



STANFORD UNIVERSITY

2018 General Use Permit

Transportation Impact Analysis Part 2

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Stanford 2018 General Use Permit (GUP): Transportation Impact Analysis Part 2

Prepared for:
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EXECUTIVE SUMMARY

This report presents the results of the transportation impact analysis (TIA) conducted for the proposed Stanford University 2018 General Use Permit in Santa Clara County, located west and north of the City of Palo Alto and south of the City of Menlo Park. Stanford proposes the following as a part of the 2018 General Use Permit:

- Construction of up to 2,275,000 additional net new square feet of academic and academic support uses,
- Construction of up to 3,150 net new housing units/beds, and
- Establishment of an approximately 2,000 parking space reserve that would be constructed only upon specified further County approval.

The impacts of the proposed project were evaluated following the Santa Clara County Valley Transportation Authority (VTA) TIA Guidelines (October 2014) and the California Governor's Office of Planning and Research (OPR) *Technical Advisory on Evaluating Transportation Impacts in CEQA* (January 2016). Following the VTA guidance, significance standards for intersection, freeway segments, and neighborhood streets were based upon the standards used by the jurisdiction in which the affected intersections, freeway segments, and neighborhood streets are located. Based on the guidance in the OPR Technical Advisory, an increase in transit users is not considered an adverse impact on the environment.



Roadway system operations were evaluated under the following scenarios:

- *Existing Conditions.*
- *Background (2018) No Project Conditions.* This includes build out of the 2000 General Use Permit with the exception of the Escondido Village Graduate Residences, which is not expected to be completed until 2020. This scenario also includes background traffic growth in the VTA regional traffic model through 2020 (the available VTA Travel Demand Model year), and offsite projects anticipated to be completed by 2018. As such, it contains substantial non-Project growth, which contributes to the impacts identified in the Background (2018) With Project case.
- *Background (2018) With Project Conditions.* This scenario adds all of the housing and academic and academic support space proposed under the proposed 2018 General Use Permit.

- *Cumulative (2035) No Project Conditions.* This scenario includes the build-out of the 2000 General Use Permit including the Escondido Village Graduate Residences and background traffic growth in the VTA regional traffic model through 2040 (the available VTA Travel Demand Model year).
- *Cumulative (2035) With Project Conditions.* This scenario adds all of the housing and academic and academic support space proposed under the proposed 2018 General Use Permit.

2018 General Use Permit Traffic Estimates

The Stanford Community Plan, which is part of the Santa Clara County General Plan, establishes a goal for the Stanford campus of No Net New Commute Trips. To date, Stanford has achieved the No Net New Commute Trips standard each year, meaning that there has not been an increase in peak hour, peak direction commute trips compared to measured baseline conditions. Per the Stanford Community Plan policy, the goal has been achieved through a combination of on-site trip reduction programs and offsite programs that have removed trips from the roads nearest to the campus (the impact area identified in the Environmental Impact Report for the 2000 General Use Permit).

Stanford intends to continue to implement programs to achieve the No Net New Commute Trips goal during the remainder of the 2000 General Use Permit and to expand those programs throughout the life of the proposed 2018 General Use Permit. However, to provide a conservative analysis similar to the analysis performed for the 2000 General Use Permit, this TIA assumes Stanford does not increase its trip reduction efforts beyond the existing programs, and growth in trips above baseline conditions occurs.

The 2018 General Use Permit trip generation estimates are based on the assumption that the net new academic and academic support square footage generates trips at the existing 2015 trip generation rates. It was assumed that Stanford maintains the status quo for its Transportation Demand Management (TDM) program and travel patterns, which will show, for purposes of this analysis, an increase in commute trips over today's level.

The trip generation assumptions are described in Stanford 2018 General Use Permit: Transportation Impact Analysis Part 1. In short, if Stanford were to maintain the status quo for its TDM program rather than enhancing the program as anticipated, full development under the 2018 General Use Permit would generate a total of 1,179 net additional trips during the AM peak hour (751 inbound and 428 outbound) and 1,379 net additional trips during the PM peak hour (600 inbound and 779 outbound).

Intersection Impacts and Proposed Mitigation

The analysis identifies potentially significant adverse impacts of the proposed Project on the surrounding transportation system and, where feasible, identifies physical intersection and roadway improvements as potential means to mitigate significant impacts. For some intersections, no mitigation is identified because no physical improvements appear to be feasible. In other cases, physical improvements could reduce an

impact to a less-than-significant level. However, Santa Clara County may find that the proposed mitigation measure is unlikely to be implemented in a timely manner due to the need for approvals by other jurisdictions or the lack of available fair-share funding from other entities contributing to the impact. Therefore, intersection impacts may be identified as significant and unavoidable after a potential mitigation measure has been identified.

Stanford's employee drive-alone rate has decreased from 72 percent in 2002 to 50 percent in 2015, contributing factor to this improvement is the University's TDM program. The Project application states that Stanford intends to continue to monitor program effectiveness and adjust the specific services, incentives and disincentives over time to optimize the effectiveness of the programs.

Stanford also proposes in the Project application that Santa Clara County continue to recognize its off-campus trip reductions efforts as specified by Stanford Community Plan policy C-8, with two minor modifications. First, Stanford proposes a clarification of the existing policy, that reduction of an off-campus trip can be recognized as long as one terminus for the trip is within the boundary described by the condition. For example, if Stanford runs a shuttle to East Palo Alto and an East Palo Alto resident rides that shuttle to a business in Palo Alto, a vehicle trip will have been removed within the targeted geographic boundary.

Second, Stanford proposes that funding off-campus circulation infrastructure improvements may qualify for trip credits as long as the improvements would enhance safety or increase mobility for pedestrians, bicyclists or transit users within the local impact area. For example,

- funding roadway modifications to add transit vehicle lanes or bicycle lanes;
- adding signals to improve pedestrian or bicycle safety;
- providing transit signal pre-emption along major corridors;
- connecting gaps in the bicycle network;
- reducing non-local traffic in neighborhood areas through traffic calming measures; and
- other pedestrian, bicycle and transit-supportive projects envisioned in the Palo Alto Comprehensive Plan and ConnectMenlo, could qualify for trip credits under this approach if approved by the County.

Any proposal for such credits would be accompanied by evidence demonstrating how the infrastructure project would remove vehicular trips from the local impact area.

For the 2018 General Use Permit, Stanford proposes in its Project Application that its first priority would be to take steps within its own control to reduce trips through trip reduction measures and trip credits, as described above. However, if Stanford cannot achieve the No Net New Commute Trips goal using those two means, Stanford would 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.

Payment would be made to an account managed by the County Planning Office that would be used to fund off-campus projects that encourage and improve use of alternative transportation modes or otherwise reduce peak period traffic. These projects include but are not limited to transit improvements that directly or indirectly benefit the local impact area and community education and outreach regarding non-auto mode transportation options. This fund also could be used for transportation improvements that increase safety and mobility for pedestrians, bicyclists and transit users.

Background (2018) With Project Conditions Intersection Impacts

Intersections that would have a significant impact under Background (2018) With Project Conditions during the AM or PM peak hours are presented below, along with the physical improvements that would be capable of reducing the impact to a less-than-significant level where such improvements would be potentially feasible to implement:

- *Intersection #2: I-280 NB Off-Ramp/Sand Hill Road (AM peak hour).*
 - Mitigation: Contribute fair-share funding toward the addition of a second northbound right-turn lane as identified in the *ConnectMenlo Final Environmental Impact Report*. (LTS if implemented by the City of Menlo Park and Caltrans, and sufficient funding exists)
- *Intersection #13: I-280 SB Off-Ramp/Page Mill Road (AM and PM peak hours).*
 - Mitigation: Contribute fair-share funding toward the installation of a traffic signal. (LTS if implemented by Santa Clara County and Caltrans, and sufficient funding exists)
- *Intersection #17: Junipero Serra Boulevard-Foothill Expressway/Page Mill Road (AM and PM peak hours)*
 - Mitigation: Contribute fair-share funding toward installation of an overlap phase for northbound and southbound right-turning vehicles and widening of the southbound approach to two lanes between Page Mill Road and Stanford Avenue to align with the existing designated right-turn lane. (SU under 2018 Conditions; LTS under 2035 Conditions if implemented by Santa Clara County and sufficient funding exists)
- *Intersection #30: Foothill Expressway/Arastradero Road (PM peak hour)*
 - Mitigation: If such grade separation is approved and implemented, contribute fair-share funding toward a grade separation project as identified in the draft *Santa Clara County Expressway Plan 2040*. (LTS if the County Expressway Plan 2040 is approved and implemented)
- *Intersection #31: Foothill Expressway/San Antonio Road (PM peak hour)*
 - Mitigation: Contribute fair-share funding toward the construction of a third southbound through lane on Foothill Expressway between San Antonio Road and El Monte Avenue as identified in the draft *Santa Clara County Expressway Plan 2040*. (LTS if implemented by Santa Clara County and sufficient funding exists)

- *Intersection #58: Alma Street/Charleston Road (PM peak hour)*
 - Mitigation: 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. (LTS if implemented by the City of Palo Alto and sufficient funding exists)

Cumulative (2035) With Project Conditions Intersection Impacts

Intersections with a significant impact under Cumulative (2035) With Project Conditions during the AM or PM peak hours are presented below along with the physical improvements that would be capable of reducing the impact to a less-than-significant level where such improvements would be potentially feasible to implement:

- *Intersection #2: I-280 NB Off-Ramp/Sand Hill Road (AM peak hour)*
 - Impact also occurs under Background (2018) With Project Conditions.
 - Mitigation: Contribute fair-share funding toward the addition of a second northbound right-turn lane as identified in the *ConnectMenlo Final Environmental Impact Report*. (LTS if implemented by the City of Menlo Park and Caltrans, and sufficient funding exists)
- *Intersection #17: Junipero Serra Boulevard-Foothill Expressway/Page Mill Road (AM and PM peak hours)*
 - Impact also occurs under Background (2018) With Project Conditions.
 - Mitigation: Contribute fair-share funding toward installation of an overlap phase for northbound and southbound right-turning vehicles and widening of the southbound approach to two lanes between Page Mill Road and Stanford Avenue to align with the existing designated right-turn lane. (LTS if implemented by Santa Clara County and sufficient funding exists)
- *Intersection #19: Hanover Street/Page Mill Road (AM peak hour)*
 - Mitigation: Contribute fair-share funding toward installation of a second westbound left-turn lane, identified as an option in the *Page Mill Expressway Corridor Study Report*. (LTS if implemented by Santa Clara County and sufficient funding is available)
- *Intersection #20: El Camino Real/Page Mill Road-Oregon Expressway (AM and PM peak hours)*
 - Mitigation: Contribute fair-share funding toward reconfiguration of the east leg of the intersection to include one right-turn lane, two through lanes, two left-turn lanes, two receiving lanes, and no on-street parking; and to the extension of the double left-turn lanes as identified in the *Page Mill Expressway Corridor Study Report*. (LTS if implemented by Santa Clara County and sufficient funding is available)

