
Jan-60	198			-103	
Feb-60	198	212		-103	-117
Mar-60	197	218		-102	-123
Apr-60	197			-102	
May-60	202	218		-107	-123
Jun-60	202			-107	
Jul-60	202			-107	
Aug-60	204	204		-109	-109
Sep-60	204	204		-109	-109
Oct-60	206			-111	
Nov-60	207			-112	
Dec-60	202			-107	
Jan-61	208			-113	
Feb-61	207			-112	
Mar-61	208	219		-113	-124
Apr-61	208	231		-113	-136
May-61	209	241		-114	-146
Jun-61	216	242		-121	-147
Jul-61	218			-123	
Sep-61	218	248		-123	-153
Oct-61	212	247		-117	-152
Nov-61	205	275		-110	-180
Dec-61	205	275		-110	-180
Jan-62	200			-105	
Feb-62	198			-103	
Mar-62	198			-103	
Apr-62	200			-105	
May-62	198	250		-103	-155
Jun-62	200	244		-105	-149
Jul-62	198	220		-103	-125
Sep-62	198	220		-103	-125
Oct-62	139	220		-44	-125
Nov-62	185			-90	
Dec-62	179			-84	
Jan-63	173			-78	
Feb-63	179			-84	
Mar-63	164			-69	
Apr-63	160	180		-65	-85
May-63	162			-67	
Jun-63	152			-57	
Jul-63	156	174		-61	-79
Aug-63	150			-55	
Sep-63	170	183		-75	-88
Oct-63	174	183		-79	-88

95	*NGVD 1929*	*Measurements from top of sounding hole to water*			
Well 3R	***Well Stand***	***Levels Run***		***95***	
Date	**Well Stand**	**Levels Run**		**Well Stand Elev**	**Levels Run Elev**
Nov-63	173	183		-78	-88
Dec-63	166			-71	
Jan-64	166			-71	
Feb-64	166			-71	
Mar-64	159			-64	
Apr-64	159			-64	
May-64	156	172		-61	-77
Jun-64	155			-60	
Jul-64	155			-60	
Aug-64	154			-59	
Sep-64	164			-69	
Oct-64	168			-73	
Dec-64	158	178		-63	-83
Feb-65	155	170		-60	-75
Mar-65	150	170		-55	-75
Apr-65	163			-68	
May-65	145	160		-50	-65
Jun-65	145	160		-50	-65
Jul-65	174	165		-79	-70
Aug-65	150	167		-55	-72
Sep-65	151	168		-56	-73
Oct-65	153	168		-58	-73
Nov-65	150	168		-55	-73
Dec-65	147			-52	
Jan-66	148	165		-53	-70
Feb-66	140	162		-45	-67
Mar-66	136	152		-41	-57
Apr-66	136	152		-41	-57
May-66	139	152		-44	-57
Jun-66	98	195		-3	-100
Aug-66	144	158		-49	-63
Sep-66	143	163		-48	-68
Nov-66	151	165		-56	-70
Dec-66	145	161		-50	-66
Jan-67	142	160		-47	-65
Feb-67	140			-45	
Mar-67	134	148		-39	-53
Apr-67	134	143		-39	-48
May-67	130	143		-35	-48
Sep-67	132	148		-37	-53
Oct-67	132	145		-37	-50
Nov-67	145	150		-50	-55
Dec-67	135			-40	
Jan-68	143	132		-48	-37
Feb-68	130	144		-35	-49
Apr-68	130	143		-35	-48
May-68	130			-35	
Jun-68	132	142		-37	-47
Dec-03	74.5			20.5	

95	*NGVD 1929*		*Measurements from top of sounding hole to water*		
Well 3R	***Well Stand***	***Levels Run***		***95***	
Date	**Well Stand**	**Levels Run**	**Well Stand Elev**	**Levels Run Elev**	
Mar-04	70	110	25	-15	
Sep-04	81.5		13.5		
Nov-04	82	108	13	-13	
Jan-05	74		21		
Apr-05	77		18		
Jul-05	69.5		25.5		
Aug-05	71.5		23.5		
Oct-05	74		21		
Jan-06	71.5		23.5		
May-06	62.5		32.5		
Jun-06	67.5	98.5	27.5	-3.5	
Jan-07	77		18		
Apr-07	85	110	10	-15	
May-07	72		23		
Jun-07	73	129	22	-34	
Jul-07	90	130	5	-35	
Aug-07	91	135	4	-40	
Sep-07	92	133	3	-38	
Nov-07	86	116	9	-21	
Jan-08	79		16		
Feb-08	75		20		
Mar-08	75		20		
May-08	73		22		
Jul-08	77		18		
Aug-08	90		5		
Sep-08	90		5		
Oct-08	89		6		
Dec-08	84		11		
Dec-08	84		11		
Jan-09	79.5		15.5		
Feb-09	79		16		
Mar-09	77		18		
Apr-09	75		20		
Jun-09	79		16		
Sep-09	85		10		
Oct-09	85.5		9.5		
Dec-09	79		16		
Jan-10	78		17		
Feb-10	75.5		19.5		
Feb-10	75		20		
Mar-10	77		18		
Apr-10	78	97.5	17	-2.5	
May-10	70		25		
Jul-10	80.5		14.5		
Sep-10	79.5		15.5		
Sep-10	78.5		16.5		
Nov-10	77		18		
Dec-10	79		16		
Dec-10	79		16		

95	*NGVD 1929*		*Measurements from top of sounding hole to water*		
Well 3R	***Well Stand***	***Levels***	***Run***	***95***	
Date	**Well Stand**	**Levels**	**Run**	**Well Stand Elev**	**Levels Run Elev**
Feb-11	72			23	
Mar-11	71.5			23.5	
Jun-11	71.5			23.5	
Jul-11	73.5			21.5	
Oct-11	84			11	
Dec-11	73			22	
Dec-10	79			16	
Feb-11	72			23	
Mar-11	71.5			23.5	
Jun-11	71.5			23.5	
Jul-11	73.5			21.5	
Oct-11	84			11	
Dec-11	73			22	
Jan-11	75			20	
Apr-12	74			21	
May-12	76			19	
Sep-12	86			9	
Oct-12	85			10	
Nov-12	79			16	
Dec-11	73			22	
Jan-11	75			20	
Apr-12	74			21	
May-12	76			19	
Sep-12	86			9	
Oct-12	85			10	
Nov-12	79			16	
Mar-13	72			23	
Jun-13	78			17	
Aug-13	79	84		16	11
Nov-13	84			11	
Mar-14	88			7	
Mar-14	88			7	
Mar-14	88			7	
Mar-14	89			6	
Apr-14	92			3	
Jun-14	92			3	
Jun-14	94			1	
Jun-14	94			1	
Jul-14	99			-4	
Sep-14	80			15	
Oct-14	92			3	
Oct-14	105			-10	
Oct-14	104			-9	
Oct-14	104			-9	
Nov-14	98			-3	
Nov-14	98			-3	
Nov-14	95			0	
Nov-14	92			3	
Dec-14	91			4	

95	*NGVD 1929*		*Measurements from top of sounding hole to water*				
Well 3R	*Well*	*Stand*	*Levels*	*Run*	*95*		
Date	**Well**	**Stand**	**Levels**	**Run**	**Well Stand Elev**	**Levels**	**Run Elev**
Dec-14	89				6		
Dec-14	85				10		
Dec-14	88				7		
Jan-15	86				9		
Jan-15	85				10		
Jan-15	83				12		
Jan-15	83				12		
Feb-14	83				12		

105 ***NGVD 1929*** ***Measurements from top of sounding hole to water***

Well 4R ***Well Stand*** ***Levels Run*** ***105***

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Dec-03	84		21	
Mar-04	80		25	
Oct-04		150		-45
Nov-04	92	150	13	-45
Jan-05	79	149.9	26	-44.9
Apr-05	76	153	29	-48
Jun-05		125		-20
Jul-05	79	119	26	-14
Aug-05	81		24	
Oct-05	84		21	
Jan-06	81.5		23.5	
Jun-06	81		24	
Aug-06	81		24	
Nov-06	81		24	
Jan-07	86		19	
Apr-07	86	120	19	-15
May-07	85		20	
Jun-07	97	138	8	-33
Jul-07	98	145	7	-40
Aug-07		147		-42
Sep-07	100	141	5	-36
Oct-07	108	142	-3	-37
Nov-07	96	134	9	-29
Dec-07		133		-28
Jan-08	106		-1	
May-08	83		22	
Jul-08	86		19	
Aug-08	99		6	
Sep-08	109		-4	
Oct-08	99		6	
Dec-08	90		15	
Dec-08	90		15	
Jan-09	90		15	
Jan-09	89		16	
Jan-09	90		15	
Jan-09	90		15	
Jan-09	90		15	
Jan-09	90		15	
Feb-09	89		16	
Mar-09	85		20	
Apr-09	85		20	
May-09	88		17	
Jun-09	90		15	
Sep-09	95		10	
Oct-09	95		10	
Dec-09	89		16	
Jan-10	90		15	
Jan-10	89		16	

105 ***NGVD 1929*** ***Measurements from top of sounding hole to water***

Well 4R ***Well Stand*** ***Levels Run*** ***105***

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Feb-10	88		17	
Mar-10		124		-19
Mar-10		122		-17
Mar-10		125		-20
Apr-10		125		-20
Apr-10		124		-19
Apr-10		125		-20
Apr-10		125		-20
May-10	80		25	
Jun-10	94		11	
Jun-10		129		-24
Jun-10		127		-22
Jun-10		124		-19
Jul-10	93		12	
Sep-10	92		13	
Oct-10	91		14	
Oct-10		122		-17
Nov-10	90		15	
Nov-10		128		-23
Dec-10	88		17	
Jan-11	83		22	
Feb-11	80		25	
Mar-11	84		21	
Jun-11	85		20	
Aug-11	82		23	
Aug-11		139		-34
Aug-11		143		-38
Aug-11		117		-12
Aug-11		117		-12
Aug-11		117		-12
Oct-11	87	106	18	-1
Oct-11		99		6
Dec-11	76		29	
Jan-12		113		-8
Jan-12		111		-6
Jan-12		115		-10
Jan-12		116		-11
Jan-12		111		-6
Jan-12	78		27	
Feb-12		112		-7
Feb-12		111		-6
Feb-12		111		-6
Feb-12		95		10
Mar-12		108		-3
Mar-12		110		-5
Mar-12		109		-4
Apr-12	76		29	
May-12	85		20	

105	*NGVD 1929*	*Measurements from top of sounding hole to water*		
Well 4R	*Well Stand*	*Levels Run*	*105*	

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Jun-12		95		10
Sep-12		124		-19
Oct-12	89		16	
Nov-12	88		17	
Mar-13	81		24	
May-13		105		0
Jun-13	87		18	
Nov-13	94		11	
Jan-14		125		-20
Jan-14		125		-20
Jan-14		120		-15
Jan-14		120		-15
Jan-14	99	120	6	-15
Mar-14	99		6	
Mar-14	99		6	
Mar-14	99		6	
Apr-14	95		10	
Apr-14		122		-17
Apr-14		122		-17
Apr-14	100		5	
May-14				
May-14				
May-14		125		-20
May-14		126		-21
May-14		125		-20
May-14		127		-22
May-14		128		-23
May-14		127		-22
May-14		127		-22
May-14		135		-30
Jun-14	103		2	
Jun-14		136		-31
Jun-14		136		-31
Jun-14		138		-33
Jun-14		138		-33
Jul-14		139		-34
Jul-14		133		-28
Jul-14		141		-36
Aug-14		135		-30
Aug-14		142		-37
Aug-14		142		-37
Aug-14		143		-38
Sep-14		141		-36
Sep-14		141		-36
Sep-14		145		-40
Sep-14	117	137	-12	-32
Sep-14	113		-8	
Sep-14	113		-8	

105 ***NGVD 1929*** ***Measurements from top of sounding hole to water***

Well 4R ***Well Stand*** ***Levels Run*** ***105***

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Oct-14		141		-36
Oct-14		142		-37
Oct-14		142		-37
Oct-14		142		-37
Oct-14		145		-40
Oct-14		143		-38
Oct-14		144		-39
Oct-14		143		-38
Oct-14		145		-40
Oct-14		142		-37
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Oct-14		142		-37
Oct-14		142		-37
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Oct-14		143		-38
Nov-14	115		-10	
Nov-14	96		9	
Nov-14	103		2	
Nov-14	107		-2	
Nov-14	104		1	
Nov-14	102		3	
Dec-14	100		5	
Dec-14	101		4	
Dec-14	97		8	
Jan-15	93		12	
Jan-15	84		21	
Jan-15	93		12	
Jan-15	93		12	
Feb-15	85		20	

53 NGVD 1929 Measurements from top of sounding hole to water

Well 5 53

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Jun-58	147	156	-94	-103
Jul-58	161	181	-108	-128
Sep-58	148		-95	
Oct-58	147		-94	
Nov-58	146		-93	
Dec-58	146		-93	
Jan-59	145.5		-92.5	
Apr-59	159.5	179.5	-106.5	-126.5
Jan-60	165		-112	
Feb-60	161		-108	
Mar-60	161		-108	
Apr-60	163		-110	
May-60	162	198	-109	-145
Jun-60	200	247	-147	-194
Jul-60	195		-142	
Aug-60	218		-165	
Sep-60		246		-193
Oct-60	180		-127	
Nov-60	179	230	-126	-177
Dec-60	178		-125	
Jan-61	170		-117	
Feb-61	169		-116	
Mar-61	170		-117	
Apr-61	174		-121	
May-61	172		-119	
Jun-61	200		-147	
Jul-61	195	230	-142	-177
Aug-61	218	260	-165	-207
Sep-61		254		-201
Oct-61	179	224	-126	-171
Nov-61	179	230	-126	-177
Dec-61	177		-124	
Jan-62	177	175	-124	-122
Feb-62	175	173	-122	-120
Mar-62	175		-122	
Apr-62	175	250	-122	-197
May-62	177		-124	
Jun-62	177	232	-124	-179
Jul-62	175		-122	
Aug-62	159		-106	
Sep-62	153	200	-100	-147
Oct-62	150		-97	
Nov-62	150	200	-97	-147
Dec-62	140	195	-87	-142
Jan-63	140	190	-87	-137
Feb-63		195		-142
Mar-63	135	190	-82	-137
Apr-63	130	190	-77	-137
May-63		194		-141

53 ***NGVD 1929*** ***Measurements from top of sounding hole to water***

Well 5 ***53***

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Jun-63		198		-145
Jul-63		198		-145
Aug-63		200		-147
Sep-63	135	184	-82	-131
Oct-63	135	190	-82	-137
Nov-63	115	190	-62	-137
Dec-63	115	194	-62	-141
Jan-64	112	195	-59	-142
Feb-64	198	196	-145	-143
Mar-64	114	196	-61	-143
Apr-64		196		-143
May-64	115	196	-62	-143
Jun-64		192		-139
Jul-64		198		-145
Aug-64	110	196	-57	-143
Sep-64		195		-142
Oct-64		192		-139
Nov-64		193		-140
Dec-64	110	194	-57	-141
Jan-65	104	194	-51	-141
Feb-65	105	194	-52	-141
Mar-65		187		-134
Apr-65	97	185	-44	-132
May-65	186		-133	
Jun-65	100	185	-47	-132
Jul-65	100	193	-47	-140
Aug-65	100	192	-47	-139
Sep-65	103	192	-50	-139
Oct-65	108	215	-55	-162
Nov-65	100	200	-47	-147
Dec-65	95	184	-42	-131
Jan-66	95	183	-42	-130
Feb-66	95	186	-42	-133
Mar-66	95	188	-42	-135
Apr-66	95	196	-42	-143
May-66	95	192	-42	-139
Jun-66	95	194	-42	-141
Jul-66	95	195	-42	-142
Aug-66	95	195	-42	-142
Sep-66	95	195	-42	-142
Oct-66	95	195	-42	-142
Nov-66	95		-42	
Dec-66	95	195	-42	-142
Jan-67	95		-42	
Feb-67	95	195	-42	-142
Mar-67	95		-42	
Apr-67	95		-42	
May-67		200		-147
Jun-67	92	197	-39	-144

53 ***NGVD 1929*** ***Measurements from top of sounding hole to water***

Well 5 ***53***

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Jul-67		200		-147
Aug-67	90	200	-37	-147
Sep-67		205		-152
Oct-67	90	212	-37	-159
Nov-67	90	195	-37	-142
Dec-67	90		-37	
Jan-68	90	195	-37	-142
Feb-68	90		-37	
Mar-68	90	195	-37	-142
Apr-68	90	195	-37	-142
May-68		200		-147
Jun-68		210		-157
Jul-68		210		-157
Aug-68		200		-147
Sep-68		210		-157
Oct-68		185		-132
Nov-68	92	203	-39	-150
Dec-68		205		-152
Jan-69		223		-170
Feb-69				
Mar-69		221		-168
Apr-69		215		-162
May-69		212		-159
Jun-69		210		-157
Aug-69		210		-157
Sep-69		210		-157
Nov-69		212		-159
Dec-69		220		-167
Jan-70		220		-167
Feb-70		225		-172
Jun-70		228		-175
Jul-70		220		-167
Sep-70		220		-167
Oct-70	90	230	-37	-177
Mar-85	28		25	
Apr-85	27.5		25.5	
May-85	29		24	
Jun-85	29		24	
Oct-85	34		19	
Nov-85	34		19	
Mar-86	32.5		20.5	
Apr-86	31		22	
May-86	28		25	
Jun-86	28		25	
Jul-86	28		25	
Aug-86	29		24	
Nov-86	31		22	
Dec-86	31		22	
Mar-87	31		22	

53 NGVD 1929 Measurements from top of sounding hole to water

Well 5 53

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Apr-87	31		22	
Jun-87	31		22	
Jul-87	30		23	
Aug-87	31		22	
Oct-87	34		19	
Nov-87	34		19	
Feb-88	32		21	
May-88	35		18	
Jun-88	36.5	148	16.5	-95
Jul-88		150		-97
Aug-88		150		-97
Sep-88		165		-112
Oct-88		183		-130
Nov-88		177		-124
Dec-88		170		-117
Jan-89	58		-5	
Mar-89	57		-4	
May-89	45	220	8	-167
Jan-95	41.5		11.5	
Apr-96	31		22	
Jun-96	32		21	
Oct-97	39		14	
Oct-01		151		-98
May-02	32		21	
Jun-02	37		16	
Jul-02		131.5		-78.5
Oct-03		112		-59
Dec-03	36		17	
Mar-04	32		21	
Sep-04		117		-64
Feb-05	30		23	
Jul-05	29		24	
Aug-05	30		23	
Oct-05	32		21	
Jan-06	32		21	
May-06	25.5		27.5	
Jun-06	26.5		26.5	
Jan-07	29.5		23.5	
Feb-07	44		9	
May-07	32	131	21	-78
Jul-07	44	129	9	-76
Sep-07		151.5		-98.5
Oct-07	51	150.5	2	-97.5
May-08	34		19	
Jul-08	32		21	
Aug-08	43		10	
Jan-09	36		17	
Mar-09	35		18	
Apr-09	35.2		17.8	

53 NGVD 1929 Measurements from top of sounding hole to water

Well 5 53

Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Sep-09	42		11	
Oct-09	43		10	
Dec-09	40		13	
Dec-09	40		13	
Jan-10	38		15	
Jan-10	38		15	
Feb-10	36		17	
Mar-10	36		17	
Jul-10	38		15	
Oct-10	38		15	
Nov-10	37		16	
Dec-10	37		16	
Nov-10	37		16	
Dec-10	37		16	
Feb-11	33		20	
Mar-11	32.5		20.5	
Jun-11	31		22	
Jul-11	35		18	
Oct-11	36		17	
Dec-11	34.5		18.5	
Jan-12	35		18	
Apr-12	35		18	
May-12	35		18	
Jun-12	37		16	
Sep-12	43		10	
Oct-12	44		9	
Nov-12	41		12	
Nov-12	41		12	
Nov-12	41		12	
Mar-13	34.5		18.5	
Jun-13	48		5	
Nov-13	47		6	
Mar-14	57		-4	
Mar-14		105		-52
Mar-14		113		-60
Mar-14		113		-60
Apr-14	43		10	
Apr-14		114		-61
Apr-14	84		-31	
May-14	50		3	
Jun-14		117		-64
Jun-14		120		-67
Jul-14	52	52	1	1
Dec-14	51	51	2	2
Dec-14	50	50	3	3
Dec-14	51	51	2	2
Jan-14	48		5	
Jan-15	42		11	
Jan-15	46		7	