- *Intersection #21: Middlefield Road/Oregon Expressway (AM peak hour)*
 - Due to close proximity of the Oregon Avenue frontage road and the County's desire to preserve the shoulder striping along Oregon Expressway for use by bicyclists, no feasible improvement is available to mitigate this impact. (SU)
- *Intersection #29: Foothill Expressway/Hillview Avenue (AM peak hour)*
 - Due to physical constraints at this location, no feasible improvement is available to mitigate this impact. (SU)
- *Intersection #30: Foothill Expressway/Arastradero Road (AM peak hour)*
 - Impact also occurs under Background (2018) With Project Conditions PM peak hour.
 - Mitigation: If such grade separation is approved and implemented, contribute fair-share funding toward grade separation as identified in the draft *Santa Clara County Expressway Plan 2040*. (LTS if the County Expressway Plan 2040 is approved and implemented)
- *Intersection #31: Foothill Expressway/San Antonio Road (PM peak hour)*
 - Impact also occurs under Background (2018) With Project Conditions.
 - Mitigation: Contribute fair-share funding toward the construction of a third southbound through lane on Foothill Expressway between San Antonio Road and El Monte Avenue as identified in the draft *Santa Clara County Expressway Plan 2040*. (LTS if implemented by Santa Clara County and sufficient funding is available)
- *Intersection #32: Foothill Expressway/El Monte Avenue (AM peak hour)*
 - Mitigation: Contribute fair-share funding toward the construction of a third northbound through lane at the intersection and associated receiving lane as identified in the draft *Santa Clara County Expressway Plan 2040*. (LTS if implemented by Santa Clara County and sufficient funding is available)
- *Intersection #33: Foothill Expressway/Springer Road-Magdalena Avenue (AM and PM peak hours)*
 - Mitigation: Contribute fair-share funding toward the following improvements:
 - Convert to an eight-phase signal as identified in the draft *Santa Clara County Expressway Plan 2040*,
 - Change the lane configuration for the east leg to have two left-turn lanes, one through lane, and one right-turn lane, and
 - Change the lane configuration for the west leg to have one left-turn lane, two through lanes, and one right-turn lane.(LTS if implemented by Santa Clara County and sufficient funding exists)
- *Intersection #37: El Camino Real/Encinal Avenue (PM peak hour)*
 - Mitigation: Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane. (LTS if implemented by the City of Menlo Park and sufficient funding exists)

- *Intersection #38: El Camino Real/Valparaiso Avenue (PM peak hour)*
 - Mitigation: Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane. (LTS if implemented by the City of Menlo Park and sufficient funding exists)
- *Intersection #41: El Camino Real/Ravenswood Road (PM peak hour)*
 - Mitigation: Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane. (LTS if implemented by the City of Menlo Park and sufficient funding exists)
- *Intersection #48: El Camino Real/Embarcadero Road (PM peak hour)*
 - Mitigation: Contribute fair-share funding toward the addition of a second northbound left-turn lane. (LTS if implemented by the City of Palo Alto and sufficient funding exists)
- *Intersection #56: Alma Street/Hamilton Avenue (PM peak hour)*
 - Mitigation: Contribute fair-share funding toward the reconfiguration of the westbound approach to have one left-turn lane and one right-turn lane, by removing on-street parking. (LTS if implemented by the City of Palo Alto and sufficient funding exists)
- *Intersection #58: Alma Street/Charleston Road (PM peak hour)*
 - Impact also occurs under Background (2018) With Project Conditions.
 - Mitigation: Contribute fair-share funding toward add a designated right-turn lane and install an overlap phase for the northbound and southbound right-turn movements. (LTS if implemented by the City of Palo Alto and sufficient funding exists)
- *Intersection #59: Middlefield Road/Marsh Road (AM peak hour)*
 - Mitigation: Contribute fair-share funding toward the addition of a second westbound left-turn lane and a second receiving lane on the south leg, consistent with recommendations in the *ConnectMenlo Final EIR (November 2016)* and the *Middle Plaza at 500 El Camino Real Draft EIR (March 2017)*. (LTS if implemented by the Town of Atherton and sufficient funding exists)
- *Intersection #63: Middlefield Road/Lytton Avenue (PM peak hour)*
 - Due to the close proximity of the residential units near the intersection, no feasible improvement is available to mitigate this impact. (SU)
- *Intersection #66: Middlefield Road/Embarcadero Road (AM and PM peak hours)*
 - Due to the close proximity of the residential units near the intersection, no feasible improvement is available to mitigate this impact. (SU)
- *Intersection #89: Central Expressway/Castro Street-Moffett Boulevard (AM peak hour)*
 - Mitigation: Close Castro Street at the train tracks to form a T-intersection with Central Expressway and Moffett Boulevard, consistent with recommendations in the *Mountain View Transit Center Master Plan (May 2017)*. (LTS if implemented by the City of Mountain View)

- Mitigation Alternative: If the City of Mountain View does not close Castro Street, contribute fair-share funding toward the construction of a second southbound left-turn lane from Central Expressway to Moffett Boulevard. (LTS if implemented by Santa Clara County and sufficient funds exist)
- *Intersection #90: Foothill Expressway/Edith Avenue (PM peak hour)*
 - Due to close proximity of the Miranda Avenue/Hillview Avenue intersection and lack of improvement identified in the *Santa Clara County Expressway Plan 2040* at this intersection, no feasible improvement is available to mitigate this impact. (SU)

Freeway Segment Impacts

Mitigation of freeway impacts is considered beyond the scope of an individual development project. Therefore, the Project's freeway impacts are considered significant and unavoidable.

Background (2018) With Project Conditions Freeway Impacts

Freeway segments with significant Project impacts under Background (2018) With Project Conditions are:

- Northbound State Route 85
 - South De Anza Boulevard to Stevens Creek Boulevard (AM peak hour);
 - Stevens Creek Boulevard to I-280 (AM peak hour);
- Southbound State Route 85
 - Stevens Creek Boulevard to South De Anza Boulevard (PM peak hour);
- Southbound Interstate 280
 - El Monte Road to Magdalena Avenue (PM peak hour).

Cumulative (2035) With Project Conditions Freeway Impacts

Freeway segments with significant Project impacts under Cumulative (2035) With Project Conditions are:

- Northbound State Route 85
 - South De Anza Boulevard to Stevens Creek Boulevard (AM peak hour);
 - Stevens Creek Boulevard to I-280 (AM Peak hour);
- Southbound State Route 85
 - Stevens Creek Boulevard to South De Anza Boulevard (PM peak hour);
- Northbound Interstate 280
 - Wolfe Road to De Anza Boulevard (AM peak hour);
 - State Route 85 to Foothill Expressway (AM and PM peak hours);
 - Foothill Expressway to Magdalena Avenue (AM peak hour);
 - Sand Hill Road to Woodside Road (PM peak hour).

- Southbound Interstate 280
 - Sheep Camp Trail to Edgewood Road (AM peak hour);
 - Magdalena Avenue to Foothill Expressway (PM peak hour);
 - Foothill Expressway to State Route 85 (PM peak hour);
 - De Anza Boulevard to Wolfe Road (PM peak hour).

Neighborhood Street Impacts

The College Terrace and Crescent Park neighborhoods were evaluated for potential neighborhood street impacts. Traffic impacts on residential streets within the City of Palo Alto are estimated using the Traffic Infusion on Residential Environment (TIRE) methodology. The TIRE method is based on the premise that any traffic change that would cause an index increase of 0.1 or more would be noticeable to residents. The traffic generated by the Project would not surpass the 0.1 change in TIRE index on any of the local residential street segments evaluated in this analysis.

Transit, Bicycle and Pedestrian Impacts

The 2018 General Use Permit application does not propose any infrastructure changes outside the campus and, thus, would not interfere with transit agencies' ability to modify or expand service. Therefore, the Project's impact on transit services would be less-than-significant. In addition, traffic congestion resulting from implementation of the Project would not result in substantial delays for transit vehicles.

The 2018 General Use Permit application does not propose any infrastructure changes outside the campus and, thus, would not create hazardous conditions where none exist today, nor would it conflict with planned bicycle and pedestrian facilities. Therefore, the Project's impact on pedestrian and bicycle facilities would be less-than-significant. In addition, physical improvements identified to address intersection impacts would not result in a significant impact to pedestrian and bicycle facilities.

Safety and Emergency Access Impacts

There would be no impacts to safety or emergency access resulting from the proposed Project.



1. INTRODUCTION

This report presents the results of the transportation impact analysis (TIA) for the proposed Stanford University 2018 General Use Permit (the “Project”) located in the Santa Clara County, California. The Stanford University academic campus (the “Project site”) is located east of Junipero Serra Boulevard, north of Page Mill Road, south of Sand Hill Road, and west of El Camino Real.

The purpose of the TIA is to address the impacts of the proposed 2018 General Use Permit on the surrounding transportation system external to the Stanford University campus including the roadways, transit service, pedestrian facilities, and bicycle facilities. The TIA complies with the Santa Clara Valley Transportation Authority (VTA) TIA Guidelines (October 2014), the congestion management agency for Santa Clara County, and the California Environmental Quality Act (CEQA).

This section provides a description of the Project, an overview of the study area, a description of the analysis methods, and an overview of the report organization.

1.1 PROJECT DESCRIPTION

In December 2000, the Santa Clara County Board of Supervisors approved the current Stanford University General Use Permit (the “2000 General Use Permit”) that defined the conditions of Stanford’s planned growth and development. The 2000 General Use Permit authorized specified quantities of new academic and academic support facilities and housing units (units and/or student beds) within the campus. Stanford is about to reach the 2000 General Use Permit development limits in terms of both the academic and

academic support space, and housing units. Therefore, Stanford is applying for an updated general use permit (the proposed 2018 General Use Permit) to establish the conditions for the next increment of campus growth.

Stanford proposes the following as a part of the 2018 General Use Permit:

- Completion of the academic and academic support space and parking authorized by the 2000 General Use Permit,
- Construction of up to 2,275,000 additional net new square feet of academic and academic support uses,
- Construction of up to 3,150 net new housing units/beds, and
- Establishment of an approximately 2,000 parking space reserve that would be constructed only upon specified further County approval.

1.1.1 ADDITIONAL DOCUMENTATION

The Stanford 2018 General Use Permit transportation analysis is a three-part document. Each document is identified below along with a brief description of the content included in the document and how it is referenced throughout the rest of this document (2018 General Use Permit: TIA Part 2).

1. Stanford 2018 General Use Permit: Transportation Impact Analysis Part 1

Referenced as: 2018 General Use Permit: TIA Part 1

This document describes Stanford University's trip generation, distribution, mode choice, and transportation demand management programs.

2. Stanford 2018 General Use Permit: SB 743 Vehicle Miles Traveled Analysis

Referenced as: 2018 General Use Permit: VMT Report

This document presents the impacts of the Project in terms of criteria proposed by the California Governor's Office of Planning and Research to implement California State Law Senate Bill 743.

3. Stanford 2018 General Use Permit: Transportation Impact Analysis Part 2 (this document)

Referenced as: 2018 General Use Permit: TIA Part 2

1.2 STUDY AREA

The Stanford Community Plan, which is part of the Santa Clara County General Plan, establishes a goal for the Stanford campus of No Net New Commute Trips. To date, Stanford has achieved the No Net New Commute Trips standard each year, meaning that there has not been an increase in peak hour, peak direction commute trips compared to measured baseline conditions. Per Community Plan policy, the goal has been achieved through a combination of onsite trip reduction programs and offsite programs that have removed trips from the roads nearest to the campus (the impact area identified in the Environmental Impact Report for the 2000 General Use Permit).

Stanford intends to continue to implement programs to achieve the No Net New Commute Trips goal during the remainder of the 2000 General Use Permit and to expand those programs throughout the life of the proposed 2018 General Use Permit. However, to provide a conservative analysis similar to the analysis performed for the 2000 General Use Permit, this TIA assumes Stanford does not increase its trip reduction efforts beyond the existing programs, and growth in trips above baseline conditions occurs. The trip generation assumptions are described in 2018 General Use Permit: TIA Part 1.

For analysis of potential transportation impacts of the proposed Project, a list of study intersections and freeway segments was selected by identifying locations where the Project would contribute a noticeable amount of traffic as discussed below.

1.2.1 STUDY INTERSECTIONS

Fehr & Peers established a systematic approach to the screening and selection of the intersections to be included within the 2018 General Use Permit: TIA Part 2. The screening involved the following steps:

Step 1: Trips were assigned to the roadways that provide access to the campus based on the trip generation and distribution presented in the *2018 General Use Permit: TIA Part 1* found in the Stanford 2018 General Use Permit Application. As the Congestion Management Agency for Santa Clara County, the VTA maintains a set of TIA guidelines that is used by most jurisdictions within the county. For congestion management program (CMP) intersections, the VTA Guidelines recommends using a test of adding 10 or more net new trips per lane to determine if an intersection should be included in a TIA.

Based on the trip generation and distribution, over 125 intersections were identified using the VTA's 10 trips per lane guideline. The intersections were then screened using a point system that considered key characteristics of each intersection including:

- State or regional transportation facility,
- Proximity to campus / concentration of trips,
- Type of cross-street traffic and access provided, and
- Previously studied in Stanford-related traffic studies or environmental impact reports.

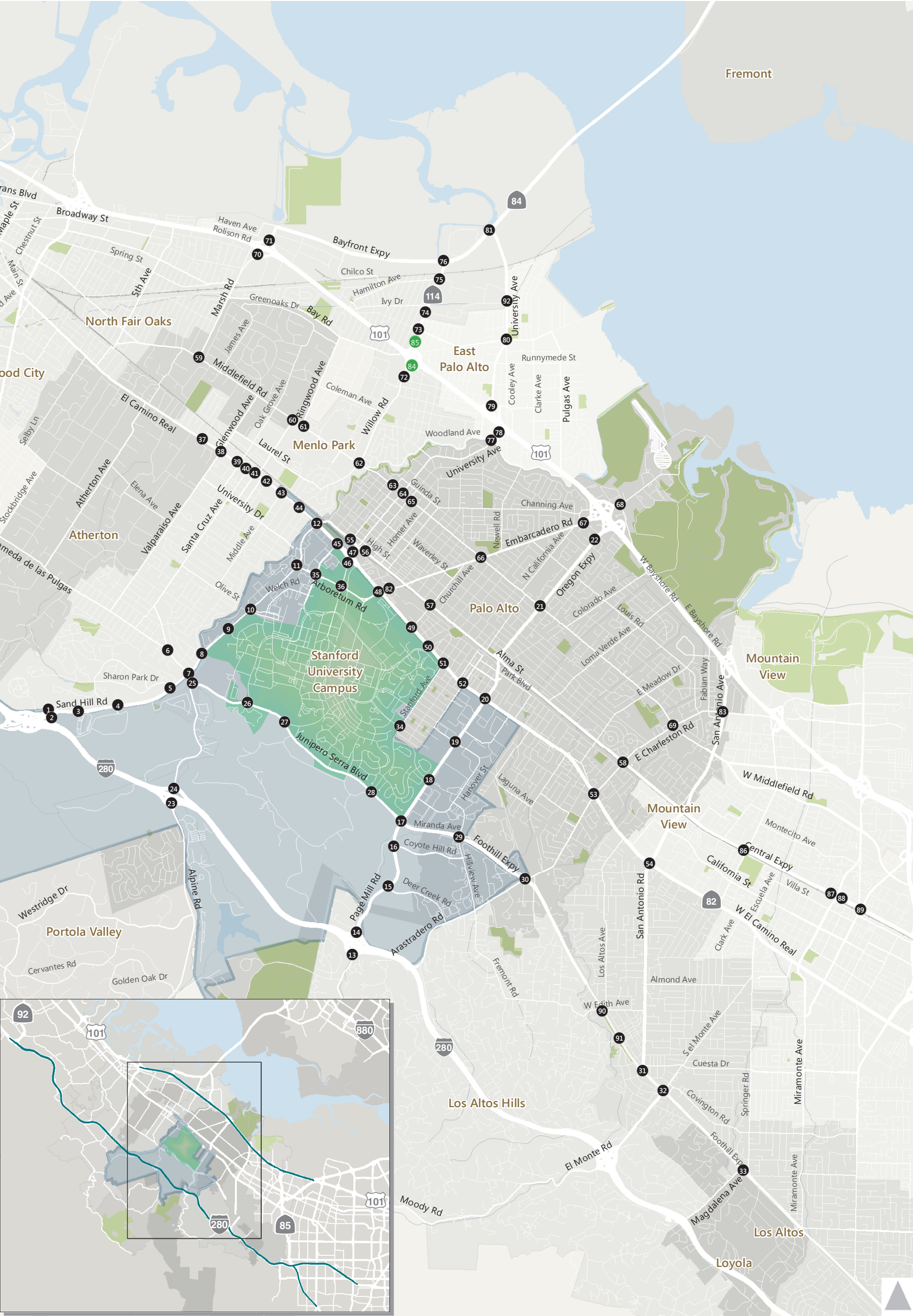
The point system is based upon professional judgment and incorporates typical factors that traffic engineers take into account to identify those intersections most likely to influence overall traffic flow and congestion within a local setting. The point system is further described in **Appendix A** along with the original list of intersections reviewed. This resulted in an *initial* identification of 79 intersections for inclusion in the 2018 General Use Permit: TIA Part 2.

Step 2: After the study intersections were established, the study intersection criteria and list of proposed study intersections was circulated to the jurisdictions of County of Santa Clara, City of Palo Alto,

City of East Palo Alto, and City of Menlo Park for review and feedback. Each jurisdiction requested at least one study intersection be added for inclusion in the 2018 General Use Permit: TIA Part 2.

Step 3: Each of the requested intersections was evaluated using the study intersection screening criteria (if it met the 10 trips per lane guideline and was not already evaluated) and additional weight was given to inclusion of the intersection based on the local knowledge of the relevant agency staff. If the intersection then met the minimum number of points to warrant evaluation, it was included as a study intersection. Intersections that did not meet the 10 trips per lane guideline or that otherwise did not meet the numeric screening criteria with additional weighting were removed from further evaluation.

Based on the above evaluation process, a total of 90 intersections were identified for inclusion in the analysis, plus two future intersections that will be built as part of the Willow Road interchange (starting in 2019). Three additional intersections were included for analysis that did not meet the study intersection selection criteria; however, they have recently been studied under the Facebook Campus Expansion Environmental Impact Report and were included at the City of East Palo Alto's request. A final list of the study intersections is provided in **Table 4-1** and **Figure 1-1**.



- #

Study Intersection
- #

Cumulative Study Intersection
- Study Freeway Segments
- Stanford University Campus
- Stanford Lands



Figure 1-1
Stanford 2018 General Use Permit Study Area

1.2.2 FREEWAY SEGMENTS

The freeway segments were selected in consultation with Santa Clara County and finalized based on VTA TIA Guidelines. Freeway segments were included for analysis if the Project was expected to add traffic equal to or greater than one percent of the freeway segment's capacity. Based on this criterion, the following freeway segments¹ were analyzed for this Project during the weekday morning and evening peak hours:

- SR 85
 - Saratoga Avenue to South De Anza Boulevard
 - South De Anza Boulevard to Stevens Creek Boulevard
 - Stevens Creek Boulevard to I-280
- US 101 (Santa Clara County)
 - SR 237 to Moffett Boulevard
 - Moffett Boulevard to SR 85
 - SR 85 to N. Shoreline Boulevard
 - N. Shoreline Boulevard to Rengstorff Avenue
 - Rengstorff Avenue to San Antonio Road
 - San Antonio Road to Oregon Expressway
 - Oregon Expressway to Embarcadero Road
- US 101 (San Mateo County)
 - Embarcadero Road to University Avenue
 - University Avenue to Willow Road (SR 11)
 - Willow Road (SR 114) to Marsh Road
 - Marsh Road to Woodside Road (SR 84)
- I-280 (Santa Clara County)
 - Lawrence Expressway to Wolfe Road
 - Wolfe Road to De Anza Boulevard
 - De Anza Boulevard to SR 85
 - SR 85 to Foothill Expressway
 - Foothill Expressway to Magdalena Avenue
 - Magdalena Avenue to El Monte Road
 - El Monte Road to La Barranca Road
 - La Barranca Road to Page Mill Road
 - Page Mill Road to Alpine Road
- I-280 (San Mateo County)
 - Alpine Road to Sand Hill Road
 - Sand Hill Road to Woodside Road (SR 84)
 - Woodside Road (SR 84) to Farm Hill Boulevard
 - Farm Hill Boulevard to Cañada Road
 - Cañada Road to Edgewood Road
 - Edgewood Road to SR 92

¹ Existing freeway segments within San Mateo County are combined and presented with one level of service evaluation based upon the worst level of service for the combined segments.

1.2.3 FREEWAY RAMPS

Freeway ramps that provide direct access to and from the Project site via US 101 and I-280 were also selected for analysis:

1. US 101 Southbound
 - i. Willow Road Off-Ramp
 - ii. University Avenue Off-Ramp
 - iii. Embarcadero Road On Ramp
 - iv. Oregon Expressway On Ramp
2. US 101 Northbound
 - i. Willow Road On-Ramp (loop)
 - ii. University Avenue On-Ramp (loop)
 - iii. Embarcadero Road Off Ramp²
3. I-280 Southbound
 - i. Sand Hill Road On-Ramp (loop)
 - ii. Sand Hill Road Off-Ramp (loop)
 - iii. Alpine Road Off-Ramp
 - iv. Alpine Road On-Ramp (loop)
 - v. Page Mill Road Off-Ramp
 - vi. Page Mill Road On-Ramp (loop)
4. I-280 Northbound
 - i. Page Mill Road Off-Ramp
 - ii. Page Mill Road On-Ramp
 - iii. Alpine Road Off-Ramp
 - iv. Alpine Road On-Ramp
 - v. Sand Hill Road Off-Ramp
 - vi. Sand Hill Road On-Ramp

1.2.4 NEIGHBORHOODS

Multiple neighborhoods were considered for analysis as identified in Section 8.3. After reviewing the potential for Stanford to induce impacts in each of the reviewed neighborhoods, the College Terrace and Crescent Park neighborhoods were evaluated for potential street impacts due to the Project.

² The Oregon Expressway off-ramp from US 101 northbound was not included as Oregon Expressway terminates at the US 101 northbound ramps.

1.3 ANALYSIS SCENARIOS

This study addresses the Project's impacts on the roadway system and the adjacent bicycle, pedestrian, and transit networks. Intersection and freeway operations were evaluated during the weekday peak hours within the morning (7:00 AM to 10:00 AM) and evening (4:00 PM to 7:00 PM) peak periods for the scenarios listed below. Intersection turning movement counts may be found in **Appendix B**. The exact peak hour within each peak period varies by study intersection, and each intersection's peak hour was evaluated in this analysis. For example, one intersection might have a peak hour of 7:15 AM to 8:15 AM and another might have a peak hour of 7:45 AM to 8:45 AM.

- **Existing Conditions** uses existing volumes obtained from new traffic counts and current roadway geometries.
- **Background (2018) Conditions** uses the VTA-C/CAG³ 2020 travel demand forecasting model to determine local growth as assumed by fall 2018, and will assume completion of the existing 2000 General Use Permit academic and academic support development. Because the Escondido Village Graduate Student Residences project will not be occupied by 2018, this project is not included in Background (2018) Conditions.
- **Background (2018) with Project Conditions** adds the full buildout of 2018 General Use Permit land uses to the Background (2018) Condition.
- **Cumulative (2035) Conditions** uses the VTA-C/CAG 2040 travel demand forecasting model to determine future year volumes assumed in Year 2035, the estimated duration for the 2018 General Use Permit. The Cumulative (2035) Conditions scenario includes the Escondido Village Graduate Student Residences project because the project will be built and occupied prior to 2035.
- **Cumulative (2035) with Project Conditions** adds the full buildout of 2018 General Use Permit land uses to the Cumulative Condition.