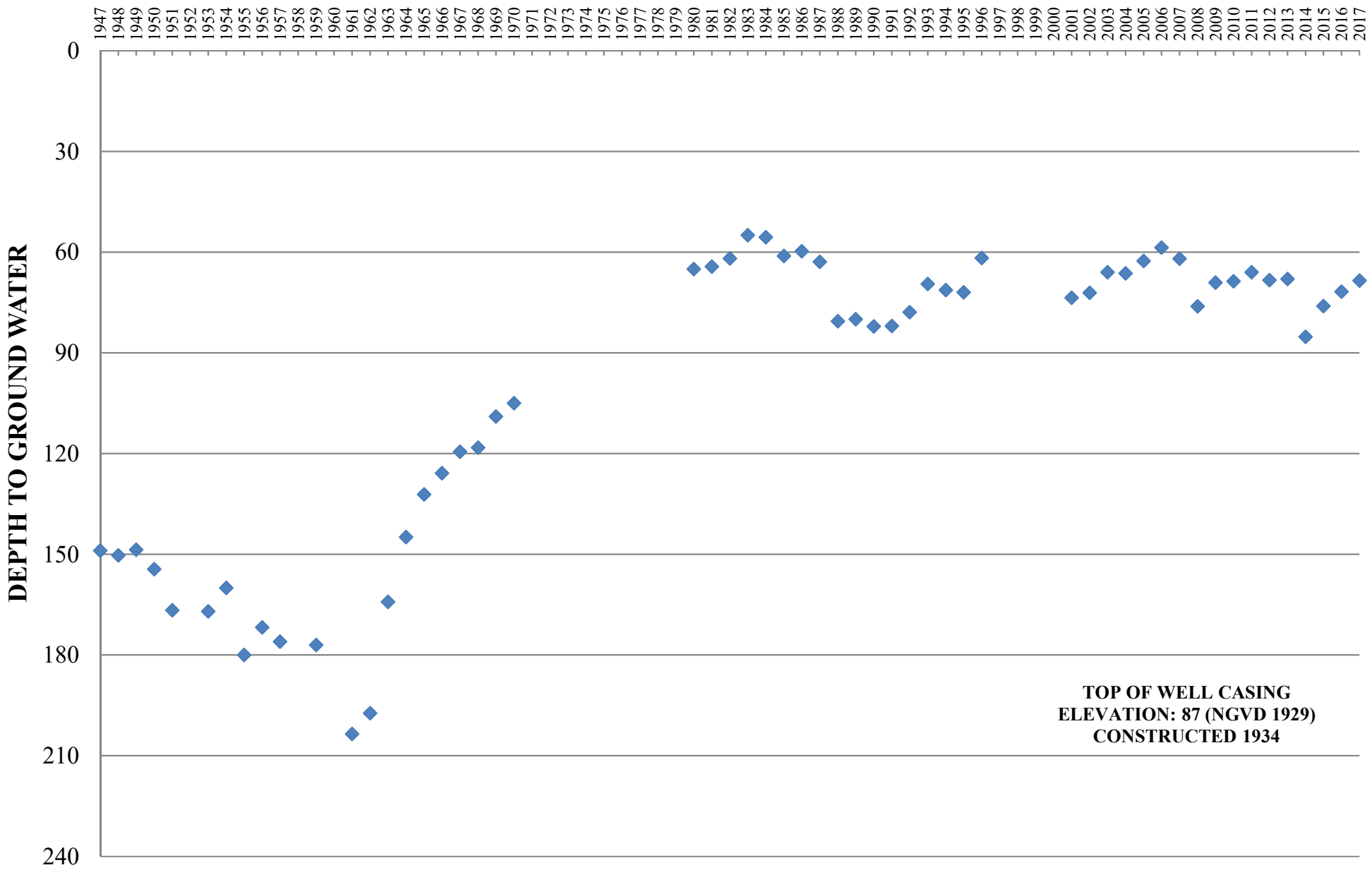
53 ***NGVD 1929*** ***Measurements from top of sounding hole to water***

Well 5 ***53***

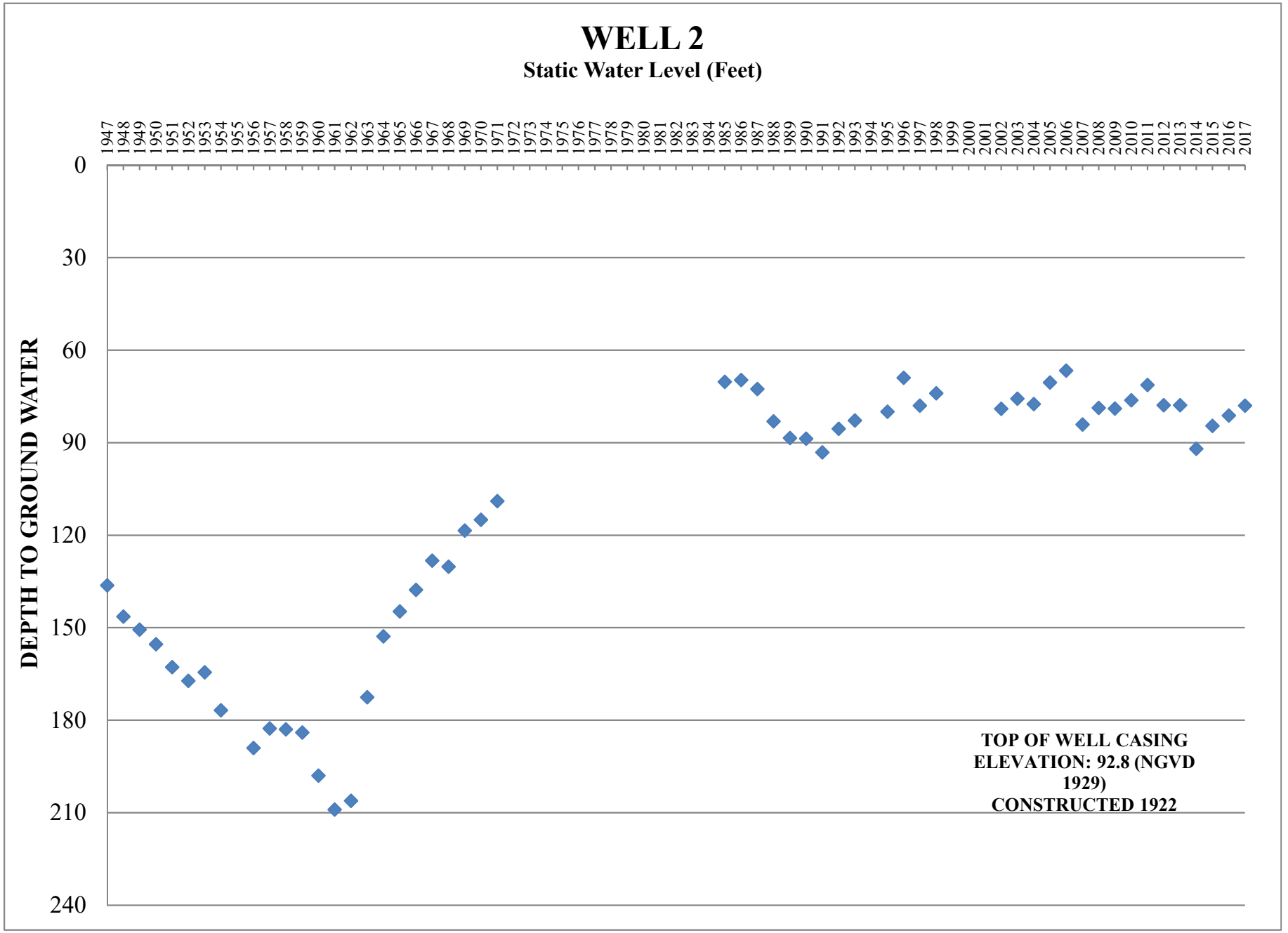
Date	Well Stand	Levels Run	Well Stand Elev	Levels Run Elev
Jan-15	45.5		7.5	
Feb-15	46		7	

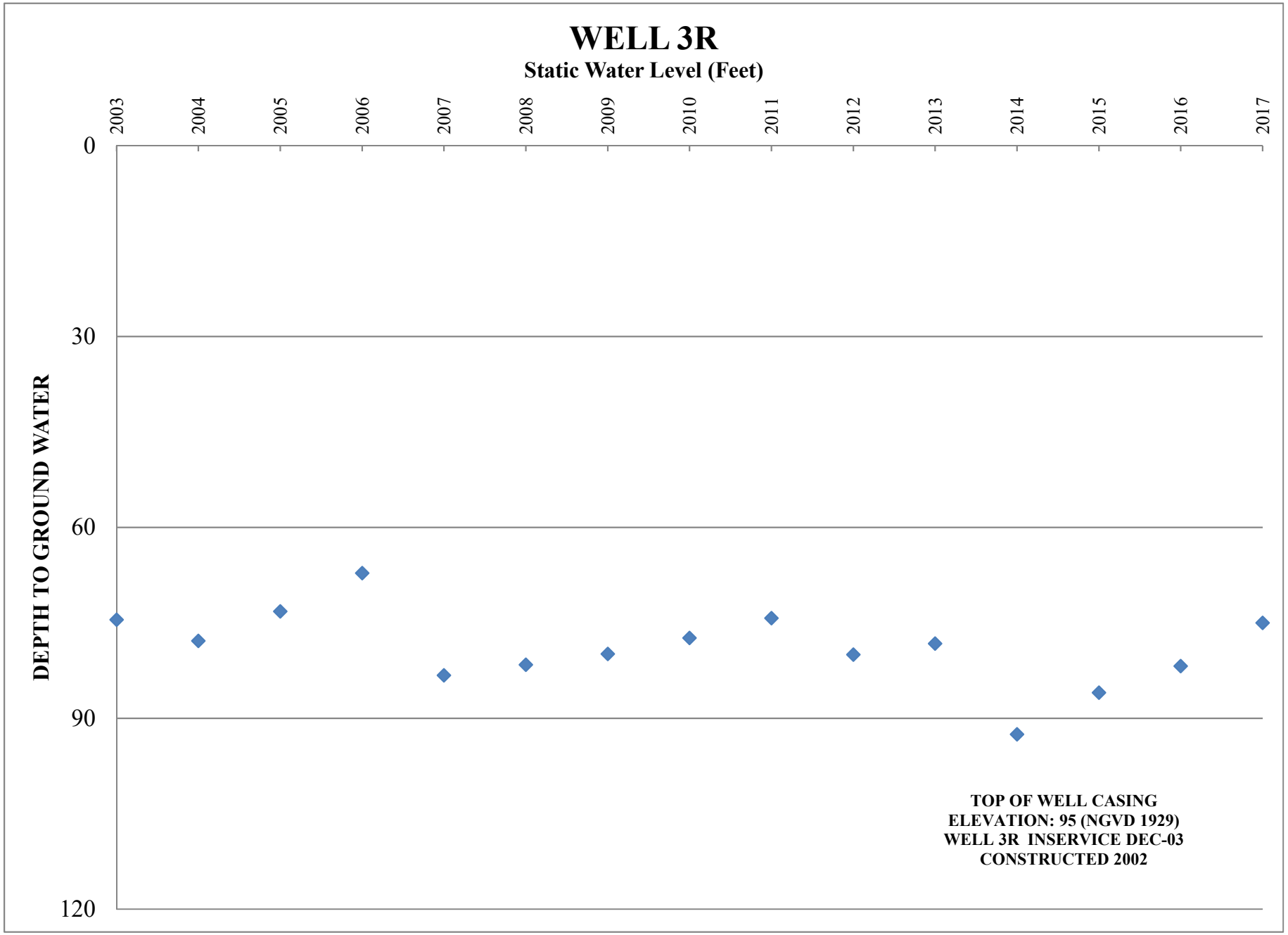
WELL 1

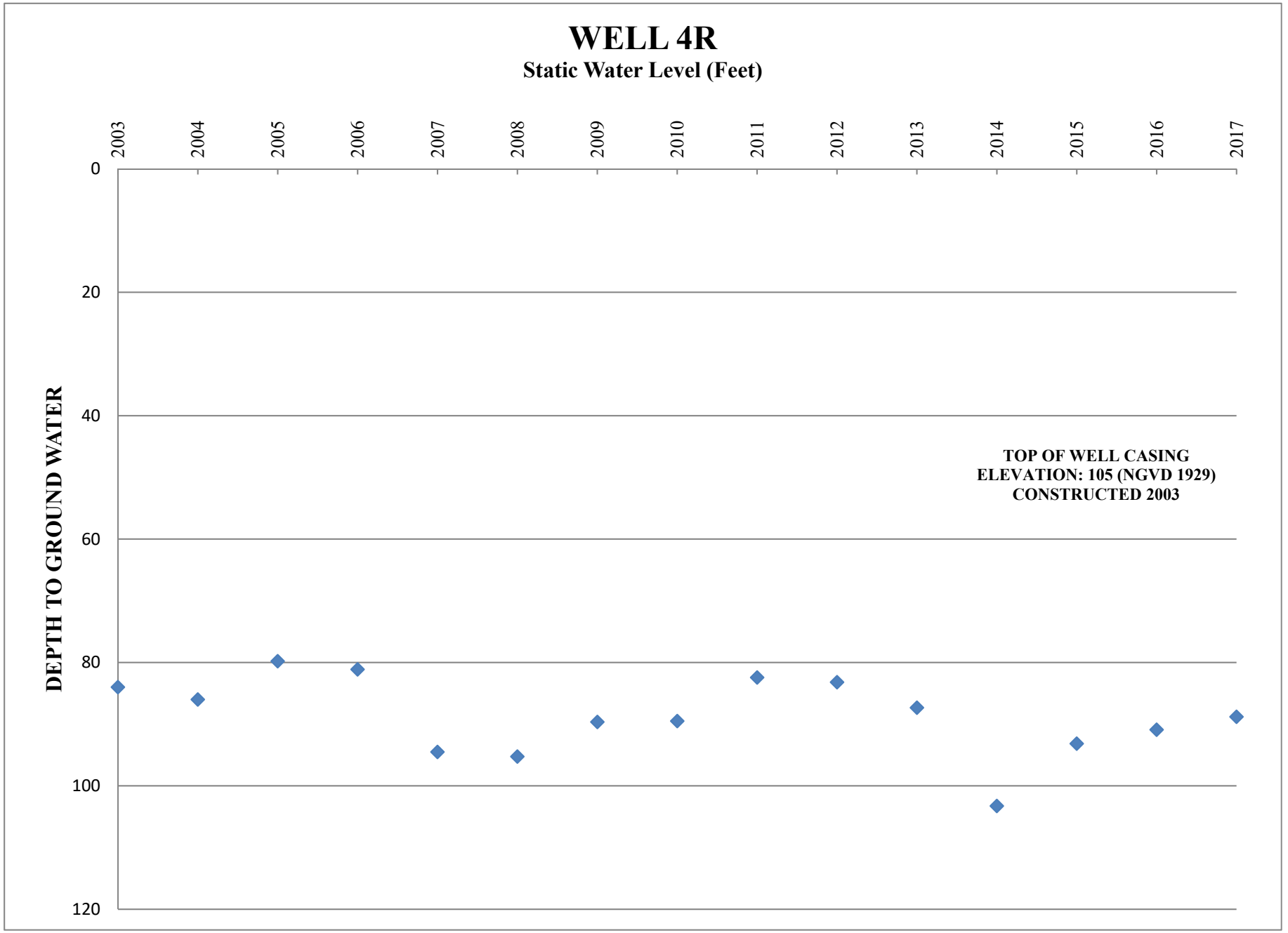
Static Water Level (Feet)

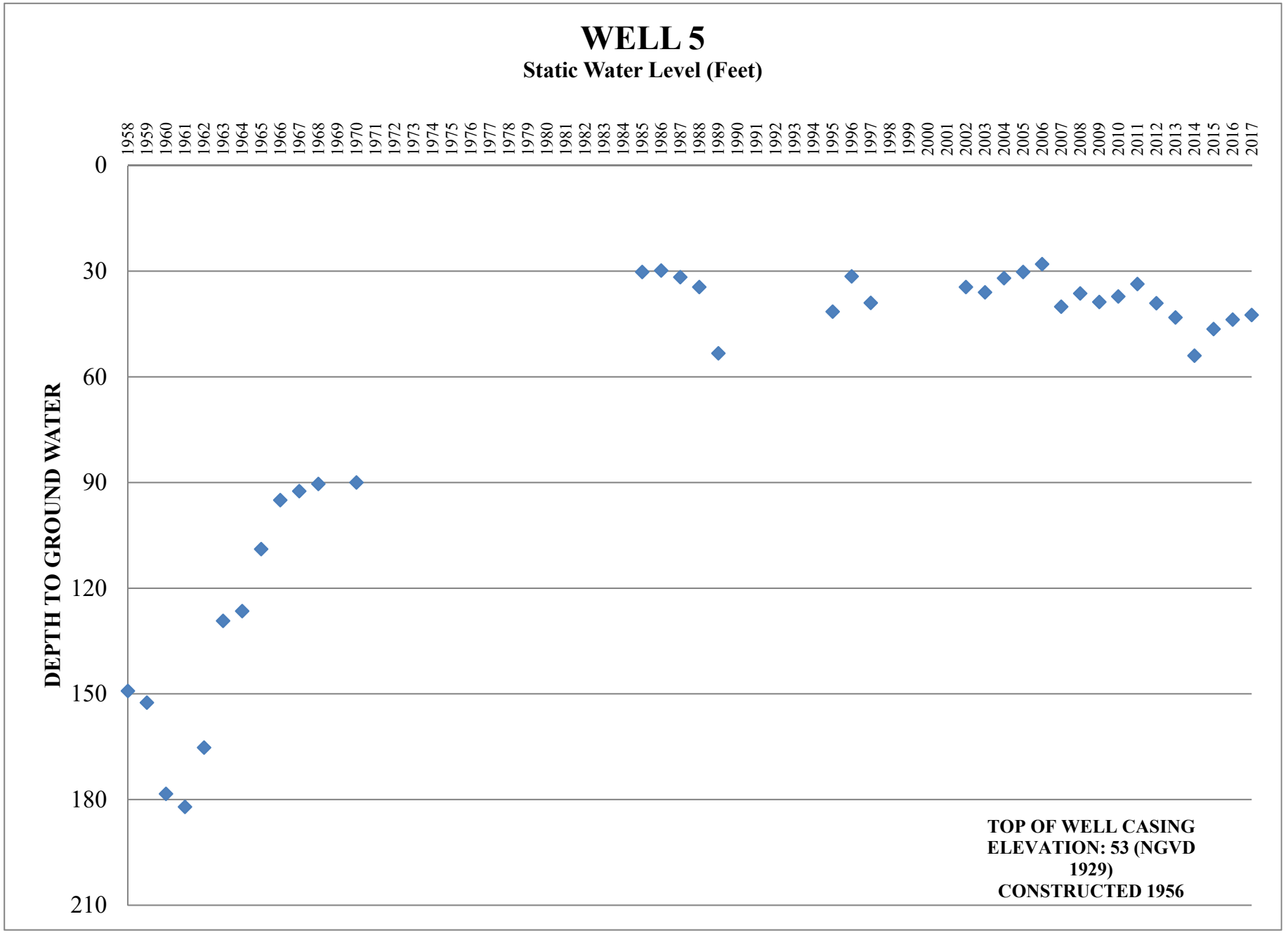


7/9/2018


WELL 2
Static Water Level (Feet)
DEPTH TO GROUND WATER
0
30
60
90
120
150
180
210
240
1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
TOP OF WELL CASING ELEVATION: 92.8 (NGVD 1929)
CONSTRUCTED 1922