1.4 REPORT ORGANIZATION

This report is divided into seven additional chapters as described below:

- **Chapter 2 – Regulatory Setting** presents the relevant transportation regulatory framework, which includes federal, state, regional, and local programs.
- **Chapter 3 – Analysis Methodology** presents the analysis methods for intersections, freeways, transit operations, and bicycle and pedestrian facilities. In addition, the level of service standards and significant impact criteria are presented for each jurisdiction.
- **Chapter 4 – Existing Conditions** describes the transportation system near the Project site, including the surrounding roadway network, morning and evening peak period intersection turning movement

³ C/CAG = San Mateo County City/County Association of Governments. C/CAG is the congestion management agency for San Mateo County.

volumes, existing bicycle, pedestrian, and transit facilities, intersection level of service, and freeway segment levels of service.

- **Chapter 5 – Project Traffic Estimates** describes the Project trip generation, distribution and assignment methods for intersections and freeways.
- **Chapter 6 – Background (2018) Conditions** presents the transportation operations with and without the Project under Background (2018) Conditions.
- **Chapter 7 – Cumulative (2035) Conditions** presents the transportation operations with and without the Project under Cumulative (2035) Conditions.
- **Chapter 8 –Transportation Impact Assessment** presents the transportation impacts of the Project based on the CEQA significance criteria for the study intersections, freeway segments, and neighborhood streets and also provides mitigation measures to address Project impacts under Background (2018) and Cumulative (2035) Conditions. This chapter includes any potential secondary impacts to the transit service, bicycle, and pedestrian facilities. Any safety or emergency access impacts are also discussed.



2. REGULATORY SETTING

This section describes the Project's relevant transportation regulatory framework. The regulatory framework includes federal, State, regional, and local programs and plans related to the Project, including the status of implementation, as some of these are still in-progress and not yet fully adopted.

2.1 FEDERAL REGULATIONS

Federal regulations are described below.

2.1.1 FEDERAL HIGHWAY ADMINISTRATION

The Federal Highway Administration (FHWA) is a major agency within the U.S. Department of Transportation. In partnership with State and local agencies, FHWA carries out federal highway programs to meet the nation's transportation needs. FHWA administers and oversees federal highway programs to ensure that federal funds are used efficiently.

2.1.2 SURFACE TRANSPORTATION FUNDING PROGRAM (FAST ACT)

On December 4, 2015, President Obama signed the Fixing America's Surface Transportation (FAST) Act (Pub. L. No. 114-94) 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 infrastructure, highway and motor vehicle safety, public

transportation, motor carrier safety, hazardous materials safety, rail, and research, technology, and statistics programs. The FAST Act maintains the focus on safety, keeps intact the established structure of the various highway-related programs the FHWA manages, continues efforts to streamline project delivery and, for the first time, provides a dedicated source of federal dollars for freight projects. With the enactment of the FAST Act, states and local governments are now moving forward with critical transportation projects with the confidence that they will have a federal partner over the long term.

2.1.3 AMERICANS WITH DISABILITIES ACT OF 1990

The Americans with Disabilities Act of 1990 (ADA) (revised 2010) is a landmark civil rights law that prohibits discrimination based on disability. Titles I, II, III, and V of the ADA have been codified in Title 42 of the United States Code, beginning at Section 12101. Title III prohibits discrimination on the basis of disability in “places of public accommodation” (businesses and non-profit agencies that serve the public) and “commercial facilities” (other businesses). The regulation includes Appendix 3.3-A to Part 36 (Standards for Accessible Design), which establishes minimum standards for ensuring accessibility for the disabled when designing and constructing a new facility or altering an existing facility, including roadways, parking lots, and sidewalks. Examples of key guidelines include detectable warnings for pedestrians when entering traffic where there is no curb, a clear zone of 48 inches for the pedestrian travel way, and a vibration-free zone for pedestrians.

2.2 STATE REGULATIONS

State transportation agencies and plans are described in the following sections, organized by jurisdiction/agency.

2.2.1 CALIFORNIA DEPARTMENT OF TRANSPORTATION

The California Department of Transportation (Caltrans) has authority over the State highway system, including freeways, interchanges, and arterial routes. Caltrans operates and maintains State highways in Santa Clara. The Guide for the Preparation of Traffic Impact Studies (Caltrans 2001) provides information that Caltrans uses to review impacts on State highway facilities, including freeway ramps and segments. However, as the Congestion Management Agency for Santa Clara County, VTA is responsible for monitoring operations on Caltrans facilities within Santa Clara County.

2.2.2 STATE TRANSPORTATION IMPROVEMENT PROGRAM

The California Transportation Commission (CTC) administers transportation programming, which is the public decision-making process that sets priorities and funds projects that have been envisioned in long-range transportation plans. The CTC commits expected revenues for transportation projects over a multi-year period. The State Transportation Improvement Program (STIP) is a multi-year capital improvement

program for transportation projects both on and off the State Highway System. The STIP is funded with revenues from the State Highway Account and other funding sources. STIP programming typically occurs every two years. The current STIP was adopted in May 2016 and covers fiscal years 2016/17 – 2020/21.

2.2.3 CALIFORNIA TRANSPORTATION PLAN

The California Transportation Plan (CTP) 2040 was adopted in June 2016. The plan, which is overseen by the Caltrans, serves as a blueprint for California's transportation system, as defined by goals, policies, and strategies to meet the State's future mobility needs. The Plan identifies six goals:

- Improve multimodal mobility and accessibility for all people,
- Preserve the multimodal transportation system,
- Support a vibrant economy,
- Improve public safety and security,
- Foster livable and healthy communities and promote social equity, and
- Practice environmental stewardship.

The CTP 2040 is the first CTP to analyze theoretical statewide transportation scenarios intended to reduce greenhouse gas emissions. Based on this analysis, and the vision and goals of the plan, a set of policies and implementation measures to achieve each goal was developed. Implementation highlights include improving transit, reducing maintenance costs, improving highways and roads with management systems and technology, improving freight efficiency, improving communities through the Sustainable Communities Strategies (SCS), reducing transportation-related deaths and injuries, expanding the use and safety of bike and pedestrian facilities, making our vehicles and transportation fuels cleaner, improving public health and achieving climate and other environmental goals, and securing permanent stable and sufficient transportation revenue.

2.2.4 SENATE BILL 375

SB 375 provides guidance regarding curbing emissions from cars and light trucks to help the State meet its greenhouse gas emissions targets. There are four major components to SB 375. First, SB 375 requires regional greenhouse gas emissions targets for cars and light trucks. The California Air Resources Board's Regional Targets Advisory Committee will guide the adoption of targets to be met by 2020 and 2035 for each Metropolitan Planning Organization (MPO) in the State. These targets, which MPOs may propose themselves, must be updated every eight years in conjunction with the revision schedule of the housing and transportation elements of local general plans.

Second, MPOs are required to create a Sustainable Communities Strategy (SCS) that provides a plan for meeting regional targets. The SCS and the Regional Transportation Plan (RTP) must be consistent, including

action items and financing decisions. If the SCS does not meet the regional target, the MPO must produce an Alternative Planning Strategy that details an alternative plan for meeting the target.

Third, SB 375 requires regional housing elements and transportation plans to be synchronized on 8-year schedules. In addition, Regional Housing Needs Assessment (RHNA) allocation numbers must conform to the SCS. If local jurisdictions are required to rezone land as a result of changes in the housing element, rezoning must take place within three years of adoption of the housing element.

Finally, MPOs must use transportation and air emissions modeling techniques that are consistent with the guidelines prepared by the CTC. Regional Transportation Planning Agencies, cities, and counties are encouraged, but not required, to use travel demand models that are consistent with CTC guidelines. The 2018 General Use Permit: TIA Part 2 is based on regional land use forecasts in the Plan Bay Area Sustainable Communities Strategy that are projected to meet the region's SB 375 targets and the VTA-C/CAG 2040 travel demand model, consistent with the CTC RTP guidelines.

2.2.5 COMPLETE STREETS (AB 1358)

AB 1358, also known as the California Complete Streets Act of 2008, requires cities and counties to include "complete street" policies in their general plans. These policies address the safe accommodation of all users, including bicyclists, pedestrians, motorists, public transit vehicles and riders, children, the elderly, and the disabled. These policies can apply to new streets as well as the redesign of corridors.

2.2.6 SB 743

On September 27, 2013, Governor Jerry Brown signed SB 743 into law and started a process intended to fundamentally change transportation impact analysis as part of CEQA compliance. These changes include elimination of auto delay, level of service (LOS), and other similar measures of vehicular capacity or traffic congestion as a basis for determining significant impacts. The Governor's Office of Planning and Research (OPR) has issued draft guidance for these updates to the CEQA guidelines, and recommends use of automobile Vehicle Miles Traveled, or VMT, as the preferred CEQA transportation metric, along with the elimination of auto delay for CEQA purposes. The draft guidance may be found in the OPR document *Revised Proposal on Updates to the CEQA Guidelines on Evaluating Transportation Impacts in CEQA* (January 20, 2016). As such, each jurisdiction will need to set new thresholds for transportation impacts based on VMT. Further, parking impacts will not be considered significant impacts on the environment for select development projects with nearby frequent transit service. According to the legislative intent contained in SB 743, these changes to current practice were necessary to more appropriately balance the needs of congestion management with statewide goals related to infill development, promotion of public health through active transportation, and reduction of greenhouse gas emissions.

2.3 REGIONAL REGULATIONS

2.3.5 METROPOLITAN TRANSPORTATION COMMISSION (MTC)

The Metropolitan Transportation Commission is the transportation planning, financing and coordinating agency for the nine-county San Francisco Bay Area. MTC collaborates with a network of other public agencies to help support the streets, highways, transit systems and other transportation resources that help millions of people travel every day. MTC develops and administers the region's long-term regional transportation plan; the current plan is *Plan Bay Area*, adopted in 2013 and projects out to Year 2040. The plan charts the course for transportation investment and land use priorities for the next 25 years. It is the first MTC regional plan to incorporate the state-mandated Sustainable Communities Strategy. An update of Plan Bay Area (2040) is slated for completion in 2017.

2.3.2 SANTA CLARA COUNTY

Santa Clara County is the governing jurisdiction for the Stanford University academic campus. In addition, the Santa Clara County VTA acts as the county's transportation planning agency, transit services provider, and congestion management agency. The relevant planning documents of these agencies are described below.

2.3.2.1 Stanford Community Plan

The Stanford Community Plan (December 2000) is part of the Santa Clara County General Plan. The Stanford Community Plan provides the County General Plan policies for Stanford's academic campus. The Circulation chapter of the plan provides a description of the transportation network and services on the campus, and defines strategies, policies, and implementation steps related to transportation. The three strategies and associated policies and implementation steps are listed below.

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

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 Recommendations:

- 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/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 Intermodal 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:
 - 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.
 - 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.

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 Recommendations:

- 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.

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 Recommendations:

- 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.

2.3.3 SANTA CLARA COUNTY VALLEY TRANSPORTATION AUTHORITY (VTA)

VTA is an independent special district that provides bus, light-rail, and paratransit services, and participates as a funding partner in regional rail service including Caltrain, Capital Corridor, and the Altamont Corridor Express. As the county's congestion management agency, VTA is responsible for countywide transportation planning, including congestion management, design and construction of specific highways, pedestrian, and bicycle improvement projects, as well as promotion of transit oriented development. VTA provides these services throughout the county, including the municipalities of Campbell, Cupertino, Gilroy, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Morgan Hill, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga and Sunnyvale.

2.3.3.1 Valley Transportation Plan 2040

The VTA's current long-range transportation plan is the *Valley Transportation Plan (VTP) 2040*, adopted in October 2014. The three objectives of the plan are:

- To facilitate the creation and support of an integrated multimodal transportation system that serves all socio-economic groups efficiently and sustainably;
- To pursue, develop, and implement advances in technology, management practices, and policies; and
- To be the region's foremost advocate for transportation projects, programs, and funding.

The plan highlights the projects and programs that will be pursued in partnership with member agencies in the next 25 years. Some of the types of projects being pursued are complete streets, express lanes, bus rapid transit, and bicycle/pedestrian improvements.

2.3.3.2 Congestion Management Plan

VTA also functions as the County's congestion management agency, and maintains and implements the Congestion Management Program. The current document, the *2015 Congestion Management Plan*, was adopted in October 2015. This document includes updates to previous standards and practices, including an emphasis on multimodal analysis and the renaming of the Deficiency Plan Element to the Multimodal Improvement Plan Element to reflect the need to shift travelers from autos. The CMP System includes a roadway network, a transit network, and a bicycle network. The roadway network includes freeways, expressways and principal arterials. Within the TIA study area, CMP facilities include US 101, I-280, El Camino Real (SR 82), University Avenue, Alma Avenue, Junipero Serra Boulevard/Foothill Expressway, Page Mill Road/Oregon Expressway, and San Antonio Road (2015 CMP, Figure 1.2 and 1.3). Therefore, a portion of the study intersections in the TIA are CMP intersections. The CMP transit network and bicycle network are shown in CMP Figures 1.4 and 1.5, respectively.

The CMP currently identifies eleven multimodal transportation system performance measures for the CMP networks, including:

- traffic level of service (LOS),
- modal split,
- VMT per person-trip,
- transit accessibility,
- air quality,
- duration of congestion,
- hours of delay per person trip,
- travel time and travel time index,
- transit sustainability policy,
- travel pattern (in person trips), and
- use of the VTA TIA Guidelines.

Most of these are applied and measured system-wide or in individual “travel markets”; the traffic LOS measure is measured for freeway segments, intersections, and rural highways.

2.3.3.3 Countywide Bicycle Plan

In 2008, VTA completed the *Santa Clara Countywide Bicycle Plan* (SCCBP), which provides a foundation for maintaining and enhancing the countywide bicycle network. The County is in the process of updating this document to incorporate the advances in bicycle infrastructure design and cultural shift toward bicycling. 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. More information is provided in Section 4.7.3.1.

2.3.4 CITY/COUNTY ASSOCIATION OF GOVERNMENTS OF SAN MATEO COUNTY (C/CAG)

The City/County Association of Governments of San Mateo County (C/CAG) operates as a Joint Powers Authority and has members that include each of the 20 cities in the county as well as the County. C/CAG functions as the County’s congestion management agency, and as such, maintains, implements and periodically updates the County’s Congestion Management Program.

2.3.4.1 2015 Congestion Management Plan

The first CMP for San Mateo County was adopted by C/CAG in 1991 and was last updated in 2015 with monitoring reports provided every two years. The overall goal is to help C/CAG promote countywide solutions to transportation problems based upon cooperation and mutual support.

The latest monitoring report, *Final San Mateo County Congestion Management Program, 2015* was adopted in November 2015. The CMP network in the TIA study area includes US 101, I-280, and El Camino Real (State Route 82). The LOS standards for these facilities within the study area range from D to F (2015 CMP, Figure 4). In addition to roadway segment standards, the CMP identifies key intersections on the network, two of

which are included in the analysis: Bayfront Expressway/Willow Road and Bayfront Expressway/University Avenue. The CMP LOS standard for these intersections is LOS F (2015 CMP, Table 3).

2.3.4.2 San Mateo County Comprehensive Bicycle and Pedestrian Plan

C/CAG and the San Mateo County Transportation Authority (SMCTA) developed the 2011 San Mateo County Comprehensive Bicycle and Pedestrian Plan (CBPP) to address the planning, design, funding, and implementation of bicycle and pedestrian projects of countywide significance. More information is provided in Section 4.7.3.2.

2.4 LOCAL REGULATIONS

Most of the TIA study area falls within the Cities of Palo Alto, Menlo Park, and East Palo Alto. The following sections discuss the transportation policies of these Cities.

2.4.1 CITY OF PALO ALTO COMPREHENSIVE PLAN

The current *City of Palo Alto Comprehensive Plan* (which serves as the City's general plan) was last updated in 2007, with a land use map update in 2011. The City of Palo Alto is in the process of updating their Comprehensive Plan, a process that has been underway since 2014 and is expected to conclude in 2017. The transportation element of the update has not yet been prepared. The 2007 Comprehensive Plan Transportation Element contains goals, policies and programs designed to guide the development, operations and maintenance of the transportation facilities. The ten goals are listed below:

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 impacts on residential neighborhoods

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

The Palo Alto Comprehensive Plan Transportation Element does not provide performance standards nor significance thresholds for vehicle traffic operations or the performance of the systems serving other travel modes. However, the City has historically used Level of Service (LOS) D as the traffic LOS standard.

The Transportation Element has the following policies regarding the development of the transportation network, which are relevant to the feasibility and design of mitigation that may be identified to address impacts of the 2018 General Use Permit.

- **Policy T-14:** Improve pedestrian and bicycle access to and between local designations, including public facilities, schools, parks, open space, employment districts, shopping centers, and multi-modal transit stations. Related programs: T-19 and T-21-24.
- **Policy T-25:** When constructing or modifying roadways, plan for usage of the roadway space by all users, including motor vehicles, transit vehicles, bicyclists and pedestrians. Related program: T-33.
- **Policy T-27:** Avoid major increases in street capacity unless necessary to remedy severe traffic congestion or critical neighborhood traffic problems. Where capacity is increased, balance the needs of motor vehicles with those of pedestrians and bicyclists.
- **Policy T-28:** Make effective use of the traffic-carrying capacity of Palo Alto's major street network without compromising the needs of pedestrians and bicyclists also using this network. Related programs: T-38, T-39.
- **Policy T-31:** Evaluate smoothing and slowing traffic flow in commercial areas by reducing through-traffic lanes and trading the area for improved turning lanes, landscaping, and bicycle lanes.
- **Policy T-34:** Implement traffic calming measures to slow traffic on local and collector residential streets and prioritize these measures over congestion management. Include traffic circles and other traffic calming devices among these measures.
- **Policy T-39:** To the extent allowed by law, continue to make safety the first priority of citywide transportation planning. Prioritize pedestrian, bicycle, and automobile safety over vehicle level-of-service at intersections. Related program: T-47.

2.4.2 CITY OF MENLO PARK GENERAL PLAN

Menlo Park recently completed a General Plan update; the *ConnectMenlo* initiated in March 2013 was finalized November 29, 2016. The updated Plan replaces the previous General Plan adopted in 1994 and last amended in 2013. *ConnectMenlo* contains circulation and transportation policies; a circulation plan diagram and standards; and circulation and transportation proposals and implications. One of the Guiding Principles was:

Great Transportation Options – “Menlo Park provides thoroughly-connected, safe and convenient transportation, adequate emergency vehicles access, and multiple options for people travelling by foot, bicycle, shuttle, bus, car, and train, including daily service along the Dumbarton Rail Corridor.”

The following seven circulation and transportation goals are included in the Circulation Element:

Goal CIRC-1: Safe Transportation System – Provide and maintain a safe, efficient, attractive, user-friendly circulation system that promotes a healthy, safe, and active community and quality of life throughout Menlo Park.

Goal CIRC-2: Complete Streets – Increase accessibility for and use of streets by pedestrians, bicyclists and transit riders.

Goal CIRC-3: Sustainable Transportation – Increase mobility options to reduce traffic congestion, greenhouse gas emissions, and commute travel time.

Goal CIRC-4: Health and Wellness – Improve Menlo Park’s overall health, wellness, and quality of life through transportation enhancements.

Goal CIRC-5: Transit – Support local and regional transit that is efficient, frequent, convenient, and safe.

Goal CIRC-6: Transportation Demand Management – Provide a range of transportation choices for the Menlo Park community.

Goal CIRC-7: Parking – Utilize innovative strategies to provide efficient and adequate vehicle parking.

The Circulation Element describes the circulation plan diagram, which includes a description of the street classification system and mode priority and guidelines (Circulation Element Figure 2); bicycle standards and proposed improvements (Circulation Element Figure 3); and transit system improvements (Circulation Element Figure 4). The *ConnectMenlo* Environmental Impact Report (EIR) includes the mitigation that includes the preparation of Transportation Master Plan to identify needed roadway and other transportation improvements.

The Circulation Element contains Policy CIRC-3.4 which defines the City’s intersection LOS standard as follows:

- **Policy CIRC-3.4—Level of Service.** Strive to maintain level of service (LOS) D at all City-controlled signalized intersections during peak hours, except at the intersection of Ravenswood Avenue and Middlefield Road and at intersections along Willow Road from Middlefield Road to US 101. The City shall work with Caltrans to ensure that average stopped delay on local approaches to State-controlled signalized intersections does not exceed LOS E.

The Circulation Element has the following policies regarding the development of the transportation network, which are relevant to the feasibility and design of mitigation that may be identified to address impacts of the 2018 General Use Permit.

- **Policy CIRC 1.7—Bicycle Safety.** Support and improve bicyclist safety through roadway maintenance and design efforts. Related program: CIRC-1.A.

- **Policy CIRC-1.8—Pedestrian Safety.** Maintain and create a connected network of safe sidewalks and walkways within the public right of way ensuring that appropriate facilities, traffic control, and street lighting are provided for pedestrian safety and convenience, including for sensitive populations.
- **Policy CIRC-2.1—Accommodating All Modes.** Plan, design and construct transportation projects to safely accommodate the needs of pedestrians, bicyclists, transit riders, motorists, people with mobility challenges, and persons of all ages and abilities.
- **Policy CIRC-2.7—Walking and Biking.** Provide for the safe, efficient, and equitable use of streets by pedestrians and bicyclists through appropriate roadway design and maintenance, effective traffic law enforcement, and implementation of the City's Transportation Master Plan (following completion; until such time the Comprehensive Bicycle Development Plan, Sidewalk Master Plan and the El Camino Real/Downtown Specific Plan represent the City's proposed walking and bicycling networks).
- **Policy CIRC-2.8—Pedestrian Access at Intersections.** Support full pedestrian access across all legs of signalized intersections.
- **Policy CIRC-2.9—Bikeway System Expansion.** Expand the citywide bikeway system through appropriate roadway design, maintenance, effective traffic law enforcement, and implementation of the City's Transportation Master Plan (following completion; until such time the Comprehensive Bicycle Development Plan and the El Camino Real/Downtown Specific Plan represent the City's proposed bicycle network).
- **Policy CIRC-3.1—Vehicle-Miles Traveled.** Support development and transportation improvements that help reduce per service population (or other efficiency metric) vehicle miles traveled.
- **Policy CIRC-3.3—Emerging Transportation Technology.** Support efforts to fund emerging technological transportation advancements, including connected and autonomous vehicles, emergency vehicle pre-emption, sharing technology, electric vehicle technology, electric bikes and scooters, and innovative transit options.

2.4.3 CITY OF EAST PALO ALTO GENERAL PLAN

The City of East Palo Alto just completed a General Plan update, as its previous General Plan was adopted in 1999. The *Vista 2035 – East Palo Alto General Plan Public Draft* was released in January 2016, and the Final EIR was released on August 2016. The City adopted the General Plan on October 6, 2016.