WELL 3R
Static Water Level (Feet)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
0
30
60
90
120
DEPTH TO GROUND WATER
TOP OF WELL CASING
ELEVATION: 95 (NGVD 1929)
WELL 3R INSERVICE DEC-03
CONSTRUCTED 2002


WELL 4R
Static Water Level (Feet)
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
0
20
40
60
80
100
120
DEPTH TO GROUND WATER
TOP OF WELL CASING
ELEVATION: 105 (NGVD 1929)
CONSTRUCTED 2003


WELL 5
Static Water Level (Feet)
DEPTH TO GROUND WATER
0
30
60
90
120
150
180
210
1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017
TOP OF WELL CASING ELEVATION: 53 (NGVD 1929)
CONSTRUCTED 1956

WELL 1 DATA

FROM ORIGINAL DATA- FILTERED	
Average of Well Stand	
Date	Total
2014	85.26
Grand Total	**85.26**

ALL YEARS	
YEARS	AVERAGE OF WELL STAND
1947	148.95
1948	150.33
1949	148.67
1950	154.43
1951	166.67
1952	
1953	167.00
1954	160.00
1955	180.00
1956	171.75
1957	176.00
1958	
1959	177.00
1960	
1961	203.50
1962	197.33
1963	164.20
1964	144.91
1965	132.20
1966	125.83
1967	119.50
1968	118.25
1969	109.00
1970	105.00
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	65.10
1981	64.33
1982	61.92

ALL YEARS	
YEARS	AVERAGE OF WELL STAND
1983	55.00
1984	55.60
1985	61.14
1986	59.72
1987	62.89
1988	80.63
1989	80.00
1990	82.13
1991	82.00
1992	77.90
1993	69.50
1994	71.33
1995	72.00
1996	61.75
1997	
1998	
1999	
2000	
2001	73.63
2002	72.13
2003	66.00
2004	66.33
2005	62.63
2006	58.67
2007	62.00
2008	76.17
2009	69.13
2010	68.67
2011	66.00
2012	68.33
2013	68.00
2014	85.26
2015	76.08
2016	71.76
2017	68.52

2015 Average Updated (Jan-Oct)			
2015 Updated Numbers			
1	2015	Jan-15	74
1	2015	Jan-15	75
1	2015	Jan-15	74
1	2015	Jan-15	74
2	2015	Feb-15	75
2	2015	Feb-15	73
2	2015	Feb-15	74
3	2015	Mar-15	74
3	2015	Mar-15	74
4	2015	Apr-15	75
4	2015	Apr-15	78
4	2015	Apr-15	80
6	2015	Jun-15	74
7	2015	Jul-15	75
7	2015	Jul-15	74
7	2015	Jul-15	75
7	2015	Jul-15	75
8	2015	Aug-15	76
8	2015	Aug-15	75
9	2015	Sep-15	74
9	2015	Sep-15	76
9	2015	Sep-15	78
9	2015	Sep-15	83
10	2015	Oct-15	84
10	2015	Oct-15	84
11	2015	11/17/2015	78
11	2015	11/25/2015	77
11	2015	11/25/2015	77
12	2015	12/1/2015	76.7
12	2015	12/8/2015	75.9
12	2015	12/15/2015	74.8
12	2015	12/24/2015	74.3
12	2015	12/29/2015	74.1
	2015 AVERAGE TOTAL		**76.08**

WELL 1 DATA

2014 DATA

Date	Well Stand
3/10/2014	80
3/13/2014	80
3/20/2014	80
3/24/2014	82
4/15/2014	80
5/12/2014	84
5/20/2014	84
6/16/2014	84
6/19/2014	84
9/15/2014	92
9/25/2014	91
10/7/2014	93
10/13/2014	92
10/21/2014	92
10/27/2014	92
11/1/2014	93
11/3/2014	86
11/11/2014	84
11/13/2014	88
12/1/2014	84
12/8/2014	83
12/15/2014	79
12/30/2014	74
	85.26

Removal	
9/18/2014	97
9/22/2014	98
9/19/2014	98
11/17/2014	95
11/12/2014	93
11/24/2014	92

2016 DATA

Month	Year	Static Depth to Water		
1	2016	1/5/2016	73	June 2016 Update
1	2016	1/12/2016	73	
1	2016	1/19/2016	72	
1	2016	1/26/2016	72	
2	2016	2/2/2016	71.5	
2	2016	2/9/2016	71.5	
2	2016	2/16/2016	71	
2	2016	2/23/2016	70.5	
3	2016	3/1/2016	71	
3	2016	3/15/2016	70	
3	2016	3/22/2016	69	
3	2016	3/29/2016	69	
4	2016	4/5/2016	69	
4	2016	4/14/2016	70	
4	2016	4/19/2016	68.8	
4	2016	04/27/2016 05:45	69	
5	2016	05/11/2016 13:20	68	
5	2016	05/24/2016 10:05	68.4	
5	2016	05/31/2016	69	2/2/17 Update
6	2016	06/08/2016 09:50	64	
6	2016	06/21/2016 13:00	69	
6	2016	06/28/2016 13:55	79.9	
7	2016	07/05/2016 12:30	70.6	
7	2016	07/12/2016 08:35	70.5	
7	2016	07/26/2016 11:30	71	
8	2016	08/02/2016 09:00	71.8	
8	2016	08/09/2016 15:10	71.1	
8	2016	08/16/2016 14:45	73	
8	2016	08/30/2016 12:45	77	
9	2016	09/06/2016 11:15	78	
9	2016	09/13/2016 09:15	78	
9	2016	09/28/2016 10:55	79.8	
11	2016	11/08/2016 09:25	78.3	
11	2016	11/14/2016 11:55	78.9	
11	2016	11/22/2016 08:00	77	
11	2016	11/29/2016 09:00	73.6	
12	2016	12/13/2016	73	
12	2016	12/20/2016 12:30	73	
12	2016	12/26/2016 11:10	71.9	
		2016 Average	**72.18**	

2017 DATA

Month	Year	Static Depth to Water		
1	2017	01/03/2017 12:10	69	2/2/17 Update
1	2017	01/10/2017 09:15	68.2	
1	2017	01/17/2017	69.2	
1	2017	01/24/2017 11:00	68.5	
1	2017	01/31/2017 14:00	67.7	
		2017 Average	**68.52**	

WELL 2 DATA

FROM ORIGINAL DATA- FILTERED	
Date	Average of Well Stand
1947	136.25
1948	146.38
1949	150.64
1950	155.33
1951	162.80
1952	167.20
1953	164.45
1954	176.75
1956	189.00
1957	182.67
1958	183.00
1959	184.00
1960	198.00
1961	209.00
1962	206.13
1963	172.58
1964	152.83
1965	144.71
1966	137.75
1967	128.25
1968	130.20
1969	118.50
1970	115.00
1971	109.00
1985	70.29
1986	69.69
1987	72.63
1988	83.10
1989	88.50
1990	88.75
1991	93.13
1992	85.50
1993	82.80
1995	80.00
1996	69.00
1997	78.00
1998	74.00
2002	79.00
2003	75.75
2004	77.50
2005	70.50
2006	66.67
2007	84.13
2008	78.75
2009	78.95
2010	76.23
2011	71.33
2012	77.89
2013	77.83
2014	91.98
2015	83.20
Grand Total	**121.02**

ALL YEARS	
YEARS	AVERAGE OF WELL STAND
1947	136.25
1948	146.38
1949	150.64
1950	155.33
1951	162.80
1952	167.20
1953	164.45
1954	176.75
1955	
1956	189.00
1957	182.67
1958	183.00
1959	184.00
1960	198.00
1961	209.00
1962	206.13
1963	172.58
1964	152.83
1965	144.71
1966	137.75
1967	128.25
1968	130.20
1969	118.50
1970	115.00
1971	109.00
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	
1981	
1982	
1983	
1984	
1985	70.29
1986	69.69
1987	72.63
1988	83.10
1989	88.50
1990	88.75
1991	93.13
1992	85.50
1993	82.80
1994	
1995	80.00
1996	69.00
1997	78.00

ALL YEARS	
YEARS	AVERAGE OF WELL
1998	74.00
1999	
2000	
2001	
2002	79.00
2003	75.75
2004	77.50
2005	70.50
2006	66.67
2007	84.13
2008	78.75
2009	78.95
2010	76.23
2011	71.33
2012	77.89
2013	77.83
2014	91.98
2015	84.55
2016	81.18
2017	77.99

2015 Average Updated (Jan-Oct)			
2015 Updated Numbers			
1	2015	Jan-15	84
1	2015	Jan-15	84
1	2015	Jan-15	83
1	2015	Jan-15	83
2	2015	Feb-15	82
2	2015	Feb-15	82
2	2015	Feb-15	82
3	2015	Mar-15	82
3	2015	Mar-15	82
3	2015	Mar-15	82
3	2015	Mar-15	86
4	2015	Apr-15	86
4	2015	Apr-15	87
4	2015	Apr-15	87
4	2015	Apr-15	80
5	2015	May-15	88
6	2015	Jun-15	88
6	2015	Jun-15	84
6	2015	Jun-15	84
6	2015	Jun-15	83
6	2015	Jun-15	83
7	2015	Jul-15	84
7	2015	Jul-15	82
7	2015	Jul-15	82
7	2015	Jul-15	85
8	2015	Aug-15	86
8	2015	Aug-15	88
9	2015	Sep-15	87
9	2015	Sep-15	82
9	2015	Sep-15	83
9	2015	Sep-15	88
10	2015	Oct-15	92
11	2015	11/03/2015	89
11	2015	11/17/2015	87
11	2015	11/25/2015	86.6
12	2015	12/1/2015	85.4
12	2015	12/8/2015	84.2
12	2015	12/15/2015	83.7
12	2015	12/24/2015	82.7
12	2015	12/29/2015	82.5
		2015 AVERAGE TOTAL	**84.55**

WELL 2 DATA

Jun 2016 Update				
Month	Year	Static Depth to Water		
1	2016	1/5/2016	82	
1	2016	1/12/2016	82	
1	2016	1/19/2016	81	
1	2016	1/26/2016	81	
1	2016	1/28/2016	81.5	
2	2016	2/2/2016	80	
2	2016	2/9/2016	79.5	
2	2016	2/16/2016	80	
2	2016	2/23/2016	79	
3	2016	3/1/2016	80	
3	2016	3/8/2016	81	
3	2016	03/15/2016	79	
3	2016	3/22/2016	78	
3	2016	3/29/2016	77	
4	2016	4/5/2016	77.5	
4	2016	4/14/2016	77.5	
4	2016	4/19/2016	76.7	
4	2016	04/27/2016 05:30	77	
5	2016	05/11/2016 13:05	77	
5	2016	05/24/2016 10:20	76.3	
5	2016	05/31/2016	77	Updated 2/6/17
6	2016	06/08/2016 10:03	78	
6	2016	06/21/2016 12:45	78	
6	2016	06/28/2016 13:40	78.9	
7	2016	07/05/2016 12:45	79	
7	2016	07/12/2016 08:50	79.4	
7	2016	07/14/2016 09:15	79.5	
7	2016	07/26/2016 11:15	80	
8	2016	08/02/2016 09:10	80.3	
8	2016	08/09/2016 15:20	81.1	
8	2016	08/16/2016 14:30	81.5	
8	2016	08/23/2016 11:40	84.7	
8	2016	08/30/2016 13:00	87	
9	2016	09/06/2016 12:00	87	
9	2016	09/13/2016 09:25	87	
10	2016	10/04/2016 13:20	88.7	
10	2016	10/18/2016 12:30	89	
10	2016	10/25/2016 09:40	88.7	
11	2016	11/08/2016 09:35	85.9	
11	2016	11/15/2016 09:20	88.5	
11	2016	11/22/2016 08:10	85	
11	2016	11/29/2016 09:10	83.3	
12	2016	12/13/2016	81.25	
12	2016	12/20/2016 14:15	81	
12	2016	12/26/2016 11:00	80.4	
		2016 Average	**81.18**	

2017 DATA			
Month	Year	Static Depth to Water	
1	2017	01/03/2017 12:20	79.5
1	2017	01/10/2017 09:00	78.6
1	2017	01/17/2017	78.1
1	2017	01/24/2017 10:50	77.25
1	2017	01/31/2017 13:55	76.5
		2017 Average	**77.99**

WELL 3R DATA

Date	Average of Well Stand
2003	74.50
2004	77.83
2005	73.20
2006	67.17
2007	83.25
2008	81.60
2009	79.88
2010	77.38
2011	74.27
2012	80.00
2013	78.25
2014	92.52
2015	85.99
2016	81.80
2017	75.00

2015 Updated (Jan-Oct)			
2015 Updated Numbers			
1	2015	Jan-15	86
1	2015	Jan-15	85
1	2015	Jan-15	83
1	2015	Jan-15	83
2	2014	Feb-14	83
8	2015	Aug-15	82
2	2015	Feb-15	82
3	2015	Mar-15	85
3	2015	Mar-15	85
3	2015	Mar-15	82
5	2015	May-15	91
5	2015	May-15	91
5	2015	May-15	92
6	2015	Jun-15	90
6	2015	Jun-15	86
6	2015	Jun-15	84
6	2015	Jun-15	83
6	2015	Jun-15	83
7	2015	Jul-15	84
7	2015	Jul-15	84
7	2015	Jul-15	84
7	2015	Jul-15	83
8	2015	Aug-15	86
8	2015	Aug-15	83
9	2015	Sep-15	84
9	2015	Sep-15	82
9	2015	Sep-15	83
9	2015	Sep-15	95
10	2015	Oct-15	98
10	2015	10/13/2015	98
11	2015	11/03/2015	90
11	2015	11/17/2015	87
11	2015	11/25/2015	87
12	2015	12/1/2015	86
12	2015	12/8/2015	84.6
12	2015	12/15/2015	84.6
12	2015	12/24/2015	84.8
12	2015	12/29/2015	83.5
		2015 Average	**85.99**

WELL 3R DATA

June 2016 Update				
Month	**Year**	**Static Depth to Water**		
1	2016	1/5/2016	83	ft
1	2016	1/12/2016	82	ft
1	2016	1/19/2016	81	ft
1	2016	1/26/2016	81	ft
1	2016	1/28/2016	81.5	ft
2	2016	2/2/2016	80	ft
2	2016	2/9/2016	92	ft
2	2016	2/16/2016	91	ft
2	2016	2/23/2016	80	ft
3	2016	3/1/2016	82	ft
3	2016	3/8/2016	82	ft
3	2016	3/22/2016	79	ft
3	2016	3/29/2016	79	ft
4	2016	4/5/2016	78	ft
4	2016	4/14/2016	77.5	ft
4	2016	4/19/2016	77.1	ft
4	2016	04/27/2016 05:15	77.5	ft
5	2016	05/11/2016 12:45	77	ft
5	2016	05/31/2016	77	2/2/17 Update
6	2016	06/08/2016 10:35	78	
6	2016	06/21/2016 12:20	78	
7	2016	07/05/2016 13:30	79	
7	2016	07/12/2016 09:30	77.1	
7	2016	07/26/2016 11:00	80	
8	2016	08/02/2016 09:30	76.9	
8	2016	08/09/2016 15:40	81	
8	2016	08/16/2016 14:00	82	
8	2016	08/23/2016 11:00	84	
9	2016	09/06/2016 10:45	90	
9	2016	09/13/2016 09:35	90	
9	2016	09/28/2016 12:15	87	
10	2016	10/04/2016 13:15	86	
10	2016	10/13/2016 10:40	85	
10	2016	10/18/2016 14:30	89.3	
11	2016	11/08/2016 09:45	89	
11	2016	11/14/2016 14:00	86	
11	2016	11/22/2016 08:25	82	
11	2016	11/29/2016 09:40	81	
12	2016	12/13/2016	79	
12	2016	12/23/2016 13:40	78	
12	2016	12/26/2016 10:55	78	
		2016 Average	**81.80**	

2017 DATA				
Month	Year	Static Depth to Water		
1	2017	01/03/2017 12:40	77	2/2/2017
1	2017	01/10/2017 08:30	76	
1	2017	01/17/2017	75	
1	2017	01/24/2017 09:50	74	
1	2017	01/31/2017 13:40	73	
		2017 Average	**75**	

WELL 4R DATA

FROM ORIGINAL DATA- FILTERED

Date	Average of Well Stand
2003	84.00
2004	86.00
2005	79.80
2006	81.13
2007	94.50
2008	95.25
2009	89.64
2010	89.50
2011	82.43
2012	83.20
2013	87.33
2014	103.26
2015	89.60
Grand Total	**91.35**

2015 Updated (Jan-Oct)

2015 Updated Numbers

1	2015	Jan-15	93
1	2015	Jan-15	84
1	2015	Jan-15	93
1	2015	Jan-15	93
2	2015	Feb-15	85
2	2015	Feb-15	93
2	2015	Feb-15	92
3	2015	Mar-15	94
3	2015	Mar-15	94
3	2015	Mar-15	93
5	2015	May-15	93
5	2015	May-15	93
6	2015	Jun-15	91
6	2015	Jun-15	84
6	2015	Jun-15	93
6	2015	Jun-15	93
7	2015	Jul-15	95
7	2015	Jul-15	93
7	2015	Jul-15	92
7	2015	Jul-15	94
8	2015	Aug-15	95
8	2015	Aug-15	88
9	2015	Sep-15	91
9	2015	Sep-15	93
9	2015	Sep-15	94
9	2015	Sep-15	94
10	2015	Oct-15	105
11	2015	11/17/2015	98
11	2015	11/25/2015	98.6
12	2015	12/1/2015	97
12	2015	12/8/2015	95.8
12	2015	12/15/2015	95.1
12	2015	12/24/2015	93.9
12	2015	12/29/2015	93.8
2015 AVERAGE TOTAL:			**93.15**

Date	Average of Well Stand
2003	84.00
2004	86.00
2005	79.80
2006	81.13
2007	94.50
2008	95.25
2009	89.64
2010	89.50
2011	82.43
2012	83.20
2013	87.33
2014	103.26
2015	93.15
2016	90.90
2017	88.80

WELL 4R DATA

June 2016 Update				
Month	**Year**	**Static Depth to Water**		
1	2016	1/5/2016	93	
1	2016	1/12/2016	92	
1	2016	1/19/2016	92	
1	2016	1/26/2016	92	
2	2016	2/2/2016	90	
2	2016	2/9/2016	90.5	
2	2016	2/16/2016	92	
2	2016	2/23/2016	90	
3	2016	3/1/2016	91	
3	2016	3/9/2016	90.5	
3	2016	03/15/2016	90	
3	2016	3/22/2016	89	
3	2016	3/29/2016	88	
4	2016	4/5/2016	88	
4	2016	4/14/2016	87.5	
4	2016	4/19/2016	87.2	
4	2016	04/27/2016 05:00	87.5	
5	2016	05/11/2016 12:55	87	
5	2016	05/24/2016 10:35	87.3	
5	2016	05/31/2016	88.3	2/6/17 Update
6	2016	06/08/2016 10:48	88	
6	2016	06/21/2016 12:00	89	
6	2016	06/28/2016 11:20	89.2	
7	2016	07/05/2016 13:15	68.8	
7	2016	07/12/2016 09:20	90.1	
7	2016	07/13/2016 09:20	90	
7	2016	07/26/2016 11:10	91	
8	2016	08/02/2016 09:20	91	
8	2016	08/09/2016 15:30	92	
8	2016	08/16/2016 13:45	92.6	
8	2016	08/23/2016 10:30	95	
9	2016	09/28/2016 12:00	99	
10	2016	10/04/2016 13:05	99	
10	2016	10/13/2016 11:00	99	
10	2016	10/18/2016 14:22	99.1	
10	2016	10/25/2016 09:50	99	
11	2016	11/22/2016 08:38	96.5	
11	2016	11/29/2016 09:30	93	
12	2016	12/13/2016	91	
12	2016	12/23/2016 13:30	91	
12	2016	12/26/2016 10:45	91	
		2016 Average	**90.90**	