The updated General Plan Transportation Element contains the following transportation goals:

Goal T-1: Improve safety through the design and maintenance of sidewalks, streets, intersections, and other roadway improvements.

Goal T-2: Foster the creation of complete, multimodal streets.

Goal T-3: Create a complete, safe and comfortable pedestrian network for people of all ages and abilities.

Goal T-4: Build a comprehensive and well-used bicycle network that comfortably accommodates bicyclists of all ages and skill levels.

Goal T-5: Support local and regional transit that is efficient, frequent, convenient, and safe.

Goal T-6: Develop strategies to provide efficient and adequate vehicle parking.

Goal T-7: Adopt transportation performance measures.

Goal T-8: Adopt transportation demand management and roadway system efficiency strategies.

The Transportation element has the following two policies related to level of service standards and transportation performance measures:

- **Policy 7.1—Automobile Level of Service Standards.** Improve the East Palo Alto circulation system roadways in concert with land development to maintain adequate levels of service for automobile travel. Automobile Level of Service (LOS) performance can be measured using a volume-to-capacity (V/C) ratio. V/C ratios are calculated based on existing or future average daily traffic (ADT) volumes and daily capacity values for various types of roadways. A level of service scale is used to evaluate roadway performance based on V/C ratios. These levels range from "A" to "F", with LOS A representing free flow conditions and LOS F representing severe traffic congestion. Descriptions of traffic flow for the different levels of service are provided in Table 6-4 Standards for Roadway Levels of Service. The performance criteria for evaluating volumes and capacities of the East Palo Alto roadway system is LOS D. At a signalized intersection, an impact is considered significant if it causes operations to degrade from LOS D or better to LOS E or F; or exacerbates LOS E or F conditions by increasing critical delay by >4 seconds and increasing V/C ratio by 0.01; or increases the V/C ratio by > 0.01 at an intersection that exhibits unacceptable operations, even if the calculated LOS is acceptable. At an unsignalized intersection, an impact is considered significant if it: causes operations to degrade from LOS D or better to LOS E or F; or exacerbates LOS E or F conditions by increasing control delay; or causes volumes under project conditions to exceed the Caltrans Peak Hour Volume Warrant Criteria. Where the City determines that proposed development projects will cause LOS standards to be exceeded, appropriate mitigation will be required to improve roadways to meet LOS standards.
- **Policy 7.2—Updating Transportation Performance Measures.** Update the transportation performance measures in this Transportation Element, including Automobile Level of Service standards, once the State of California has amended the California Environmental Quality Act Guidelines to implement Senate Bill 743's requirement to provide an alternative to automobile Level of Service for evaluating transportation impacts (See California Public Resources Code Section 21099(b)(1).) Additionally, designate appropriate infill opportunity zones within East Palo Alto, within which the automobile Level of Service standards prescribed by California Government Code Section 65089 shall not apply. (See Government Code Sections 65088.1 and 65088.4.)

The Transportation Element has the following policies regarding the development of the transportation network, which are relevant to the feasibility and design of mitigation that may be identified to address impacts of the 2018 General Use Permit.

- **Policy 2.1—Accommodating all modes.** Plan, design and construct transportation projects to safely accommodate the needs of pedestrians, bicyclists, transit riders, motorists, people with disabilities, and persons of all ages and abilities.
- **Policy 2.2—University Avenue.** As the main transportation spine of East Palo Alto, ensure that any future redesign of University Avenue include improvements for all modes of travel, focusing on its local function as a community centerpiece for local activity and travel. Design options could include buffered and painted bicycle lanes, streetscape improvements such as benches and pedestrian scale lighting, and mid-block crossings, reversible lanes, and the reintroduction of on-street parking. The City shall maintain control of University Avenue (not Caltrans).
- **Policy 2.6—Pedestrian and bicycle crossings.** Encourage pedestrian and bicycle crossings at key locations and across existing barriers such as Highway 101 and to local employment and schools, such as Bay Road.
- **Policy 3.3—Pedestrian network.** Create a safe, comfortable and convenient pedestrian network that focuses on a) safe travel; b) improving connections between neighborhoods and commercial areas, and across existing barriers; c) providing places to sit or gather, pedestrian-scaled street lighting, and buffers from moving vehicle traffic; and d) includes amenities that attract people of all ages and abilities.
- **Policy 4.1—Bicycle network.** Improve facilities and eliminate gaps along the bicycle network to connect destinations across the city and create a network of bicycle facilities of multiple types that connect to neighboring cities, including a path along Newell Road between Highway 101 and San Francisquito Creek. The network should facilitate bicycling for commuting, school, shopping, and recreational trips by riders of all ages and levels of experience.
- **Policy 5.4—Access to transit.** Provide connecting bicycle and pedestrian infrastructure and amenities to improve access to transit stations and stops, and encourage new development projects near transit to improve transit stop amenities.
- **Policy 8.2—Avoidance of street widening.** When feasible, avoid widening streets to increase automobile capacity, focusing instead on operational improvements such as signal timing optimization, modern roundabouts and other Transportation Systems Management (TSM) strategies that aim to improve traffic conditions and reduce cut-through traffic by maximizing the efficiency of existing vehicle infrastructure.



3. SIGNIFICANCE CRITERIA & ANALYSIS METHODOLOGY

The determination of significance for Project impacts is based on policies, regulations, goals, and guidelines defined by Santa Clara County and the surrounding jurisdictions of San Mateo County, Palo Alto, Menlo Park, East Palo Alto, Mountain View, Los Altos, and Atherton. The detailed impact criteria presented below focuses on elements of the CEQA checklist pertaining to roadway system operations and its effects on users, including drivers, pedestrians, bicyclists, transit passengers, and first responders in emergency access vehicles.

The operations of roadway facilities are described with the term level of service ("LOS", a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver). Six levels are defined from LOS A, as the best operating conditions, to LOS F, or the worst operating conditions. LOS E represents "at-capacity" operations. When traffic volumes exceed the intersection capacity, stop-and-go conditions result, and operations are designated as LOS F.

3.1 SIGNALIZED INTERSECTIONS

There are signalized study intersections in ten different jurisdictions including six cities, two counties, and two congestion management programs. Information regarding these signalized intersections is provided below.

3.1.1 SIGNIFICANCE CRITERIA

As described in the CEQA Guidelines (2016), the Project may cause a significant impact to signalized intersections if an element of the Project would:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit, or
- Conflict with applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.

Signalized intersection operations and impacts are evaluated based on the appropriate jurisdiction's LOS standards (i.e., minimum threshold for acceptable operations) as shown in **Table 3-1**.

TABLE 3-1: SIGNALIZED INTERSECTION LOS STANDARDS

Jurisdiction	Intersection LOS Standards	Citation
Santa Clara County	LOS E for all Santa Clara County intersections.	Santa Clara County General Plan, pages F-18 and F-19 (1994)
VTA Congestion Management Program (CMP)	LOS E for all VTA CMP intersections.	Santa Clara County Annual Monitoring and Conformance Report, page 9 (2014)
San Mateo County	LOS C for all San Mateo County intersections with no individual movement operating at less than LOS D. LOS D may be allowed for peak periods in dense urban conditions per County's discretion.	Traffic Impact Study Requirements, page 5 (2013)
C/CAG Congestion Management Program (CMP)	LOS E/F depending on location. Within the study area, all C/CAG CMP intersections have a LOS standard of LOS F.	San Mateo County Congestion Management Program 2015 (2015)
City of Palo Alto	LOS D for all City of Palo Alto intersections.	2007 Comprehensive Plan working documents; and Staff Report #6805 dated 6/29/16.
City of Menlo Park	LOS C for City of Menlo Park collector street intersections. LOS D for all arterial streets or local approaches to State-controlled signalized intersections.	Menlo Park Transportation Impact Analysis Guidelines (2014)
City of East Palo Alto	LOS D for all City of East Palo Alto intersections.	City of East Palo Alto General Plan Update EIR, page 4.14-26 (2016)
City of Mountain View	LOS D for all City of Mountain View intersections.	City of Mountain View 2030 General Plan and Greenhouse Gas Reduction Program EIR, page 121 (2011)
City of Los Altos	LOS D for all City of Los Altos intersections.	Los Altos General Plan, page 9 (2002)
Town of Atherton	LOS D for all Town of Atherton intersections.	N/A

Sources: Stated above.

The signalized intersection LOS impact criteria for each jurisdiction within the study area are described below.

3.1.1.1 Santa Clara County and Congestion Management Program (CMP)

The LOS standard for Santa Clara County (*VTA Congestion Management Program*, 2014) expressway and CMP intersections is LOS E. Traffic impacts at these intersections would occur when the addition of Project traffic:

- Causes intersection operations to deteriorate from an acceptable level (LOS E or better) to an unacceptable level (LOS F); or

- Exacerbates unacceptable operations by increasing the average critical delay more than four seconds and increasing the critical volume-to-capacity (V/C) ratio by 0.01 or more at an intersection operating at LOS F; or
- Increases the V/C ratio by 0.01 or more at an intersection with unacceptable operations (LOS F) when the change in critical delay is negative (i.e., decreases). This can occur if the critical movements change.

3.1.1.2 San Mateo County

According to the San Mateo County Public Works *Traffic Impact Study Requirements* (September 2013), the minimum acceptable LOS in San Mateo County is LOS C with no individual movement operating at less than LOS D. Level of service D may be allowed for peak periods in dense urban conditions per County's discretion.

Traffic impacts at intersections NOT located within dense urban conditions would occur when the addition of Project traffic:

- Causes intersection operations to deteriorate from an acceptable level (LOS C or better) with no individual movement operating at worse than LOS D to an unacceptable level (LOS D or worse); or
- Exacerbates unacceptable operations by increasing the average control delay more than four seconds.

Traffic impacts at intersections located within dense urban conditions would occur when the addition of Project traffic:

- Causes intersection operations to deteriorate from an acceptable level (LOS D or better to an unacceptable level (LOS E or worse); or
- Exacerbates unacceptable operations by increasing the average control delay more than four seconds.

3.1.1.3 San Mateo County Congestion Management Program (CMP)

The LOS standard for San Mateo County CMP intersections varies depending on location. There are two San Mateo County CMP intersections within the study area and both have a LOS standard of LOS F (based on conditions when the CMP baseline conditions were surveyed).

According to Section V of the *Policy on Traffic Impact Analysis (TIA) To Determine Traffic Impacts on the Congestion Management Program (CMP) Roadway Network Resulting From Roadway Changes, General Plan Updates, and Land Use Development Projects* (August 10, 2006), a project is considered to have a CMP impact if it causes one or more of the following:

- For a CMP intersection currently **in compliance** with the adopted LOS standard:
 - If a proposed project will cause the CMP intersection to operate at a level of service that violates the standard adopted in the current Congestion Management Program (CMP).
 - If the cumulative analysis indicates that the combination of a proposed project and future cumulative traffic demand will result in the CMP intersection to operate at a level of service that violates the standard adopted in the current Congestion Management Program (CMP) and that proposed project increases average control delay at the intersection by four seconds or more.
- For a CMP intersection currently **not in compliance** with the adopted LOS standard:
 - If a proposed project will add any additional traffic to the CMP intersection that does not comply with its adopted level of service standard as established in the current Congestion Management Program (CMP).

3.1.1.4 Cities of Palo Alto, Mountain View, and Los Altos

The signalized intersection LOS standard for the Cities of Palo Alto, Mountain View, and Los Altos is LOS D. Traffic impacts at these intersections would occur when the addition of traffic associated with a project:

- Causes intersection operations to deteriorate from an acceptable level (LOS D or better) to an unacceptable level (LOS E or worse); or
- Exacerbates unacceptable operations by increasing the average critical delay by four seconds or more and increasing the critical V/C ratio by 0.01 or more at an intersection operating at LOS E or F; or
- Increases the V/C ratio by 0.01 or more at an intersection with unacceptable operations (LOS E or F) when the change in critical delay is negative (i.e., decreases). This can occur if the critical movements change.

3.1.1.5 City of Menlo Park

Within the City of Menlo Park, the LOS standard for intersections on collector streets is LOS C and intersections on arterials have a standard of LOS D. The City also has a LOS D standard for local approaches to State-controlled signalized intersections. Traffic impacts at these intersections would occur when the addition of traffic associated with a project causes:

- Intersection operations on a collector street to deteriorate from an acceptable level (LOS C or better) to an unacceptable level (LOS D or worse); or
- Intersection operations on an arterial street or local approaches to a State-controlled signalized intersection to deteriorate from an acceptable level (LOS D or better) to an unacceptable level (LOS E or worse); or

- The average vehicle delay to increase by 23 seconds or more at an intersection operating at acceptable levels; or
- An increase of more than 0.8 seconds of average delay on all critical movements for an intersection operating at an unacceptable level on a collector or arterial; or
- An increase of more than 0.8 seconds of average delay on any critical movement that is located on the local approach to a State-controlled signalized intersection operating at an unacceptable level.

3.1.1.6 City of East Palo Alto

The signalized intersection LOS standard for the City of East Palo Alto is LOS D. Traffic impacts at these intersections would occur when the addition of traffic associated with a project:

- Causes intersection operations to deteriorate from an acceptable level (LOS D or better) to an unacceptable level (LOS E or worse); or
- Exacerbates unacceptable operations by increasing the average critical delay by four seconds or more and increasing the critical V/C ratio by 0.01 or more at an intersection operating at LOS E or F; or
- Increases the V/C ratio by 0.01 or more at an intersection with unacceptable operations (LOS E or F) when the change in critical delay is negative (i.e., decreases). This can occur if the critical movements change.⁴

3.1.1.7 Town of Atherton

The General Plan for the Town of Atherton does not specify a LOS impact criterion for signalized intersections. For purposes of this TIA, the San Mateo County's significance thresholds were used with a LOS D standard for the Town of Atherton. Traffic impacts at these intersections would occur when the addition of traffic associated with a project:

- Causes intersection operations to deteriorate from an acceptable level (LOS D or better) to an unacceptable level (LOS E or worse); or
- Exacerbates unacceptable operations by increasing the average critical delay by four seconds or more and increasing the critical V/C ratio by 0.01 or more at an intersection operating at LOS E or F; or

⁴ The East Palo Alto General Plan (January 2016) states that an impact can also occur when a project "Increases the V/C ratio by 0.01 or more at an intersection that exhibits unacceptable operations, even if the calculated LOS is acceptable." This criteria is subject to speculation and has been adjusted to provide a measureable criteria for use in CEQA documents.

- Increases the V/C ratio by 0.01 or more at an intersection with unacceptable operations (LOS E or F) when the change in critical delay is negative (i.e., decreases). This can occur if the critical movements change.

3.1.2 ANALYSIS METHODS

The method described in Chapter 16 of the 2000 *Highway Capacity Manual* (HCM) (Transportation Research Board) was used to prepare the level of service calculation for the study intersections. This level of service method, which is approved by Santa Clara County and VTA, analyzes a signalized intersection's operation based on average control delay per vehicle. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay is calculated using TRAFFIX 8.0 analysis software and is correlated to an LOS designation as shown in **Table 3-2**.

TABLE 3-2: SIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Average Control Delay per Vehicle (seconds)
A	Operations with very low delay occurring with favorable progression and / or short cycle lengths.	≤ 10.0
B	Operations with low delay occurring with good progression and / or short cycle lengths.	10.1 to 20.0
C	Operations with average delays resulting from fair progression and / or longer cycle lengths. Individual cycle failures begin to appear.	20.1 to 35.0
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high volume-to-capacity (V / C) ratios. Many vehicles stop and individual cycle failures are noticeable.	35.1 to 55.0
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V / C ratios. Individual cycle failures are frequent occurrences.	55.1 to 80.0
F	Operations with delays unacceptable to most drivers occurring due to over-saturation, poor progression, or very long cycle lengths.	> 80.0

Source: *Traffic Level of Service Analysis Guidelines*, VTA Congestion Management Program, June 2003; and *Highway Capacity Manual*, Transportation Research Board, 2000.

3.2 UNSIGNALIZED INTERSECTIONS

There are five unsignalized study intersections: north and southbound ramps at the I-280/Page Mill Road interchange in Santa Clara County, north and southbound ramps at the I-280/Alpine Road interchange in San Mateo County, and Bowdoin Street/Stanford Avenue on the Stanford University campus.

3.2.1 SIGNIFICANCE CRITERIA

As described in the CEQA Guidelines (2016), the Project may cause a significant impact to signalized intersections if an element of the Project would:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit, or
- Conflict with applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.

None of the applicable jurisdictions have an officially adopted significance criterion for unsignalized intersections. For purposes of this TIA, 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, or a project adds traffic to an unsignalized intersection already operating at LOS F; and
- The intersection satisfies the peak hour traffic signal warrant from the California Manual of Uniform Traffic Control Devices (CA MUTCD).

3.2.2 ANALYSIS METHODS

The operations of the unsignalized intersections were evaluated using the method contained in Chapter 17 of the *2000 HCM*. LOS ratings for stop-sign-controlled intersections are based on the average control delay expressed in seconds per vehicle. At two-way or side-street-controlled intersections, the average control delay is calculated for each stopped movement, not for the intersection as a whole. For approaches composed of a single lane, the control delay is computed as the average of all movements in that lane.

Table 3-3 summarizes the relationship between delay and LOS for unsignalized intersections.

TABLE 3-3: UNSIGNALIZED INTERSECTION LEVEL OF SERVICE DEFINITIONS

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Little or no delay.	≤ 10.0
B	Short traffic delay.	10.1 to 15.0
C	Average traffic delays.	15.1 to 25.0
D	Long traffic delays.	25.1 to 35.0
E	Very long traffic delays.	35.1 to 50.0
F	Extreme traffic delays with intersection capacity exceeded.	> 50.0

Sources: *Traffic Level of Service Analysis Guidelines*, VTA Congestion Management Program, June 2003; *Highway Capacity Manual*, Transportation Research Board, 2000.

Additionally, the adjacent jurisdictions may apply the *California Manual on Uniform Traffic Control Devices* (CA MUTCD) peak-hour volume signal warrant to intersections operating at LOS F.⁵

Warrant 3 – Peak hour vehicle volume

This warrant determines if the minor street traffic suffers undue delay when entering or crossing the major street for a minimum of one hour of an average day. This is based on the major street left-turn volume, the higher-volume minor-street approach volume, and calculated delay for vehicles on the higher-volume minor-street approach.

3.3 FREEWAY SEGMENTS

The study area includes freeway segments within Santa Clara and San Mateo Counties. Caltrans has authority over the State highway system, including freeways, interchanges, and arterial State Routes while operating and maintaining the State Highways in Santa Clara and San Mateo Counties. *The Guide for the Preparation of Traffic Impact Studies* (Caltrans, 2001) covers the information needed for Caltrans to review the impact on State highway facilities, including freeway segments. However, as the Congestion Management Agencies, VTA and C/CAG are responsible for monitoring operations on Caltrans facilities within Santa Clara and San Mateo Counties, respectively.

⁵ Signal warrant analysis is intended to examine the general correlation between the planned level of future development and the need to install new traffic signals. It estimates future development-generated traffic compared to a sub-set of the standard traffic signal warrants recommended in the 2012 *California Manual on Uniform Traffic Control Devices* (CA MUTCD) guidelines. While satisfying one or more of these warrants could justify the installation of a signal at an intersection, this analysis should not serve as the only basis for deciding whether and when to install a signal. To reach such a decision, the full set of warrants should be investigated by an experienced engineer based on field-measured rather than forecast traffic data and a thorough study of traffic and roadway conditions. Furthermore, the decision to install a signal should not be based solely upon the warrants, since the installation of signals may lead to certain types of collisions.

3.3.1 SIGNIFICANCE CRITERIA

As described in the CEQA Guidelines (2016), the Project may cause a significant impact to signalized intersections if an element of the Project would:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit, or
- Conflict with applicable congestion management program, including, but not limited to, level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.

For the freeway impact analysis the relevant jurisdiction's CMP level of service standards are used.

3.3.1.1 Santa Clara County

The LOS standard for CMP freeway segments in Santa Clara County is LOS E for both mixed-flow and High Occupancy Vehicle (HOV) lanes (*Santa Clara County Annual Monitoring and Conformance Report 2014*, VTA, 2015).

Under Existing Conditions, traffic impacts on CMP freeway segments in Santa Clara County are determined based on density. In order to conform with the VTA TIA Guidelines, an Existing With Project Condition will be evaluated for freeway segments in Santa Clara County and be presented under the Background (2018) Conditions. Under this Existing With Project Condition, a traffic impact would occur if one of the following happens:

- Freeway segment operations to deteriorate from an acceptable level (LOS E or better) under Existing Conditions to an unacceptable level (LOS F); or
- An increase in traffic of more than one percent of the capacity of the segments that operate at LOS F under Existing Conditions.

Under Background (2018) and Cumulative (2035) Conditions, a traffic impact would occur on a CMP freeway segment in Santa Clara County if one of the following happens:

- The addition of project traffic causes a freeway segment V/C ratio to increase from less than or equal to one (1.0) to greater than one (1.0); or
- The addition of project traffic increases traffic demand on the freeway segment by an amount equal to one (1.0) percent or more of the segment capacity on a freeway segment already operating at a V/C ratio greater than one (1.0).

3.3.1.2 San Mateo County

The LOS standards adopted by C/CAG for the freeway segments are presented below (*Final San Mateo County Congestion Management Program 2015*, C/CAG, November 2015).

- US 101
 - SR 92 to Whipple Avenue – LOS E
 - Whipple Avenue to Santa Clara County Line – LOS F
- I-280
 - SR 92 to SR 84 – LOS D
 - SR 84 to Santa Clara County Line – LOS F

Traffic impacts on freeway segments in San Mateo County are determined according to C/CAG criteria. A traffic impact would occur on a freeway segment in San Mateo County when one of the following happens:

- Freeway segment operations deteriorate from an acceptable level (a LOS equal to or better than the LOS threshold listed above) under No Project Conditions to an unacceptable level under With Project Conditions; or
- On a freeway segment already operating at an unacceptable level under No Project Conditions, the addition of project traffic increases traffic demand on the freeway segment by an amount equal to one (1.0) percent or more of the segment capacity, or causes the freeway segment V/C ratio to increase by one (1.0) percent.

3.3.2 ANALYSIS METHODS

Santa Clara County and San Mateo County evaluate the operations of basic freeway segments based on different metrics. Santa Clara County uses density to evaluate existing conditions operations and volume-to-capacity to evaluate future year conditions. San Mateo County uses volume-to-capacity to evaluate operations under all scenarios.

3.3.2.1 Santa Clara County

Existing freeway segments in Santa Clara County are evaluated using VTA's analysis procedure, which is based on the density of the traffic flow during the AM and PM peak hours using methods described in the 2000 HCM. Data presented in the 2014 *Santa Clara County Annual Monitoring and Conformance Report*

was used to evaluate existing freeway operations. Density is expressed in passenger cars per mile per lane. The CMP ranges of densities for each freeway segment level of service are shown in **Table 3-4**.