2017 DATA			
Month	Year	Static Depth to Water	
1	2017	01/03/2017 12:47	91
1	2017	01/10/2017 08:20	90
1	2017	01/17/2017	89
1	2017	01/24/2017 09:45	87
1	2017	01/31/2017 13:35	87
		2017 Average	**88.8**

WELL 5 DATA

FROM ORIGINAL DATA- FILTERED	
Date	**Average of Well Stand**
1958	149.17
1959	152.50
1960	178.36
1961	182.09
1962	165.25
1963	129.29
1964	126.50
1965	108.91
1966	95.00
1967	92.44
1968	90.40
1970	90.00
1985	30.25
1986	29.81
1987	31.71
1988	34.50
1989	53.33
1995	41.50
1996	31.50
1997	39.00
2002	34.50
2003	36.00
2004	32.00
2005	30.25
2006	28.00
2007	40.10
2008	36.33
2009	38.74
2010	37.20
2011	33.67
2012	39.11
2013	43.17
2014	54.00
2015	44.88
Grand Total	**84.90**

ALL YEARS	
YEARS	**AVERAGE OF WELL STAND**
1958	149.17
1959	152.50
1960	178.36
1961	182.09
1962	165.25
1963	129.29
1964	126.50
1965	108.91
1966	95.00
1967	92.44
1968	90.40

ALL YEARS	
YEARS	**AVERAGE OF WELL STAND**
1969	
1970	90.00
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	
1981	
1982	
1983	
1984	
1985	30.25
1986	29.81
1987	31.71
1988	34.50
1989	53.33
1990	
1991	
1992	
1993	
1994	
1995	41.50
1996	31.50
1997	39.00
1998	
1999	
2000	
2001	
2002	34.50
2003	36.00
2004	32.00
2005	30.25
2006	28.00
2007	40.10
2008	36.33
2009	38.74
2010	37.20
2011	33.67
2012	39.11
2013	43.17
2014	54.00
2015	46.45
2016	43.77
2017	42.46

2015 Updated (Jan-Oct)			
		2015 Updated Numbers	
1	2015	Jan-15	46
1	2015	Jan-15	45.5
2	2015	Feb-15	46
2	2015	Feb-15	44
3	2015	Mar-15	44
3	2015	Mar-15	43
3	2015	Mar-15	43
3	2015	Mar-15	45
4	2015	Apr-15	45
4	2015	Apr-15	45
6	2015	Jun-15	63
6	2015	Jun-15	48
6	2015	Jun-15	47
6	2015	Jun-15	47
6	2015	Jun-15	47
7	2015	Jul-15	47
7	2015	Jul-15	47
7	2015	Jul-15	47
7	2015	Jul-15	45
8	2015	Aug-15	43
8	2015	Aug-15	45
9	2015	Sep-15	43
9	2015	Sep-15	44
9	2015	Sep-15	47
9	2015	Sep-15	47
9	2015	Sep-15	48
10	2015	Oct-15	49
11	2015	11/25/2015	50
12	2015	12/1/2015	47.7
12	2015	12/8/2015	47.1
12	2015	12/15/2015	46.3
12	2015	12/24/2015	45.7
12	2015	12/29/2015	45.7
		2015 AVERAGE TOTAL:	**46.45**

WELL 5 DATA

June 2016 Update				
Month	**Year**	**Static Depth to Water**		
1	2016	1/5/2016	45	
1	2016	1/12/2016	44	
1	2016	1/19/2016	44	
1	2016	1/26/2016	43	
2	2016	2/2/2016	43	
2	2016	2/9/2016	43	
2	2016	2/16/2016	42.5	
2	2016	2/19/2016	42	
2	2016	2/23/2016	42	
3	2016	3/1/2016	42.5	
3	2016	3/9/2016	42	
3	2016	03/15/2016	41.5	
3	2016	3/22/2016	41	
3	2016	3/29/2016	41	
4	2016	4/5/2016	41	
4	2016	4/14/2016	40	
4	2016	4/19/2016	39.6	
4	2016	04/27/2016 13:30	40	
5	2016	05/11/2016 14:15	43.5	
5	2016	05/24/2016 09:50	39.3	
5	2016	05/31/2016	39.2	2/6/17 update
6	2016	06/08/2016 12:15	40.5	
6	2016	06/21/2016 16:00	41	
6	2016	06/28/2016 14:30	41.8	
7	2016	07/05/2016 14:45	42.2	
7	2016	07/12/2016 07:50	44.1	
7	2016	07/26/2016 14:45	43	
8	2016	08/02/2016 08:00	44.6	
8	2016	08/09/2016 14:50	44.5	
8	2016	08/16/2016 16:30	44.4	
8	2016	08/23/2016 15:00	46.1	
8	2016	08/30/2016 14:00	47.5	
9	2016	09/06/2016 15:30	48	
9	2016	09/13/2016 12:00	48	
9	2016	09/28/2016 10:00	51.3	
10	2016	10/04/2016 08:15	53.6	
11	2016	11/08/2016 07:45	49.1	
11	2016	11/14/2016 14:30	48.3	
11	2016	11/22/2016 10:35	48	
11	2016	11/29/2016 08:35	46.2	
12	2016	12/13/2016	44.25	
12	2016	12/23/2016 13:00	43.4	
12	2016	12/26/2016 12:05	43.2	
		2016 Average	43.77	

2017 DATA				
Month	**Year**	**Static Depth to Water**		
1	2017	01/03/2017 14:05	43	2/6/2017
1	2017	01/10/2017 11:25	42.1	
1	2017	01/17/2017	43.5	
1	2017	01/24/2017 12:30	43.1	
1	2017	01/31/2017 12:30	40.6	
		2017 Average	42.46	

APPENDIX PMP

Sustainable Groundwater Pumping Technical Memorandum

TECHNICAL MEMORANDUM

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

SUSTAINABLE GROUNDWATER PUMPING STANFORD UNIVERSITY

Prepared for: Tom W. Zigterman
Water Services and Civil Infrastructure
Stanford University

Date: June 30, 2016

Purpose

This technical memorandum evaluates the sustainably of groundwater pumping as part of an overall strategy of integrating groundwater with local surface water and imported water to meet water requirements for Stanford University. Pumping scenarios consist of 1) using groundwater to augment current sources of supply in all water years and 2) short-term increased groundwater pumping in dry years to offset decreased local surface water and/or imported water availability.

Scope

An empirical evaluation of sustainable groundwater yield on the Stanford campus was performed to evaluate optimal utilization of local groundwater resources. The term "sustainability" refers to an operating condition under which groundwater levels are not chronically declining (indicative of groundwater overdraft) and not chronically depressed, such that either seawater intrusion, due to a gradient reversal for flow from San Francisco Bay, or subsidence would be induced. In recognition that historically depressed groundwater levels fully recovered after significant regional and local overdraft pumping up to the early 1960s, sustainability can also be defined as a purposeful reduction of groundwater storage for periodic short-term use in dry periods, with recovery in intervening wetter periods. In this manner, sustainability would be achieved without chronic lowering of groundwater levels. Use of the resource in this way would also satisfy groundwater management under California's 2014 Sustainable Groundwater Management Act.

Groundwater Use and Historic Conditions

Prior to the 1970s, Stanford used groundwater from campus wells to satisfy all potable and some non-potable water requirements. Local surface water was used for non-potable irrigation and is presently used conjunctively with groundwater for this purpose. Peak groundwater use by the campus reached approximately 2,000 acre-feet per year (AFY) in the late 1960s. Since the mid-1970s, when supplemental water from San Francisco's Hetch Hetchy system became the sole

source of potable water supply, groundwater pumping has ranged from 200 to 250 AFY. In drought periods, extraction has averaged up to four times higher.

Locally, the largest historical pumper was the City of Palo Alto, which used groundwater for municipal supply up to 1962 when it converted to the San Francisco Hetch Hetchy regional water system. The City's pumping peaked at approximately 7,334 acre-feet in 1961. Palo Alto is presently reactivating wells and drilling new ones for emergency and drought supply under the Emergency Water supply and Storage Project (City of Palo Alto, 2007). Other local pumping occurred in Menlo Park, East Palo Alto, and Atherton with Menlo Park and East Palo Alto currently developing groundwater facilities for emergency and drought supply.

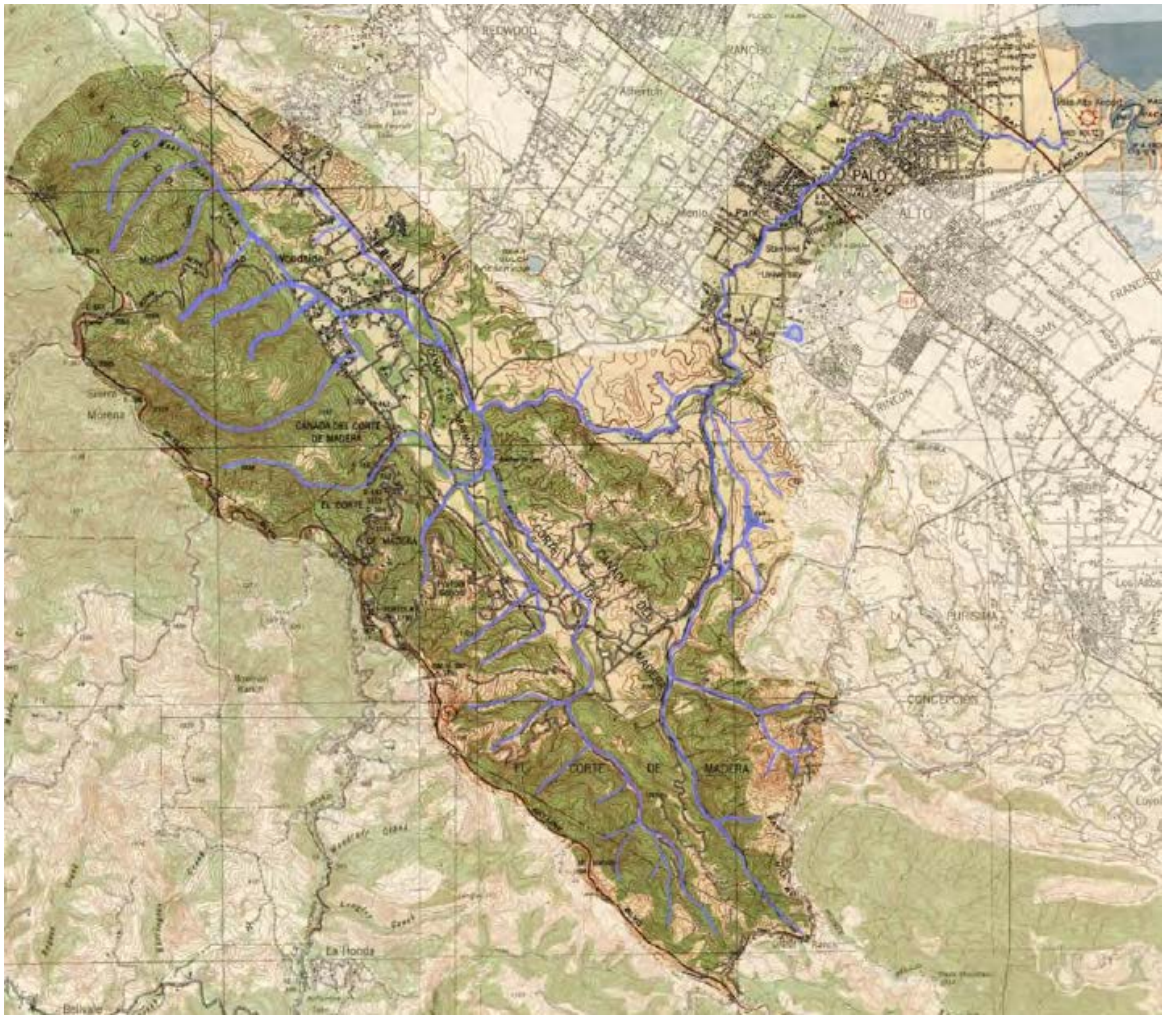
Historically, groundwater pumping in the greater Santa Clara Valley resulted in significant overdraft (DWR, 1967; SCVWD, 2001). With the expansion of agriculture in the early part of the 20th century and post-World War II urban growth, pumping caused groundwater elevations to decline chronically up to the 1960s when imported surface supplies offset overdraft. Besides increased pumping lift, declining water levels caused a groundwater gradient reversal to San Francisco Bay. This resulted in seawater intrusion where freshwater aquifers were directly connected to the Bay such as the San Jose area and the Niles Cone aquifers in Fremont and Newark. Declining groundwater levels also induced significant land subsidence, particularly in the San Jose area, due to inelastic compaction of fine-grained sediments within water bearing formations.

Chronically declining groundwater levels, seawater intrusion, and subsidence were consequences of overdraft pumping over many decades. In the late 1930s, overdraft effects were temporarily mitigated in the southern part of Santa Clara County through local conservation and purposeful recharge of runoff and construction of Coyote Dam and Reservoir (Reynolds and Narasimhan, 2000). However, the effects of these measures were insufficient to offset increased water demand during post-war urbanization that caused a return of overdraft and chronically declining water levels. Ultimately, overdraft was fully mitigated through importation of surface water to the south county region via the State Water Project in the 1960s and the San Felipe Division of the Central Valley Project in the 1980s.

In north Santa Clara county cities, including Palo Alto, Menlo Park, Mountain View, and Sunnyvale, overdraft conditions were reversed through imported water via the San Francisco water system. This occurred prior to State Water Project deliveries in the south county. On the Stanford campus and in Palo Alto, water levels declined to 120 to 140 feet below sea level up to 1962 when Palo Alto converted wholly to the San Francisco source. With resultant water level recoveries, seawater intrusion and subsidence mechanisms were eliminated. Groundwater elevations at Stanford and Palo Alto presently fluctuate from around sea level to +20 to +30 feet elevation and the gradient for groundwater flow is consistently toward San Francisco Bay.

Groundwater Setting

Groundwater encountered on the Stanford campus is part of the Santa Clara Subbasin as classified by the California Department of Water Resources (Groundwater Basin No. 2-9.02, Bulletin 118). The San Mateo-Santa Clara county line, which coincides with San Francisquito Creek, separates the Santa Clara Subbasin from the San Mateo Subbasin (2-9.03) to the north. Groundwater is connected across the subbasins via the San Francisquito Creek alluvial fan and similarly local groundwater recharge is associated with the overlapping San Francisquito Creek watershed, shown below.

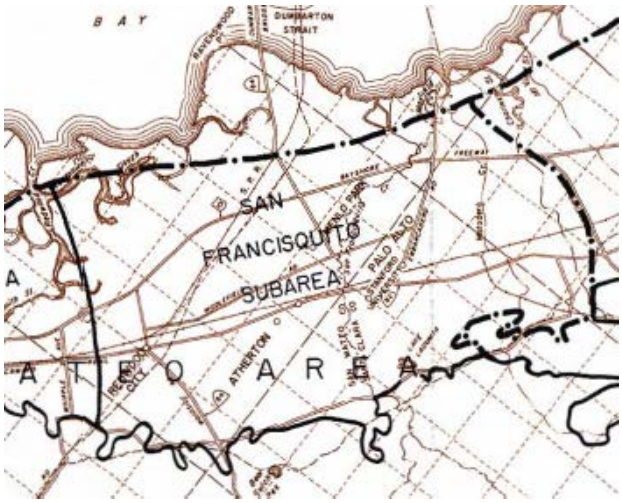


San Francisquito Creek Watershed
(San Francisco Bay Area Historic Topographic Quadrangles)

The San Francisquito alluvial fan coincides with DWR's San Francisquito Cone physiographic unit and the San Francisquito groundwater subarea of the South Bay (see below). The San

Francisquito Subarea was characterized as the most significant groundwater source on west side of the Bay with Palo Alto, Stanford, Menlo Park, and Atherton identified as significant pumpers.

San Francisquito Cone Physiographic Unit



San Francisquito Groundwater Subarea

DWR Bulletin 118-1 (1967)

The highest yielding wells in the San Francisquito Cone occur near the modern-day stream channel. Along this alignment, wells encounter thick, coarse sands and gravels to about 300 feet below ground surface. On the Stanford campus, Wells 1, 2, 3R, and 4R are aligned along the creek and are the primary groundwater supply sources serving non-potable irrigation and back-up domestic supply. Stanford Well 5 is located on the edge of the alluvial fan to the south, but has low yield and poor water quality.

Palo Alto has activated old wells and installed new ones as part of an emergency storage and supply project. The two highest yielding wells are located next to the creek with a significant drop-off in yield for wells south of the San Francisquito Creek alluvial fan (LSCE, 2010). Other emergency supply well projects are in various stages of planning and development in Menlo Park and East Palo. The San Francisquito alluvial fan and existing and planned wells are shown on **Figure 1**.

Santa Clara Valley Water District (SCVWD) is the groundwater management authority in Santa Clara County. The District seeks to manage pumping and recharge to avoid historical problems associated with overdraft. The District has estimated operational storage in the Santa Clara Subbasin at 350,000 acre-feet (SCVWD, 2001 and 2012).

Factors Related to Sustainable Pumping

Historical groundwater conditions on the Stanford campus and vicinity exhibited similarities to those throughout Santa Clara Valley. Up to the early 1960s, local groundwater levels declined to

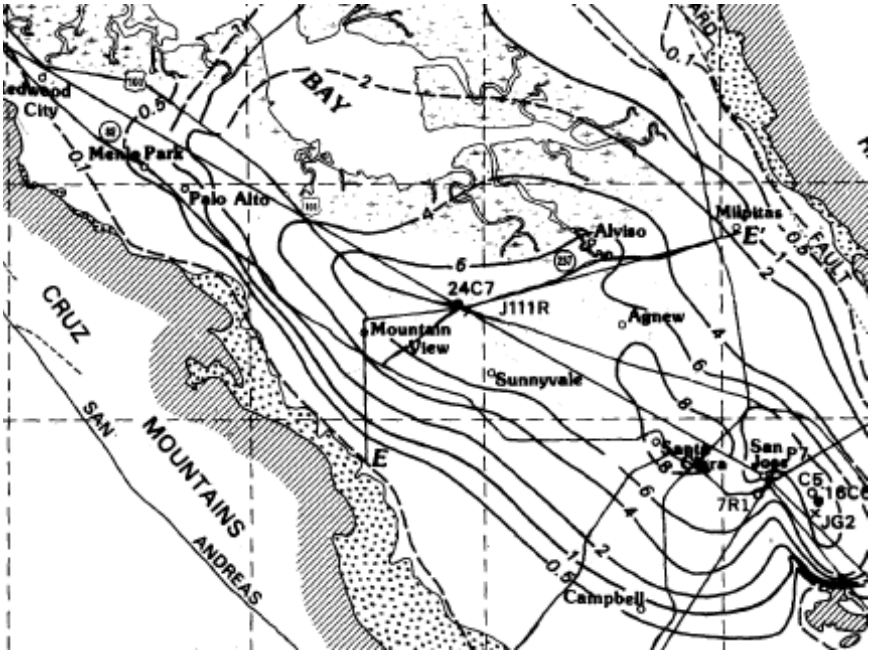
as much as 140 feet below sea level due to overdraft pumping. This resulted in greater pumping lifts and a reversal of the hydraulic gradient to the Bay. As early as the 1920s, local salinity problems were experienced in wells next to the Bay, something that was also occurring elsewhere in the Bay area. However, a study by Killingsworth and Hyde (1932) indicated that blue clay formations in the Palo Alto area impeded intrusion into to the primary production aquifers and that salinity problems were localized due to cross-flow from shallow to deep zones through inadequately sealed wells. Killingsworth and Hyde concluded that the problem would eventually be eliminated with proper plugging of unsealed wells and with use of cemented conductor casings in new wells.

Although salinity problems were experienced in the San Francisquito Cone, direct intrusion into freshwater aquifers never occurred in the area. After Palo Alto ceased pumping and converted to the Hetch Hetchy water after 1962, groundwater levels immediately began to recover and a gradient for flow to the Bay was eventually restored. The following graphic is excerpted from a Santa Clara Valley Water District report on groundwater conditions and shows recent groundwater elevation contours indicating a flow direction toward the Bay in the Stanford vicinity.

Groundwater contours in northern Santa Clara Subasin – Fall 2003
(SCVWD, 2005)

Subsidence was experienced throughout the Santa Clara Valley due to overdraft and inelastic compaction of fine-grained sediments. Poland and Ireland (1988) conducted a detailed survey of subsidence and found that the greatest magnitudes occurred south of the San Francisquito Cone,

from Mountain View to San Jose. At Stanford, subsidence was projected between 0.1 to 0.5 feet (see below), but it was noted that survey control was limited in this area.



Subsidence from 1934 to 1967
From Poland and Ireland (1988)

The lack of intrusion and minor subsidence experienced in Stanford and Palo Alto are due to unique geologic conditions of the San Francisquito Cone. **Figure 2** shows a portion of a regional geologic cross section. It depicts the geology from west of Well 4R on the Stanford campus to Dumbarton Point on the east side of the Bay. It was constructed with lithologic data from wells in Stanford, Palo Alto, and East Palo Alto, well logs from borings along the Bay Shore by Spring Valley Water Company in the early 1900s, and boring logs from construction of the Dumbarton Bridge. The cross section alignment is along San Francisquito Creek where the highest yielding wells in the San Francisquito Cone are located. Two distinguishing geologic features are evident in **Figure 2**:

1. Fine-grained clay formations underlying the Bay act as a barrier between seawater and water supply aquifers completed in Stanford and Palo Alto wells along San Francisquito Creek. This is consistent with findings by Killingsworth and Hyde (1932).

2. West of the Bay and particularly along the creek alignment, aquifer materials tapped for water supply are predominantly coarse-grained. The minor subsidence in the area is attributed to limited occurrence of fine-grained beds within these aquifer units.

Sustainable pumping on the Stanford campus discussed in this memorandum is related to the absence of seawater intrusion and subsidence during historic overdraft periods, recovery of local

groundwater levels as a result of reduced pumping, and favorable geologic features that make the area less vulnerable to adverse impacts if groundwater levels fluctuate below sea level.

Empirical Method for Estimating Sustainable Pumping Scenarios

Sustainable groundwater yield may be assessed in various ways. Santa Clara Valley Water District has undertaken regional groundwater flow modeling to evaluate operational strategies for conjunctive use of groundwater and imported surface water to maximize overall water supply in the greater Santa Clara Subbasin. As Stanford is located at the edge of the basin and pumps from wells completed in the San Francisquito Cone, SCVWD's regional model may not provide meaningful estimates of sustainable pumping for campus supply. Alternatively, and with sufficient historical data spanning representative hydrologic periods, an empirical analysis may reliably provide sustainable pumping rates, if not maximum sustainable yield in the Stanford area.

As defined previously, sustainable yield corresponds to annual pumping rates that do not cause chronic declines in water levels. Although in some settings it may be imperative to maintain water levels above sea level, for example, the development history and geologic setting at Stanford indicate that groundwater levels can sustain significant fluctuations below sea level without such adverse effects. On this basis, the following overview of historic pumping and water level response supports estimates of sustainable pumping on the San Francisquito Cone.

Groundwater Levels

Early descriptions of groundwater conditions on the Stanford campus were made by Killingsworth and Hyde (1932). The evaluation included a detailed survey of water levels and pumping on the San Francisquito alluvial fan for the 1930 and 1931 water years. It also discussed prior historical conditions in the area noting that local wells exhibited artesian flowing conditions up to about 1917, but that by 1932 water levels had declined by 100 feet, or more.

Information from Killingsworth and Hyde (1932) and subsequent water level data collected by Stanford are presented in **Figure 3a**. This figure shows local groundwater elevations from the 1930-31 survey by Killingsworth and Hyde (1932) and water level data for Stanford Well 1 from the 1940s to present. Included is Stanford's annual groundwater pumping in acre-feet, which was compiled and discussed in a report on campus groundwater use and water requirements (LSCE, 2010). Recent significant droughts are highlighted in this and subsequent hydrographs (see 1976-77, 1987-92, 2007-2009, and 2012 to present).

Figure 3a has two gaps in water elevation data. The first gap is between the time of the Killingsworth and Hyde survey to the late 1940s. The second gap is between 1971 and 1980 when Stanford converted to Hetch Hetchy for domestic supply. To fill the data gaps, **Figure 3b** incorporates a groundwater level dataset from a nearby City of Palo Alto well. The period of record for this well, which is completed in coarse-grained channel sands along the San

Francisquito Cone axis (see **Figure 1**), spans the late 1930s to 2009. Stanford Well 1 and the Palo Alto well are representative of the respective water systems and the combined data set shows consistent conditions on the Stanford campus and in Palo Alto.
The Killingsworth and Hyde (1932) survey and subsequent groundwater elevation data reflect distinct periods of fluctuating groundwater conditions in the Stanford and Palo Alto area as follows:

- Prior to 1917, wells in the San Francisquito Cone area exhibited flowing artesian conditions.
- From 1917 to 1930-31, groundwater elevations declined to -40 to -65 feet elevation due to local overdraft pumping.
- From 1938 to 1947, water levels in Palo Alto recovered about 60 feet, from -90 feet to -30 feet elevation.
- From 1947 to 1962, groundwater elevations exhibit chronic decline to about -140 feet elevation.
- From 1962 to present, water levels rose steadily from -140 feet elevation to +20 to +30 feet.
- During drought periods of 1987-92 and 2012 to 2015, water levels declined sharply below sea level, but rapidly recovered to +20 to +30 feet with reduced pumping and higher precipitation.

Pumping and Groundwater Level Fluctuations

The major historical factor affecting groundwater conditions in the Santa Clara Valley and locally was imported surface water, which mitigated decades of overdraft pumping. The recovery of local groundwater levels starting after 1962 coincided with Palo Alto converting to imported surface water and shutting off all its wells. As shown in **Figures 3a** and **3b**, groundwater levels continued to recover even as Stanford increased pumping to over 2,100 acre-feet by 1968. After 1974, when Stanford converted to San Francisco for domestic supply, campus pumping decreased to about 200 to 250 AFY in non-drought years.

Figure 3b shows rising water levels in the Palo Alto well between 1938 and 1946 while campus pumping was 500 and 600 AFY. An explanation for the rising water levels was found in a 1954 engineering report on water quality problems in the Palo Alto water system. Brown and Caldwell (1954) indicated that Palo Alto purchased supplemental water from San Francisco Hetch Hetchy system between 1938 and the early 1950s. The supplemental water purchases resulted in a corresponding reduction in groundwater pumping.

Figure 4 reconciles the relationship between pumping and water levels by showing that recovery in groundwater elevations in Palo Alto occurred during the period of supplemental purchases. The purchases were made to address water quality problems attributed to the

aggressive nature of the Hetch Hetchy source, which was subsequently mitigated with lime treatment. Water levels declined again as Palo Alto pumping resumed and increased in the post-war years eventually peaking at over 7,000 AFY by 1961. Since 1962, the Palo Alto wells have been used only once, in 1988, due to drought (see **Figure 4**).

To more accurately represent the relationship between pumping and fluctuating local groundwater levels, pumping by Stanford and Palo Alto were combined and presented on **Figure 5**. Based on estimates by Killingsworth and Hyde (1932), it was assumed that Palo Alto pumping averaged 5,000 AFY prior to the supplemental purchase period. During the supplemental purchase period, it was assumed that Palo Alto pumped 1,000 AFY up to 1948 after which pumping is based on available records. As discussed by Killingsworth and Hyde (1932) and DWR (1967), other pumping occurred in the San Francisquito Cone, but was likely small compared to that by Palo Alto and Stanford. The 1930-31 Killingsworth and Hyde water survey estimated total pumping in the San Francisquito Cone at approximately 7,200 AFY of which about 5,500 to 6,000 AFY was attributed to Stanford and Palo Alto. By the early 1960s, an even greater fraction of pumping would be attributed to Stanford and Palo Alto as other north county cities switched over to the Hetch Hetchy system. After 1962, when Palo Alto stopped all pumping, Stanford became the largest pumper in the San Francisquito Cone with private pumping in Palo Alto, Menlo Park, and East Palo Alto estimated at about 150 AFY (Todd, 2005).

Under the assumptions regarding pumping rates, **Figure 5** shows a strong correlation between total pumping and groundwater level fluctuations. It can be seen, for example, that pumping in excess of 5,000 AFY is unsustainable for the area as chronic water level declines are evident prior to 1938 and after 1952 when pumping exceeded this amount. In the periods 1939 to 1949 and 1963 to 1973 in which pumping averaged about 1,700 AFY, water levels rose due to reduced overall pumping and, at this level of extraction, groundwater use is clearly within a sustainable range for the San Francisquito Cone area.

The periods of reduced total pumping are examined in detail on **Figures 6a** and **6b**. For 1939-49, shown on **Figure 6a**, average pumping was approximately 1,725 AFY with water levels flattening at about -25 feet elevation. For this period, precipitation was about 7.5 percent greater than the long-term average discussed further below. For 1963-73, shown on **Figure 6b**, Stanford's pumping averaged 1,680 AFY and peaked at 2,112 acre-feet in 1968. With water levels rising in the first few years due to Palo Alto shutting off its wells, water levels appear to stabilize at about -20 feet elevation. For this period, precipitation was about 8 percent below the long-term average.

Another relevant empirical observation is seen during the 1987-92 drought period. In 1988, Palo Alto activated wells and pumped 1,505 acre-feet in a five-month period. Combined with Stanford's use, total pumping was 2,306 acre-feet for the year (see **Figure 5**). Water levels can be seen to decline sharply to about -10 feet elevation at Stanford Well 1, but rapidly

recover the following year with water levels fluctuating above sea level in the years afterward.

Precipitation

Precipitation as the primary source of recharge in the San Francisquito Cone was examined for effects on groundwater fluctuations. The main objective in considering this factor is to ensure that conclusions regarding groundwater level fluctuations and sustainable pumping rates are not biased by excessive precipitation. Conversely, estimates based on periods of low precipitation may be judged as conservative.

Figure 7 presents the composite water level data for Stanford Well 1 and the Palo Alto well, total pumping for Stanford and Palo Alto, and cumulative departure from mean precipitation for San Jose (NOAA Station 23293). The San Jose station was selected because the available record matched the groundwater dataset. A declining departure curve indicates dry conditions (e.g., see highlighted drought periods) with precipitation below the mean, and a rising curve indicates higher than average precipitation.

For the two periods discussed above, 1939 to 1949 and 1963 to 1973, **Figure 7** indicates precipitation was generally drier (1939-49) or average to wet (1963-73). **Figure 8** focuses on the timeframe from 1981 to present when water levels appear to have stabilized after the historic low water levels up to the early 1960s. In this figure, there are sufficient wet and dry periods to indicate that pumpage has been sustainable, and that the groundwater system is resilient to increased pumping in drought periods to greater than 2,000 AFY (e.g., see 1988).

Lake Lagunita Recharge

Stanford has managed and used surface water conjunctively with other sources throughout its history through diversions to Lake Lagunita to benefit storage and aquifer recharge. Estimates of recharge through surface water impounded in Lake Lagunita were made by LSCE (2010) and are presented in **Figures 9a** and **9b** in relation to groundwater level fluctuations. **Figure 9a** shows recharge along with Stanford and Palo Alto pumping and groundwater levels for the available period of record. Up to 1962, recharge quantities were a small fraction of overall pumping. **Figure 9b** focusses on the period from 1962 to present when Stanford became the largest pumper in the San Francisquito Cone. During this period, recharge quantities are a greater fraction of pumping and a represent a more significant component of the local groundwater budget.

Pumping Scenarios

From the empirical analysis of groundwater levels, pumping, and recharge, two scenarios of increased pumping are discussed below.

Scenario 1: Increased Pumping in all Water Years

Empirical evidence indicates that pumping by Stanford may be increased from 200-250 AFY at present to at least 1,700 AFY without inducing chronic water level declines. This assumes that other pumpers in the San Francisquito Cone area do not resume pumping for regular use. At a rate of 1,700 AFY, groundwater levels would stabilize significantly higher than historic low elevations observed during overdraft periods, perhaps to about -25 feet elevation as observed in 1939-49 and 1963-73. Local pumping as high as 2,000 AFY may also be feasible.

With lower groundwater levels, there could be some loss in available drawdown in campus wells. Depending on pump characteristics, lower water levels could result in lower capacities. This effect could be mitigated through pump selection and deeper setting depths, but are likely to be minor since water levels would not be expected to fall below levels already experienced in recent dry years.

Scenario 2: Pumping for Emergency or Dry Year Supply

Under Scenario 2, it is assumed that Palo Alto, Menlo Park, and others will pump groundwater for emergency or dry year supply. Pumping by others would have cumulative effects on groundwater conditions in the San Francisquito Cone from which Stanford derives its supply. With increased dry year pumping, there would be a temporary reduction in groundwater storage and further lowering of water levels. From historical data, that lowering could theoretically be as much as -140 feet elevation without significant adverse effects in the basin (i.e., intrusion or subsidence). The key premise here is that lower water levels with increased pumping in dry years or emergencies is a temporary condition and would be followed by reduced pumping in normal to wet years to allow recovery. Empirical evidence suggests that a maximum aggregate pumping rate for the San Francisquito Cone might be up to 5,000 AFY for 1 to 2 years. During this period, water levels would trend sharply downward, but recover when wells are turned off.

The scenarios for increased pumping are shown conceptually in **Figures 10a-d** and summarized below. The figures show a simplification of the geologic cross section in **Figure 2** with hatched areas representing Bay mud sediments and non-hatched as aquifer materials. Stanford and Palo Alto well fields are represented as single wells. Recharge occurs to the west at the unconfined apex of the San Francisquito Cone. San Francisco Bay is to the east and is underlain by Bay mud.

- **Figure 10a** represents conditions in 1962 just before Palo Alto converted to Hetch Hetchy water. Water levels declined to about -140 feet due to years of overdraft pumping. Although the aquifers tapped by Stanford and Palo Alto wells were not directly connected to the Bay, contour maps would indicate a groundwater gradient reversal from the Bay inland. Stanford pumping was about 1,000 AFY and Palo Alto pumping was over 7,000 AFY at this time in history.

- **Figure 10b** represents recent and current conditions. With Stanford as the primary pumper at about 250 AFY, water levels are stable at +20 to +30 feet elevation. The gradient for flow is toward the Bay and there would be native outflow through aquifers of the alluvial cone.
- **Figure 10c** projects conditions for Scenario 1 in which Stanford increases pumping to as much as 2,000 AFY. This would occur in wet to normal years that do not trigger use of emergency wells by Palo Alto or others. Though water levels would decline, they would reach an equilibrium estimated at between -25 to -50 feet elevation. There would also be a gradient reversal and natural outflow would be reduced. Water levels would fluctuate with precipitation, as at present.

- **Figure 10d** projects conditions for Scenario 2 in which Stanford and others increase pumping for short-term emergency or dry year use. Water levels would fall below Scenario 1 as aggregate pumping exceeds 2,000 AFY. Water levels are higher than the historic low (shown in **Figure 10a**), but could theoretically fall to that level with no significant adverse impacts such as subsidence or intrusion. This case represents water temporarily removed from storage that would be replenished in subsequent wetter years when pumping is reduced.

Augmentation of Sustainable Yield

LSCE (2010) identified past water supply and management actions conducted by Stanford that can be integral to increasing groundwater yield in the San Francisquito Creek Cone. They include:

- Continued use of local surface water for non-potable water supplies;
- Conjunctive use of local groundwater to meet domestic and non-potable water requirements on campus.
- Impoundment of local runoff augmented by diversions of additional surface water via Lake Lagunita, or other site(s), to provide groundwater recharge to Stanford's supply wells.
- Maintenance and interpretation of records for groundwater pumping, water levels, and quality annually.

Continued systematic monitoring as conducted by Stanford is desirable to identify groundwater elevation equilibria as a function of average annual pumping rates.

Concluding Remarks

Concern over subsidence and seawater intrusion has previously limited reactivation of historic wells in the area for regular use. Based on this evaluation, increased pumping and associated fluctuating groundwater levels can be managed sustainably at levels that do not cause

groundwater levels to chronically decline. The risk of seawater intrusion and subsidence should be viewed as a minimal concern, at most, due to the physical characteristics of the aquifer system and as evidenced by the history of groundwater use in the San Francisquito Cone area.
Finally, the estimated rate of sustainable pumping is a small fraction of the reported operational storage of the Santa Clara Subbasin (350,000 acre-feet), underscoring the need to consider long-term balanced pumping and recharge within the San Francisquito Cone irrespective of broader basin management activities by Santa Clara Valley Water District.

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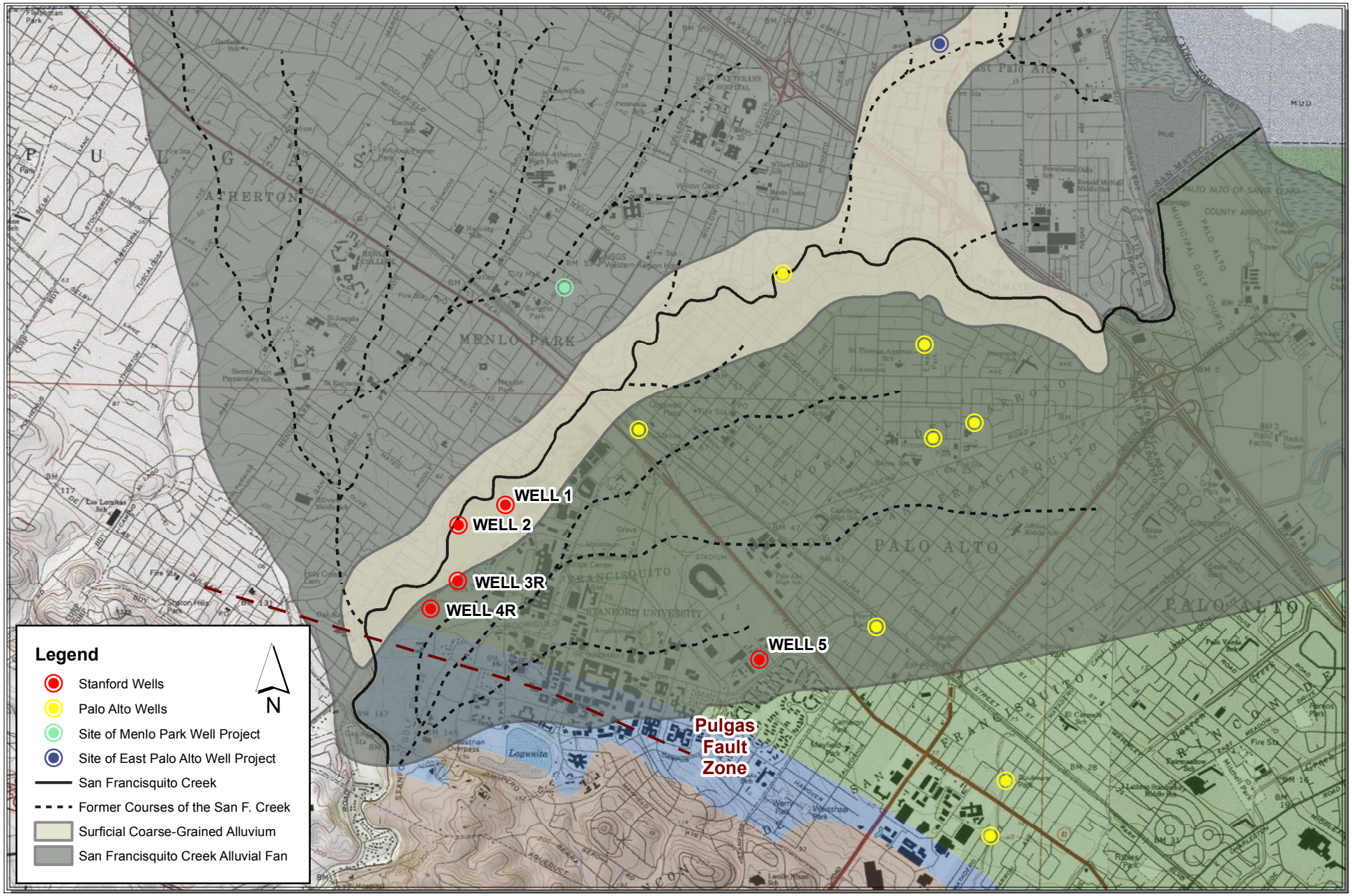

Path: Y:\Reid\CVDRMP\Lagoon Study\Figure 1 Location Map_jul2014.mxd

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Figure 1
Location Map

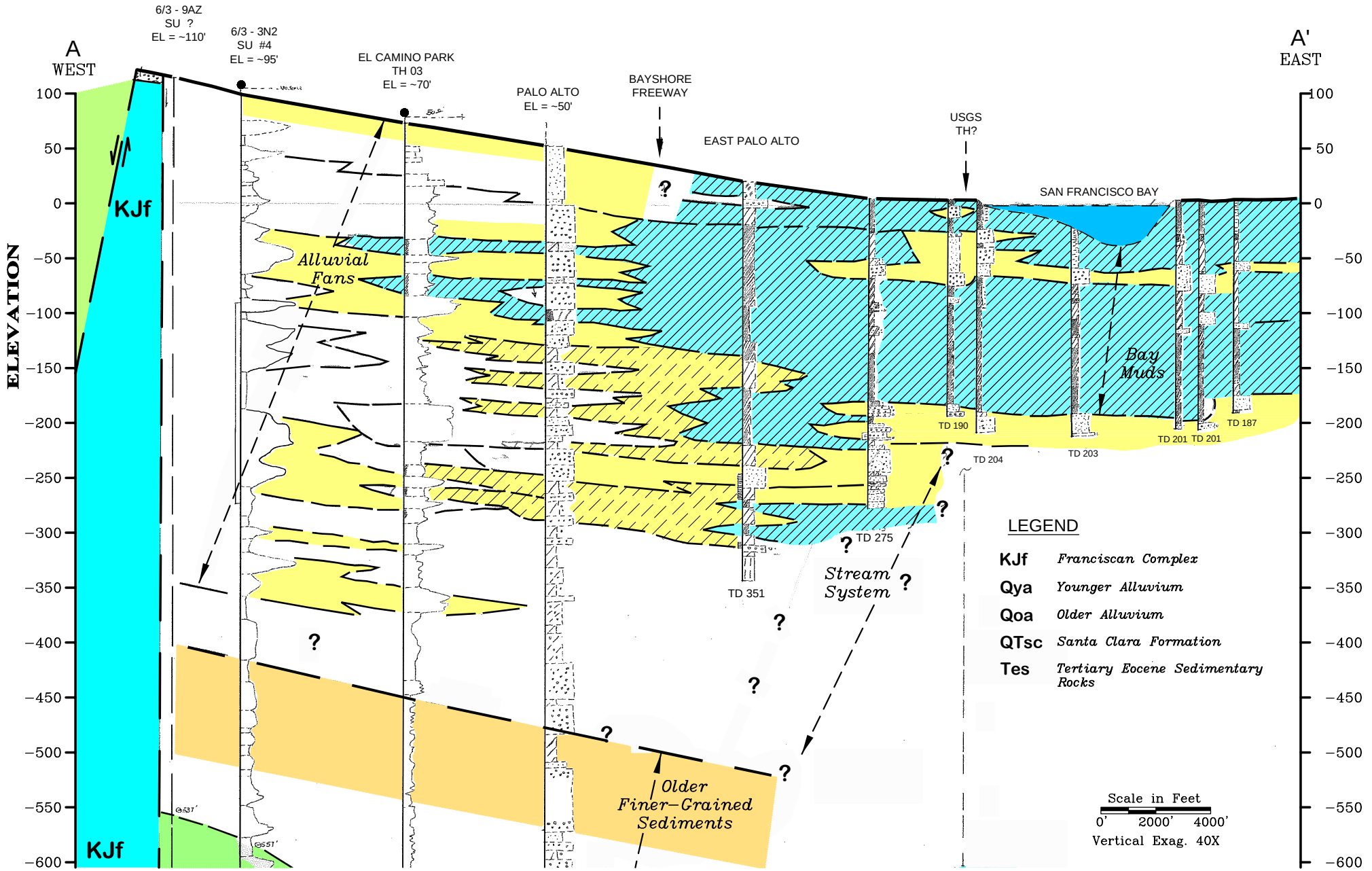

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Figure 2
Regional East-West Cross Section
Stanford Campus to Dumbarton Point

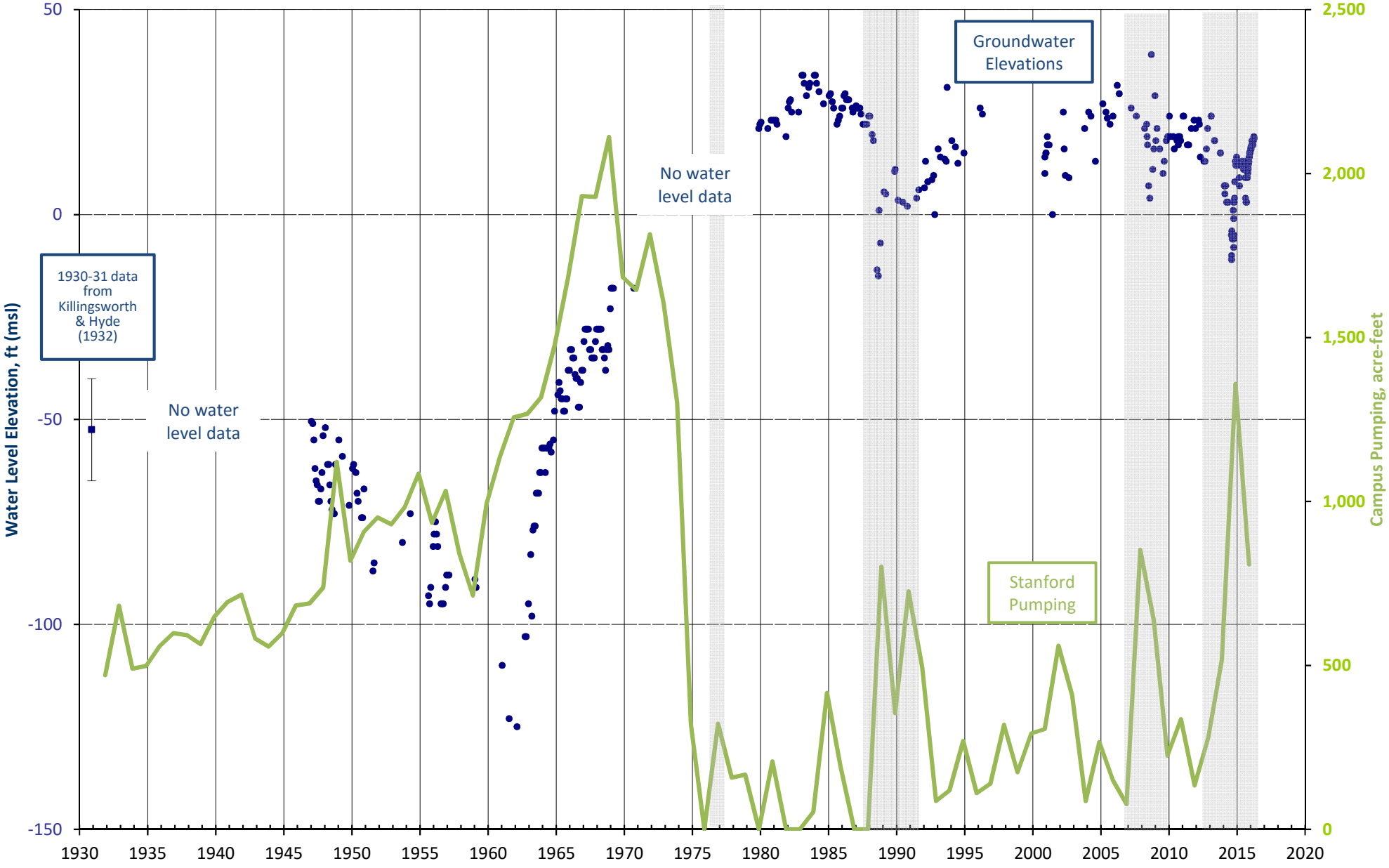

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Figure 3a
Stanford Groundwater Level Elevations and Pumping
Stanford Well 1

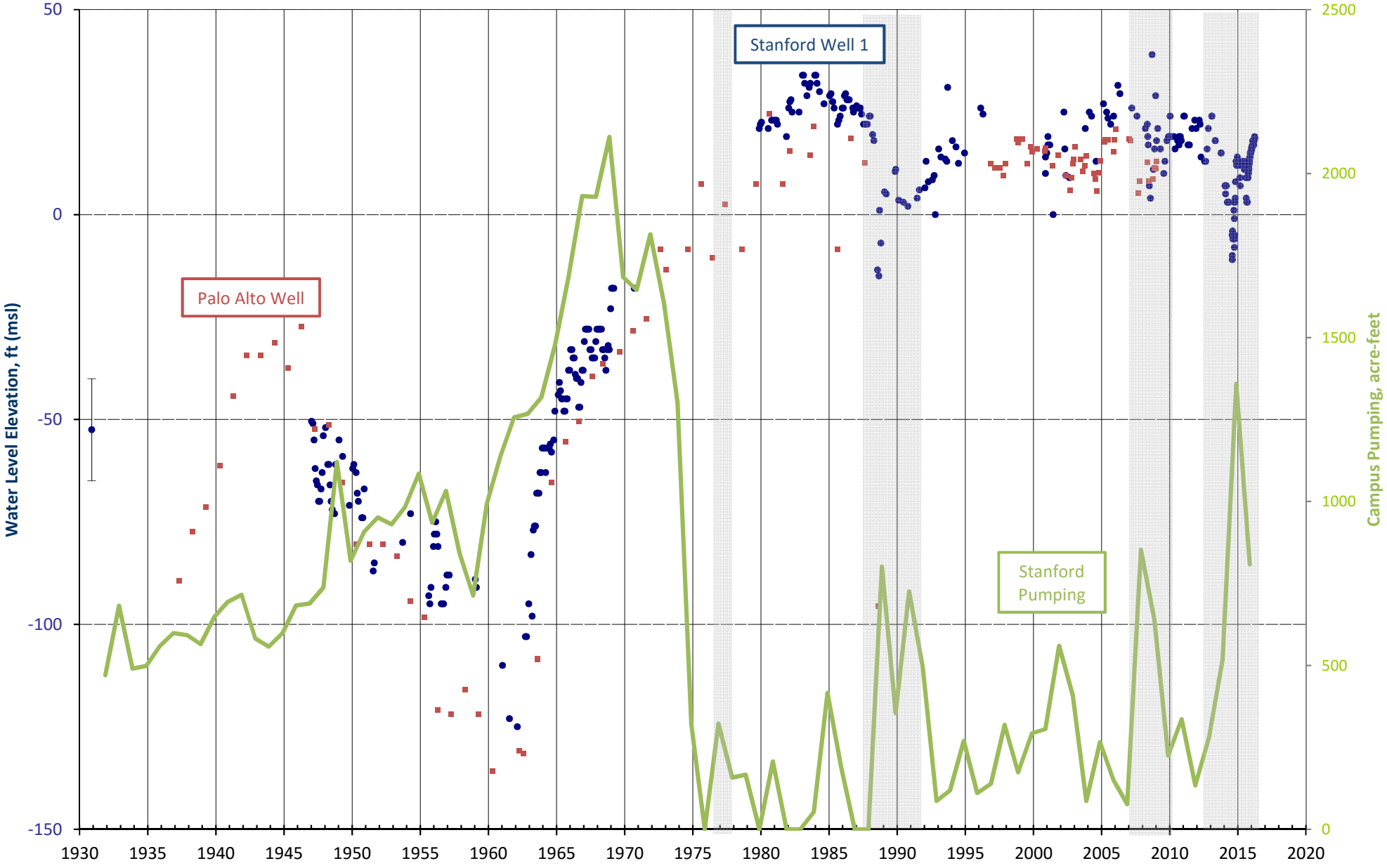

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Figure 3b
Stanford Groundwater Level Elevations and Pumping
Palo Alto Well Water Levels Added

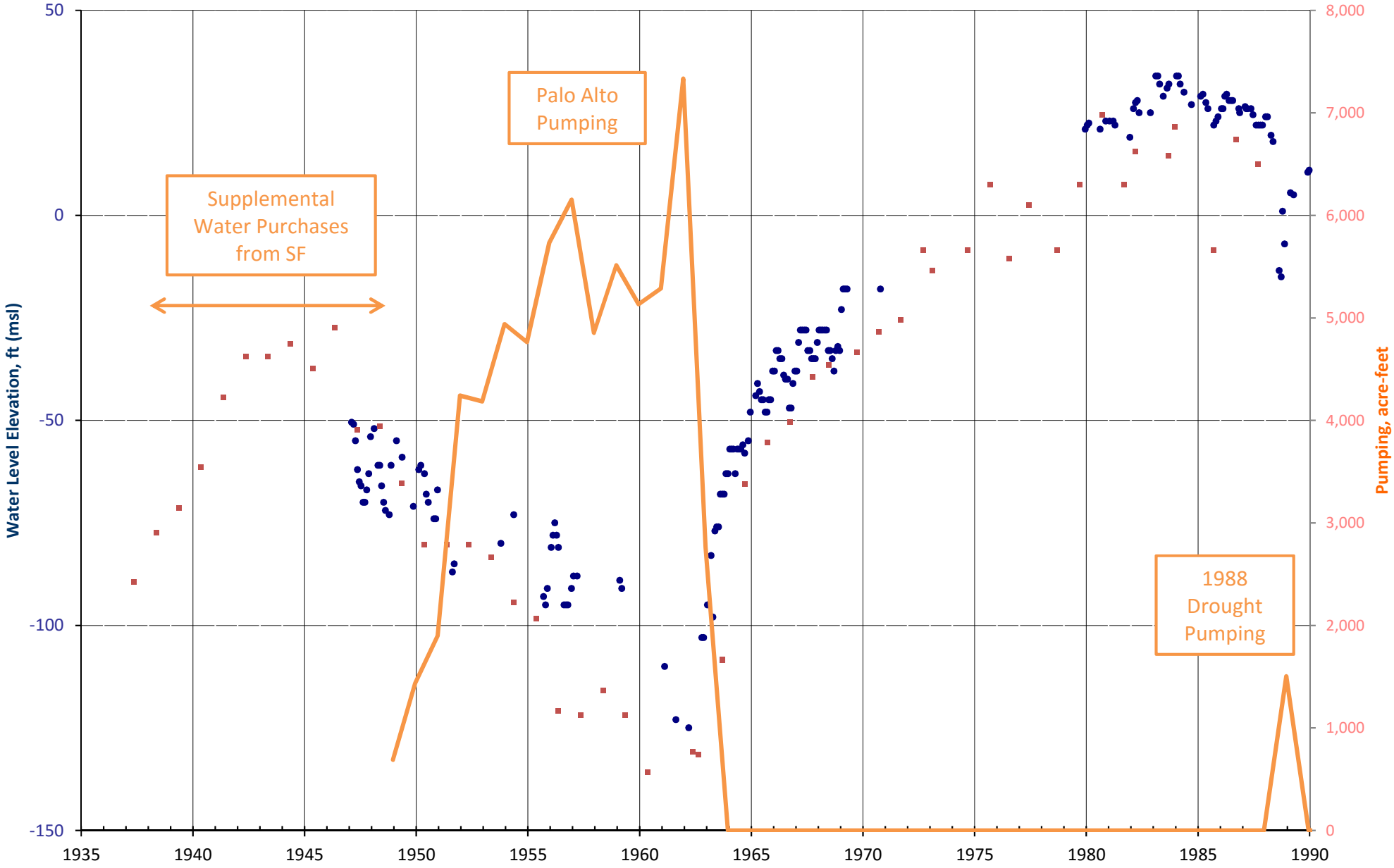

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Figure 4
Groundwater Level Elevations and Palo Alto Pumping

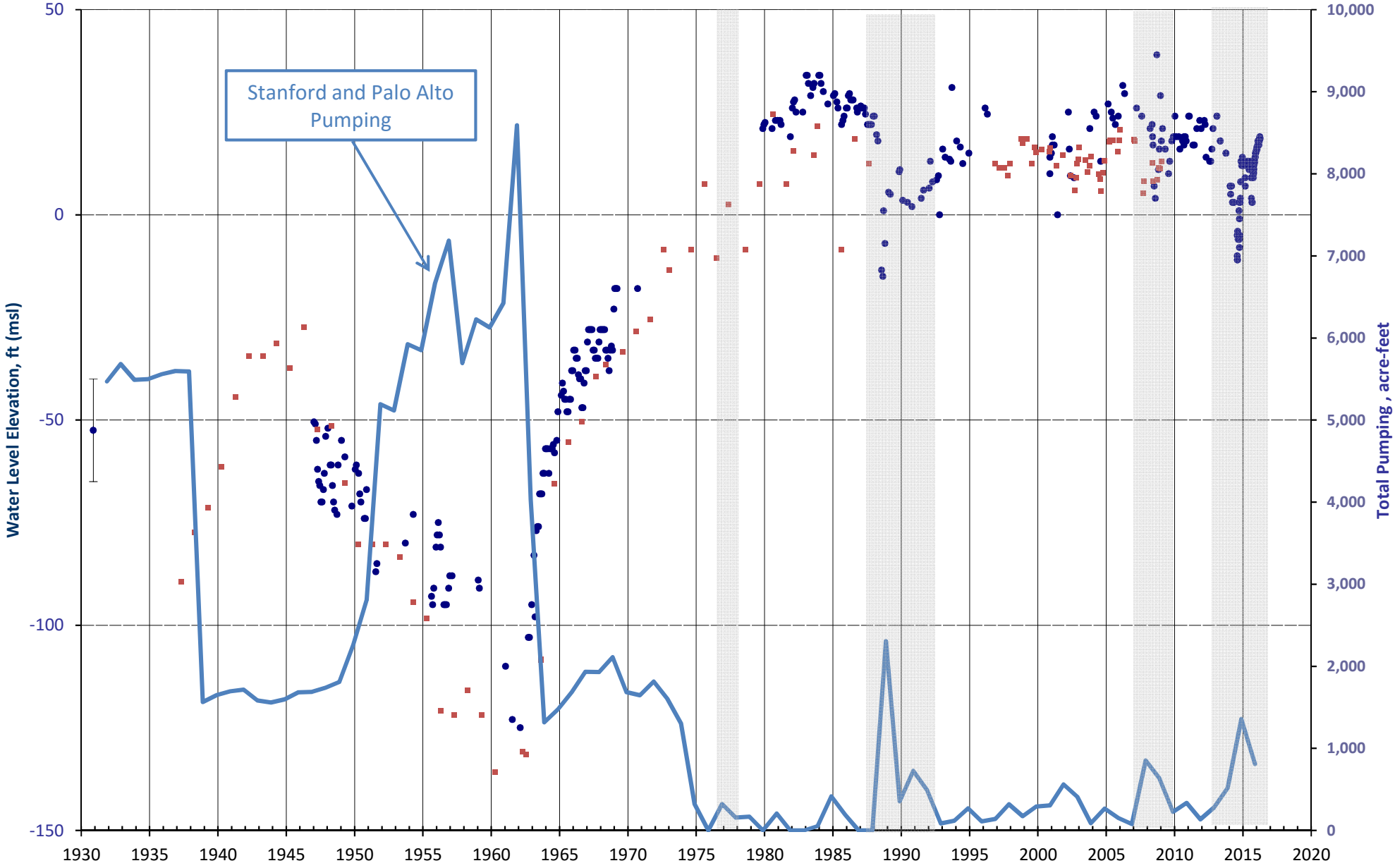

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Figure 5
Groundwater Level Elevations
Stanford and Estimated Palo Alto Pumping

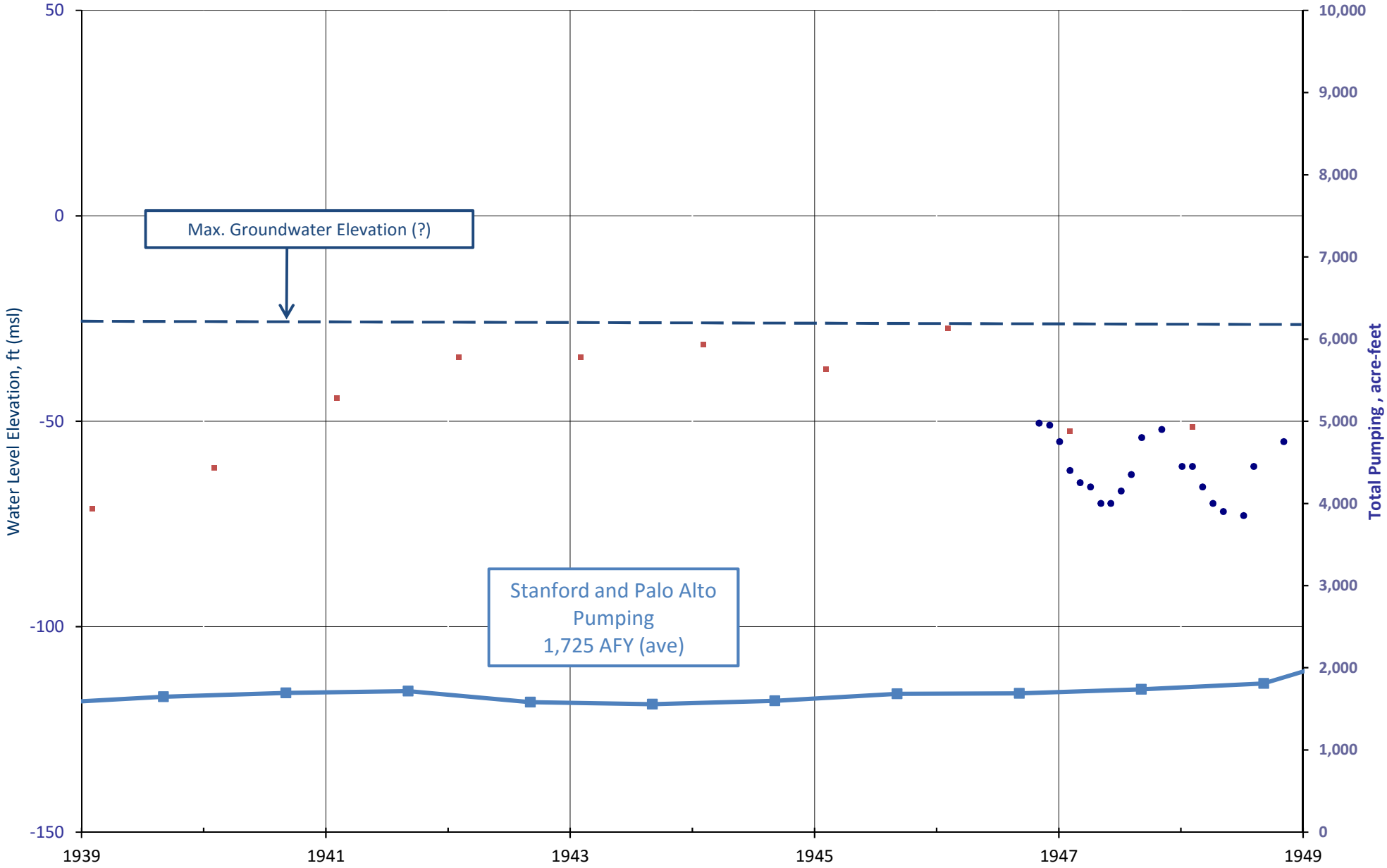

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Figure 6a
1939-49: Groundwater Level Elevation for Approximately 1,725 AFY Pumping

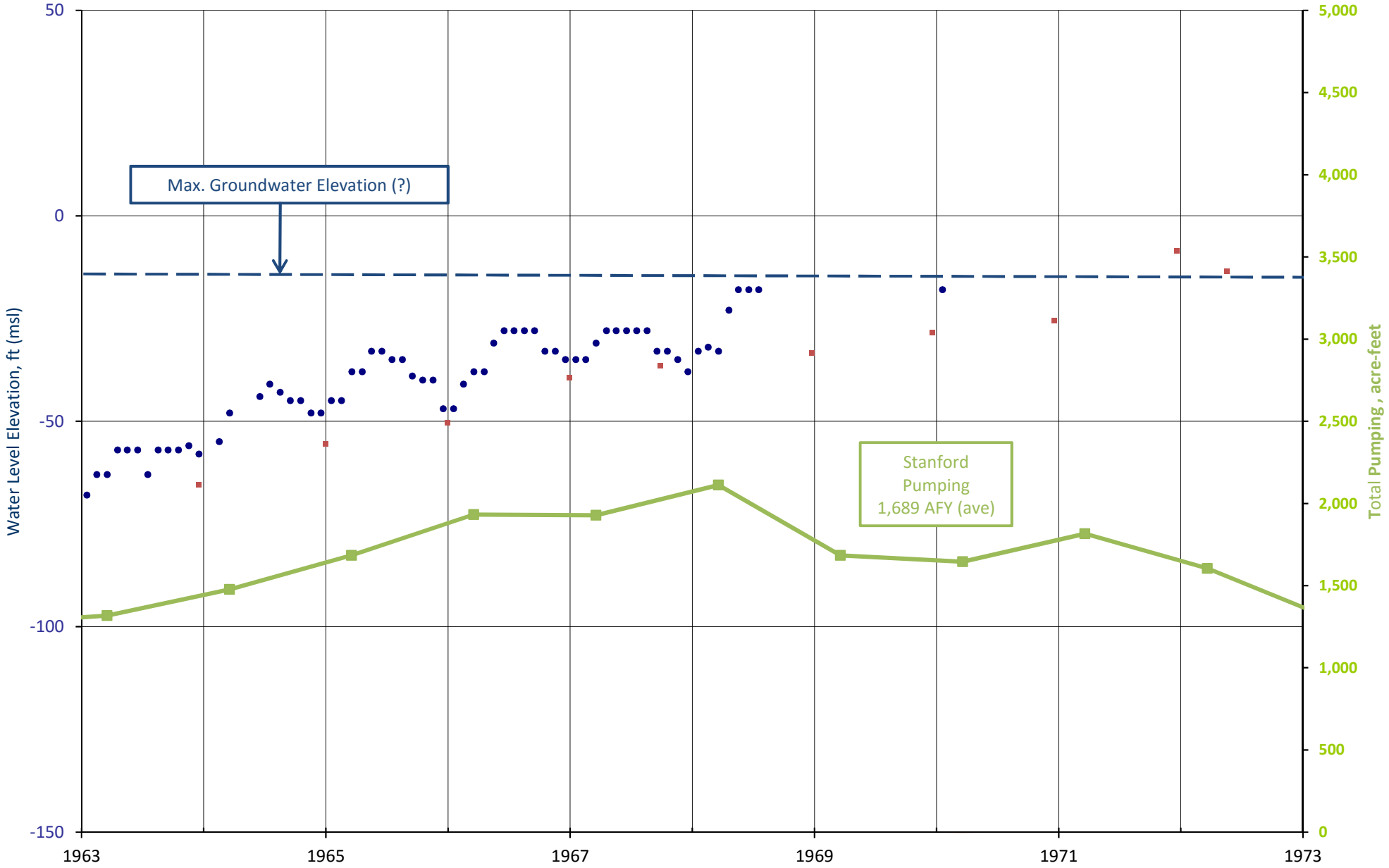

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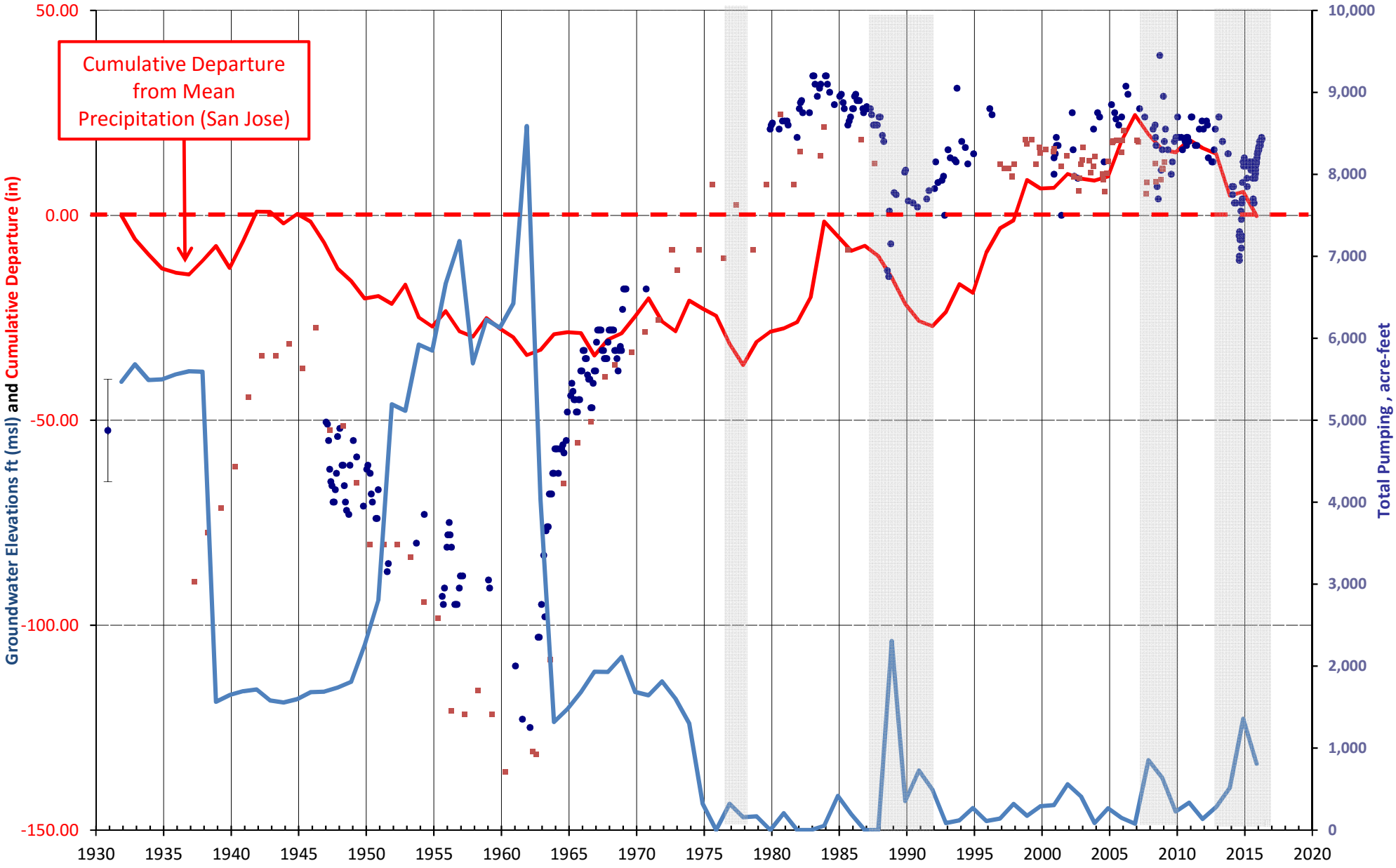
Figure 6b
1963-73: Groundwater Level Elevation for Approximately 1,680 AFY Pumping



Mean Precipitation = 14.1" (1931-2015)

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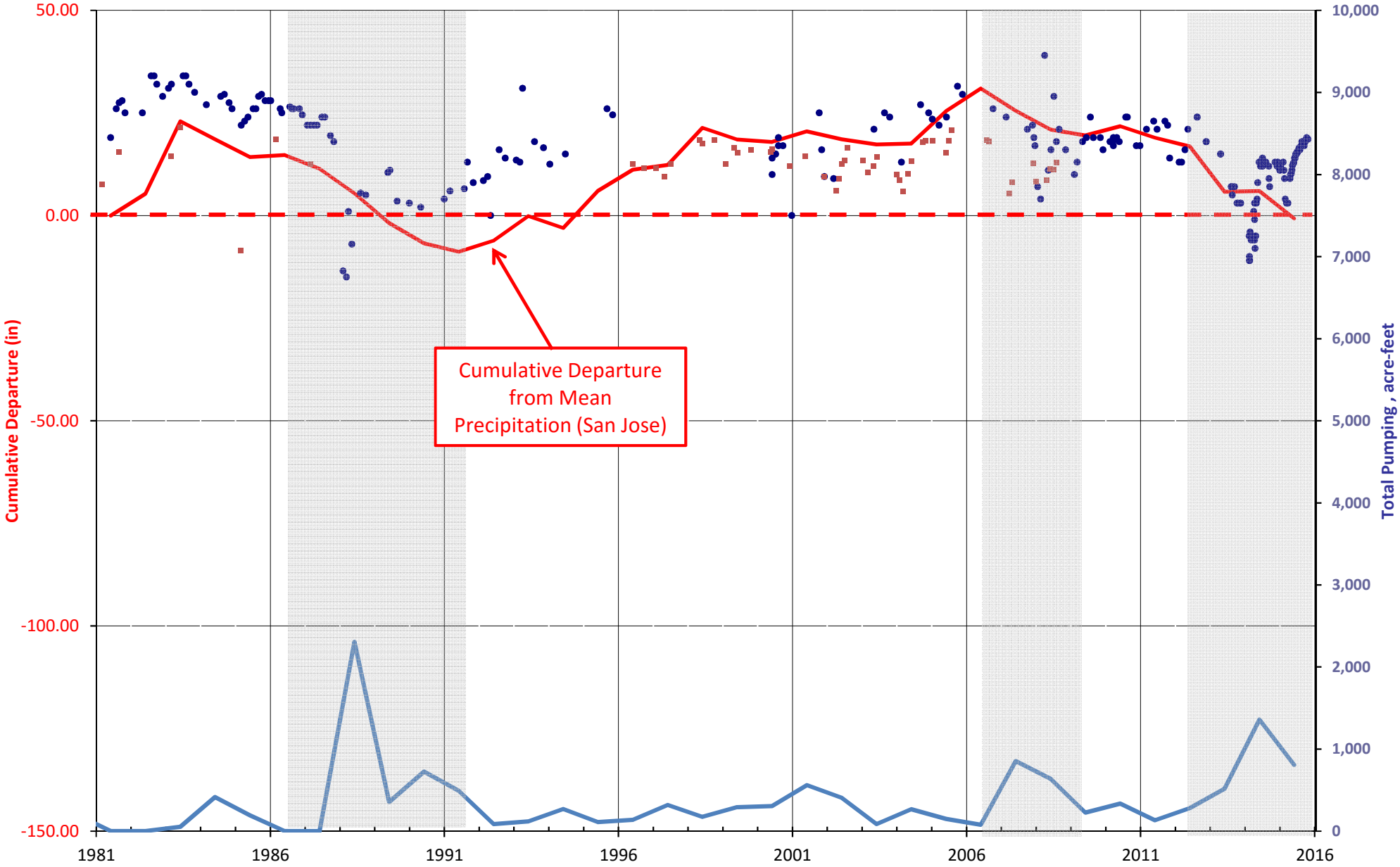
Figure 7
Groundwater Level Elevations and Pumping with Cumulative Departure from Mean Precipitation



Mean Precipitation = 14.1" (1931-2015)

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Figure 8
1981-2016: Groundwater Level Elevations and Pumping with Cumulative Departure from Mean Precipitation

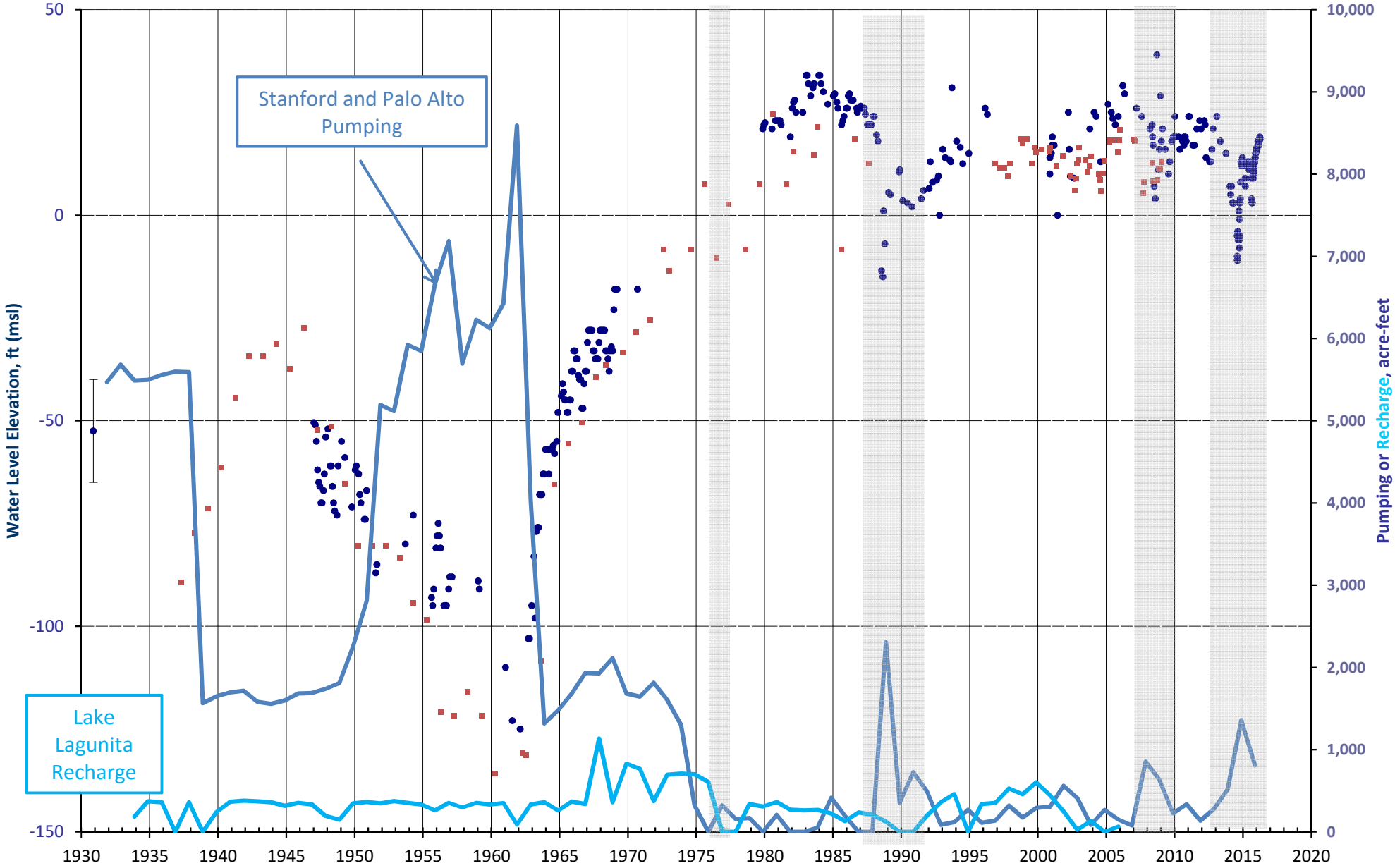

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Figure 9a
Groundwater Level Elevations
Pumping and Lake Lagunita Recharge

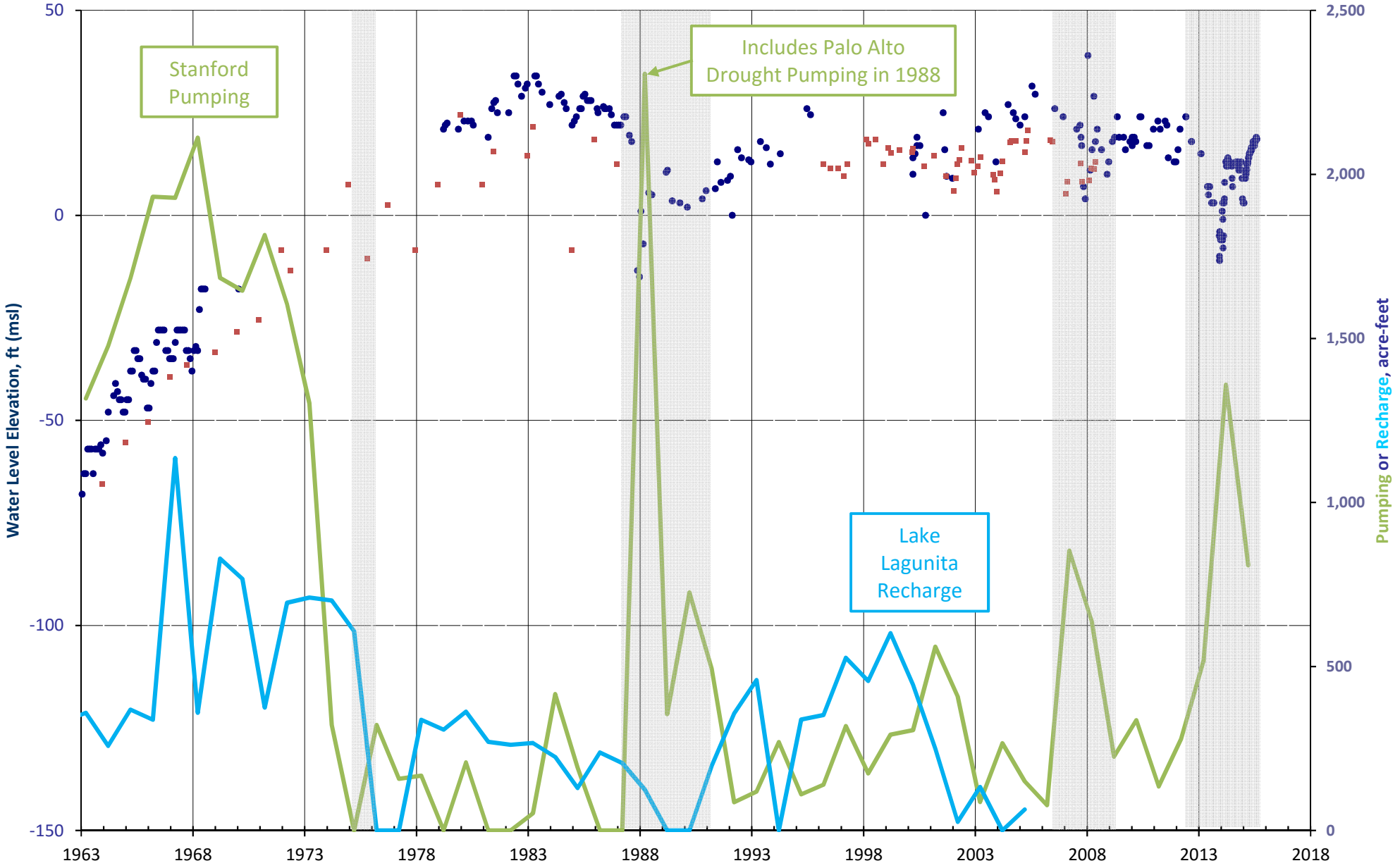

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Figure 9b
Groundwater Level Elevations
Stanford Pumping and Lake Lagunita Recharge

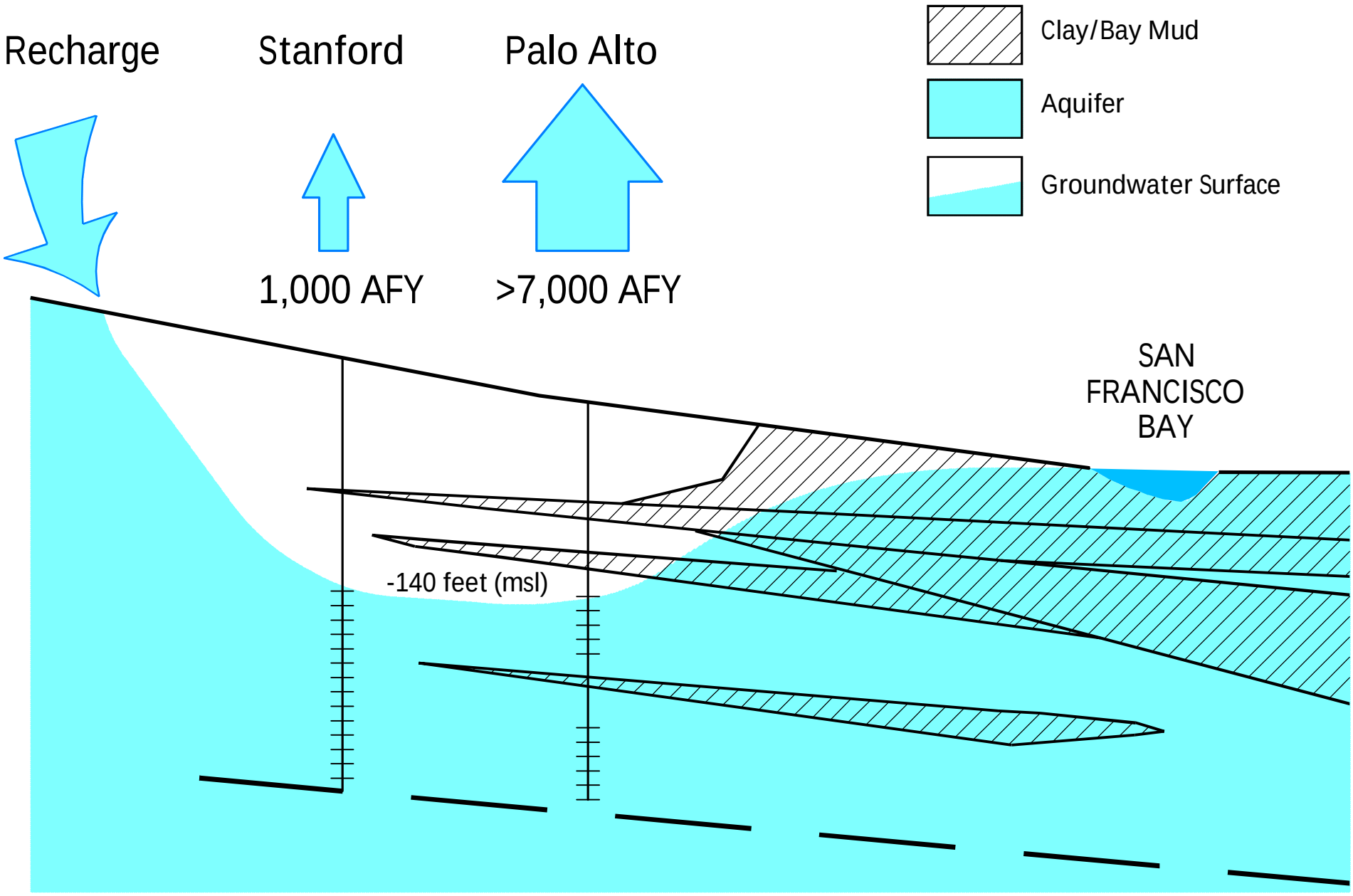

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Figure 10a
Groundwater Conditions
1962

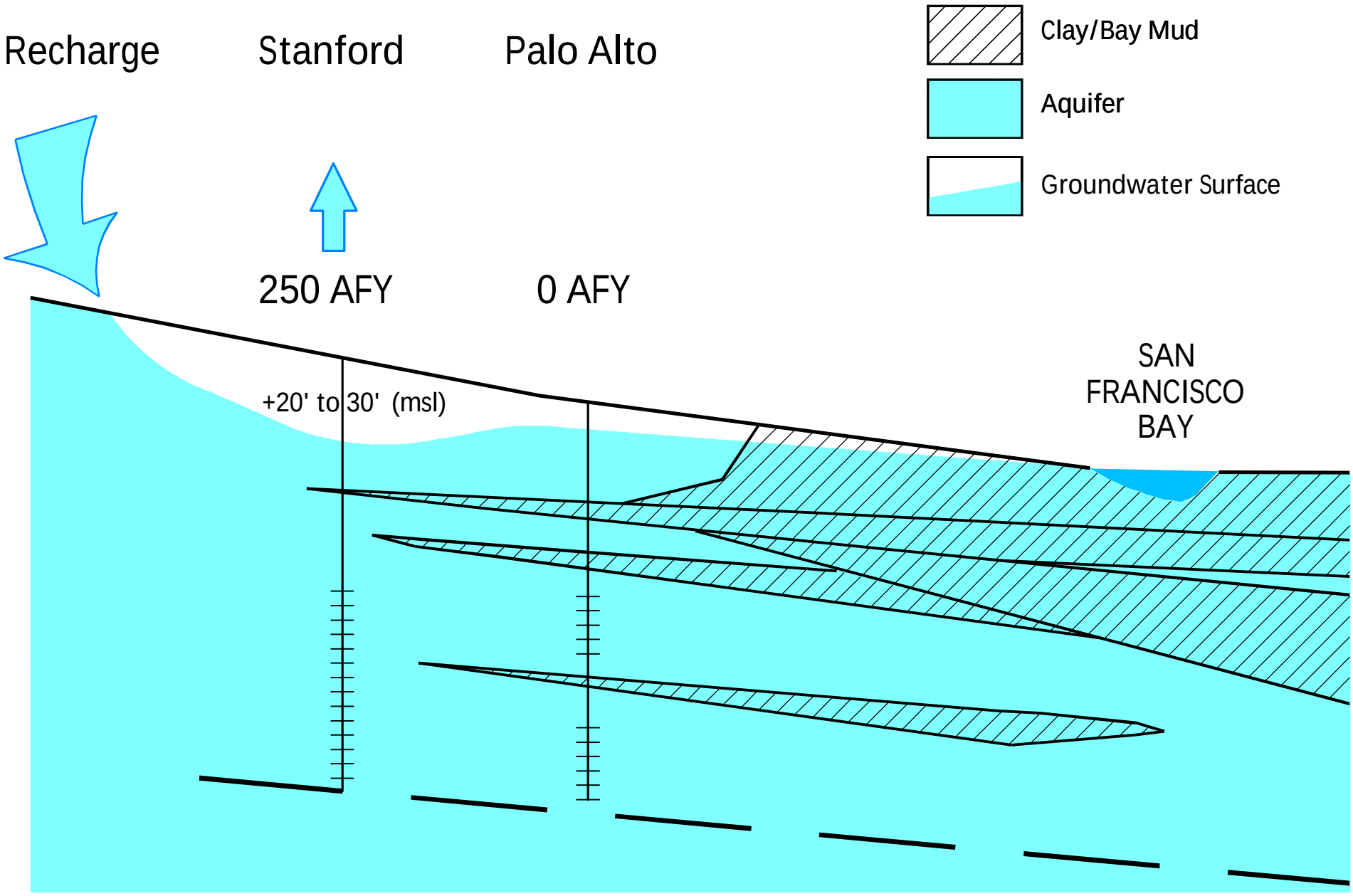

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Figure 10b
Pumpage of Groundwater Conditions
Current

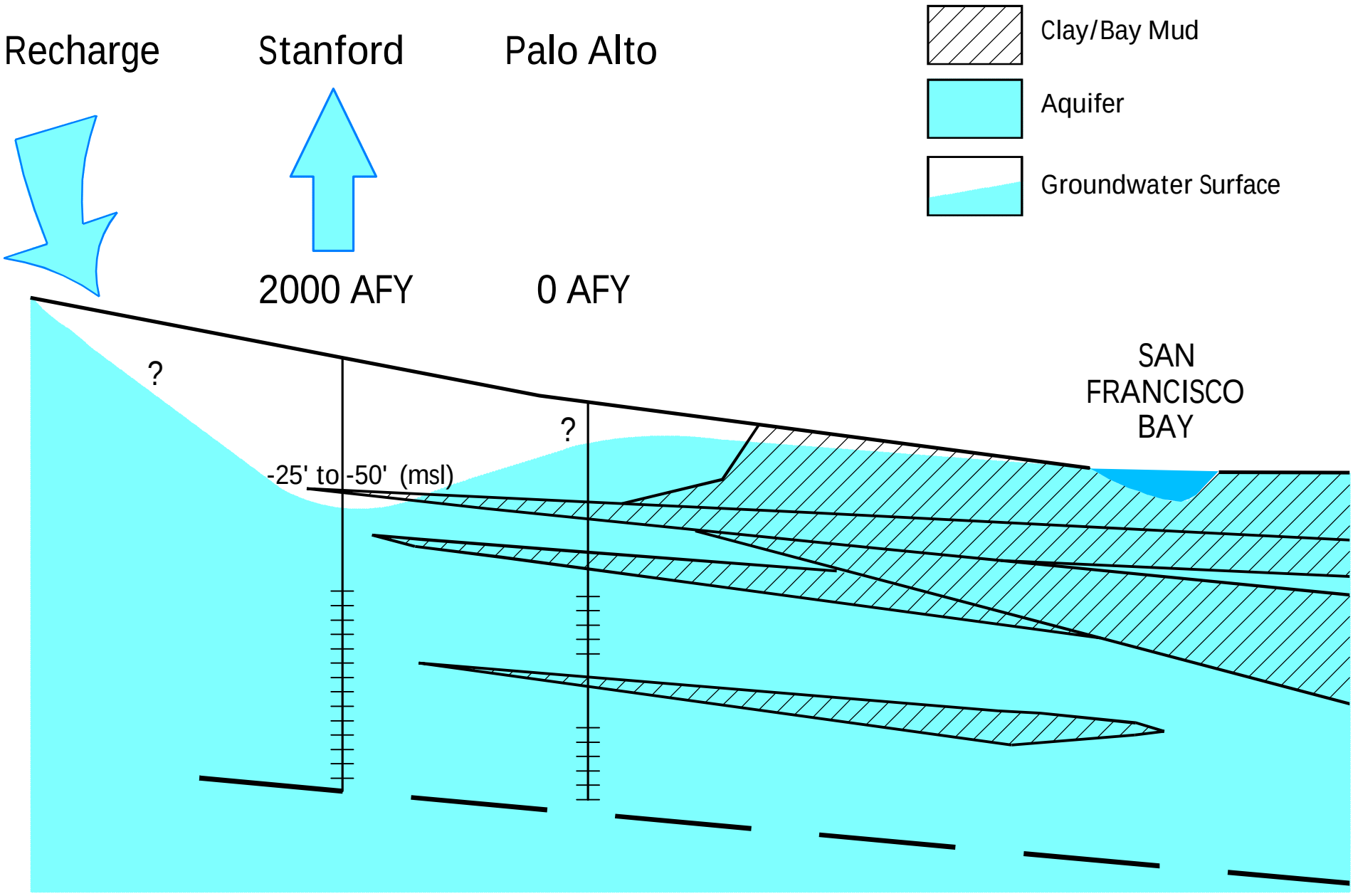

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Figure 10c
Groundwater Conditions
Increased Pumping: Normal to Wet Years

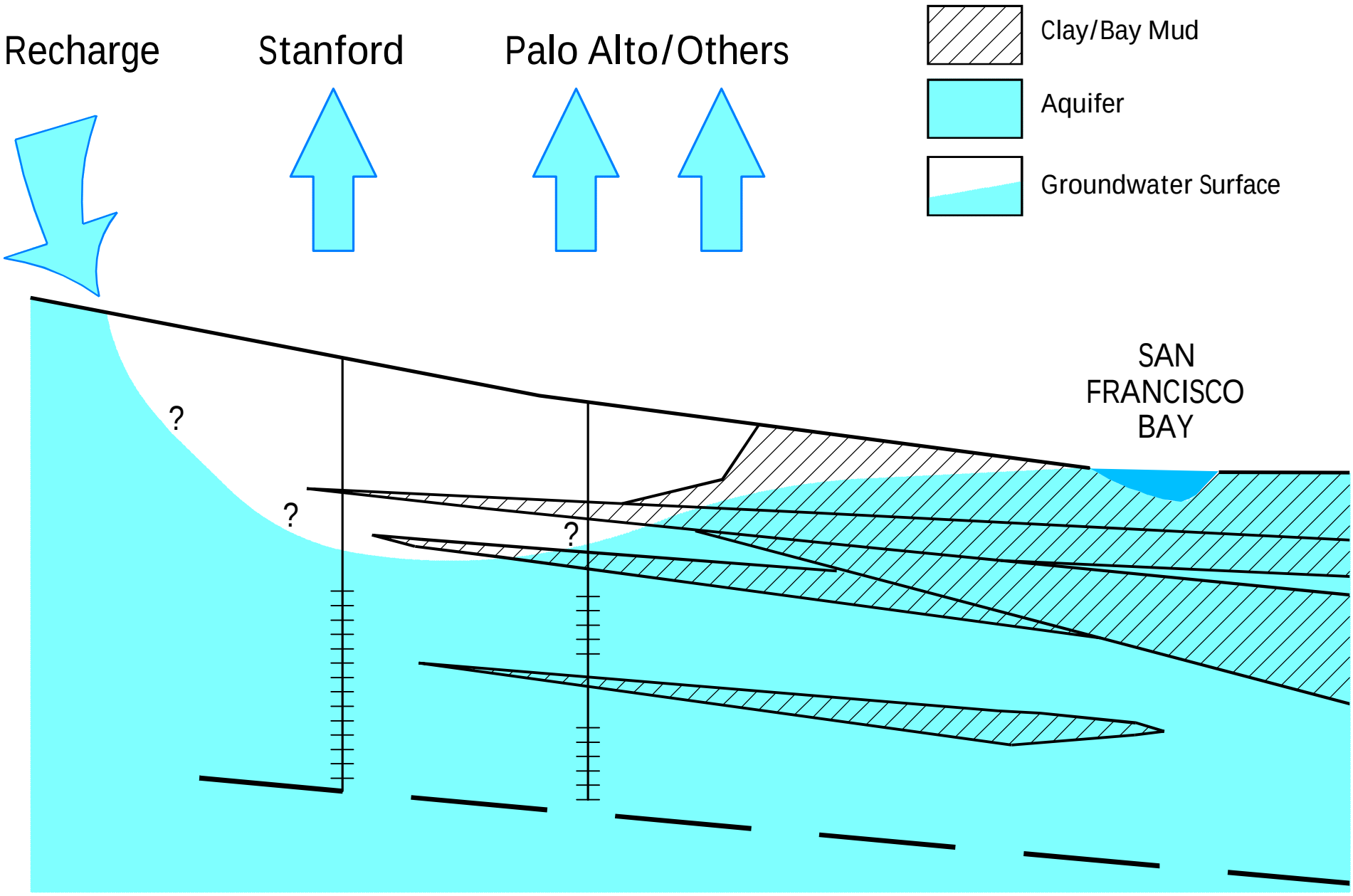

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Figure 10d
Groundwater Conditions
Short-Term Dry Year Pumping