TABLE 3-4: LEVEL OF SERVICE DEFINITIONS FOR FREEWAY SEGMENTS IN SANTA CLARA COUNTY

Level of Service	Description	Density (passenger cars per mile per lane)
A	Free Flow	≤ 11
B	Reasonably Free Flow	11.1 to 18.0
C	Stable Flow	18.1 to 26.0
D	Unstable Flow	26.1 to 46.0
E	Capacity Flow	46.1 to 58.0
F	Forced Flow	> 58.0

Sources: *Traffic Level of Service Analysis Guidelines*, VTA Congestion Management Program, June 2003; *Highway Capacity Manual*, Transportation Research Board, 2000.

The future operations of freeway mainline segments in Santa Clara County are evaluated using volume-to-capacity ratios with the volume-to-capacity ratio greater than 1.0 indicating vehicle demand exceeds capacity.

3.3.2.2 San Mateo County

Freeway mainline operations for segments in San Mateo County are evaluated using the method adopted by C/CAG, the 2000 HCM volume-to-capacity ratio method.⁶ The level of service description and the maximum volume-to-capacity ratio for each LOS designation are presented in **Table 3-5**. This analysis method was used for all existing and future year scenarios.

⁶ The CMP report evaluates the freeway segments in San Mateo County based on the 1994 HCM, which has similar V/C thresholds to those presented in the 2000 HCM.

TABLE 3-5: LEVEL OF SERVICE DEFINITIONS FOR FREEWAY SEGMENTS IN SAN MATEO COUNTY

Level of Service	Description	Maximum Volume-to-Capacity Ratio ¹
A	Highest quality of service with free-flow conditions and a high level of maneuverability.	0.30
B	Free-flow conditions, but presence of other vehicles are noticeable. Minor disruptions easily absorbed.	0.50
C	Stable operations, but minor disruptions cause significant local congestion.	0.71
D	Borders on unstable flow with ability to maneuver severely restricted due to congestion.	0.89
E	Unstable operations with conditions at or near capacity. Disruptions cannot be dissipated and cause bottlenecks to form.	1.00
F	Forced or breakdown flow with bottlenecks forming at locations where demand exceeds capacity. Speeds may drop to zero.	N/A

Notes:

1. Maximum Volume-to-Capacity Ratios are determined based on a free flow speed of 65 miles per hour.

Source: 2000 Highway Capacity Manual, Transportation Research Board.

3.4 FREEWAY RAMPS

With additional Project traffic there is the potential for increased ramp queuing during the peak hours. Queuing is not considered an environmental impact, but rather an operational consideration that is managed over time by Caltrans and local jurisdictions. Thus, this analysis summarizes the additional traffic and estimates the change in vehicle queue length compared to the existing available vehicle storage on each study ramp. Current ramp-metering plans provided by Caltrans in June 2015 were used to evaluate existing on-ramp queues and were set to match queues observed during field observations. Un-metered on-ramps are assessed based on the downstream freeway segment: if the segment is over-capacity, the on-ramp is assumed to have a queue exceeding capacity; if the segment is below-capacity, the on-ramp is determined to have a queue that is less than the ramp capacity. Off-ramp queues that terminate at an intersection were evaluated using ramp-terminal intersection queue estimates from the intersection LOS calculations (using TRAFFIX 8.0 software package) and off-ramps that with slip ramps onto local roadways were evaluated using a V/C ratio comparison.

3.5 NEIGHBORHOOD STREETS

Traffic impacts on residential streets within the City of Palo Alto are estimated using the Traffic Infusion on Residential Environment (TIRE) methodology. The TIRE index has been used by the City of Palo Alto in traffic impact analyses for development projects as an empirical methodology for determining the potential impact on residential streets. While the TIRE index is not used in all impact studies, it is used when a project may generate trips on a specific residential roadway. The TIRE index is a numerical representation of a resident's perception of the effect of street traffic on activities such as walking, cycling, or playing. The index

was developed by D.K. Goodrich, and reflects curve shapes found in work by Donald Appleyard of the University of California at Berkeley, with consideration of earlier work by Buchanan of the Ministry of Transport, England. TIRE is expressed by index values that range from zero (0) representing the least noticeable effect on traffic to five (5) representing the most severe effect. This method assumes any change in traffic that would cause an index increase of 0.1 or more would be noticeable to residents. The TIRE index is based on a logarithmic scale; therefore, the amount of added traffic to produce a 0.1 change in the TIRE index varies based on the existing traffic volume. The index and associated traffic thresholds relative to existing volumes are included in **Appendix N**.

3.6 TRANSIT SERVICE

3.6.1 SIGNIFICANCE CRITERIA

As described in the CEQA Guidelines (2016), the Project may cause a significant impact to transit facilities and services if an element of the Project would:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit, or
- Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

While the VTA TIA Guidelines call out the potential need for performing a transit capacity analysis, there is no CEQA specific threshold of significance. The California Governor's Office of Planning and Research (OPR) *Technical Advisory on Evaluating Transportation Impacts in CEQA* states that a project that blocks access to a transit stop or blocks a transit route may interfere with transit functions. By contrast, when evaluating multimodal transportation networks OPR advises:

[L]ead agencies generally should not treat the addition of new users as an adverse impact. Any travel-efficient infill development is likely to add riders to transit systems, potentially slowing transit vehicle mobility, but also potentially improving overall destination proximity. Meanwhile, such development improves regional vehicle flow generally by loading less travel onto the regional network than if that development were to occur elsewhere.

OPR recognizes that increased demand throughout a region may cause a cumulative impact requiring new or additional transit infrastructure. However, OPR states such impacts may be best addressed through a fee program that fairly allocates the cost of improvements not just to projects that locate near transit, but rather across a region to all projects that impose burdens on the entire transportation system.

3.6.2 ANALYSIS METHODS

The VTA TIA Guidelines Section 9.2 requires analysis of transit network performance including transit access and facilities and transit vehicle delay; therefore, it is provided in this TIA. An assessment of transit access and facilities near the Project site is provided in **Chapter 4** and **Chapter 8**. The Guidelines state that the transit vehicle delay analysis includes the following components:

- **A qualitative assessment** of additional transit vehicle delay caused by any roadway or intersection geometry changes proposed by a project, taking into account unique considerations of transit vehicles compared to autos (e.g., pulling into and out of stops, longer gaps needed for left-turns). These qualitative considerations may also inform the assessment of transit vehicle delay caused by auto congestion;
- **A quantitative estimate** of additional seconds of transit vehicle delay that will result from automobile congestion caused by a project and any changes to signal operations proposed by that project. This analysis may utilize information produced by the intersection Auto Level of Service (LOS) analysis or other sources, if available.

There is not a well-established national methodology for quantitatively evaluating transit network performance due to roadway congestion. Increased roadway congestion can affect transit vehicle travel time/speed and service reliability. For the purposes of this study, transit network performance is analyzed during the AM and PM peak hour based on the average transit vehicle delay associated with congestion at signalized intersections along a specified corridor with and without the Project. The change in average transit vehicle delay will be determined using the following process:

- Review TRAFFIX 8.0 analysis software output for intersection delay. The average delay, by movement, at each intersection within a study corridor in the transit vehicle path of travel will be determined.
- The transit vehicle average delay due to congestion at intersections will be determined by summing the movement delay for each signalized intersection along the study transit corridor.
- Without and With Project average transit vehicle delay associated with congestion at intersections will be compared. Note that the transit vehicle dwell time at transit stops is not included in the analysis.

This analysis methodology determines changes in transit delay based on the delay at the intersections evaluated within TIA Part 2. Not every intersection along each transit route is included in the transit delay calculation. In addition, the transit delay analysis does not account for additional delays including bus pull-out time or dwell time for boardings and alightings. Such additional delays are not anticipated to be substantial relative to delays at the major intersections studied in the traffic impact analysis.

Given the large number of transit routes in the area, the following routes within 2,000 feet of the Project and that have full day service with a frequency of 30 minutes or less are analyzed:

- VTA Route 22
- VTA Route 35
- VTA Route 89
- VTA Route 102
- VTA Route 104
- VTA Route 522
- SamTrans Route 281
- SamTrans Route ECR
- AC Transit Dumbarton Express
- AC Transit U-Line
- City of Palo Alto Embarcadero Shuttle
- City of Palo Alto Crosstown Shuttle

Per the VTA TIA Guidelines, if increased transit vehicle delay is found, the Lead Agency [Santa Clara County] should work with VTA to identify feasible transit priority measures near the affected facility and include contributions to any applicable projects that improve transit speed and reliability in the TIA.

3.7 BICYCLE AND PEDESTRIAN FACILITIES

3.7.1 SIGNIFICANCE CRITERIA

As described in the CEQA Guidelines (2016), the Project may cause a significant impact to bicycle and/or pedestrian facilities and services if an element of the Project would:

- Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including, but not limited to, intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit, or
- Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

3.7.2 ANALYSIS METHODS

The VTA TIA Guidelines Section 9.3 requires analysis of bicycle and pedestrian facilities including the effects of site development and roadway improvements on bicycle/pedestrian infrastructure, circulation, quality of service (QOS), and conformance to existing plans and policies; therefore, it is provided in this TIA. Further explanation of the bicycle and pedestrian QOS methods evaluated for use in this TIA can be seen in **Appendix C**. The Guidelines state that the QOS analysis includes the following component:

- **A Quality of Service (QOS) analysis** to review how well transportation infrastructure and streetscape features support bicycling and walking. The guidelines state that any project proposing

changes to intersection/roadway geometry or signal operations shall include a QOS analysis for bicyclists and pedestrians at the location of the proposed changes. A QOS analysis is also recommended along project frontages under Existing Conditions. Along with QOS analysis, a descriptive analysis of the project's effect on pedestrian and bicycle conditions is required.

StreetScore+, developed by Fehr & Peers, was chosen to evaluate QOS at signalized intersections that may be changed due to identified mitigation measures. StreetScore+ is an Excel-based tool that calculates pedestrian and bicyclist comfort based indices based on best design practices for active transportation users. An explanation of how the tool operates and the methodology that guides the results is provided in **Appendix D**. For bicycle facilities, the method builds off of the Level of Traffic Stress methodology developed by Mekuria, Furth, and Nixon (2012) with targeted enhancements to address cycle track and bicycle boulevard comfort, making the methodologies consistent with the National Association of City Transportation Officials' (NACTO's) Urban Bikeway Design Guide, 2nd Edition. For pedestrian facilities, StreetScore+ is calculated based on best practice guidance documentation, such as the NACTO Urban Streets Guide and safety research. These methods were chosen because they produce meaningful results without extensive data collection or inputs. Some of the considerations in the pedestrian QOS calculation include sidewalk width, presence of a buffer between the sidewalk and adjacent vehicle travel lanes, adjacent traffic speeds, lighting, and crosswalk frequency. Some of the considerations in the bicycle QOS calculation include the type of bicycle facility provided and adjacent traffic volumes and speeds.

The Bicyclist StreetScore+ scoring methodology is intended to be parallel to the Mekuria, Furth, and Nixon's LTS methodology with a 1-4 scale, correlating with the *Four Types of Cyclists* prepared by Roger Geller, Bicycle Coordinator for Portland Office of Transportation:

- StreetScore+ 1 (SS 1) - The lowest level of traffic stress and the design goal for a network that truly accommodates people of all ages and abilities. This level of traffic stress would allow children trained in traffic safety to bicycle to school by themselves as well as people interested but concerned about bicycling.
- StreetScore+ 2 (SS 2) - The highest level of acceptable traffic stress for the "interested but concerned" segment of the population. This is the threshold for a "low traffic stress" bicycle network that truly accommodates people of all ages and abilities.
- StreetScore+ 3 (SS 3) - This level of traffic stress accommodates a much smaller segment of population -Geller's "enthused and confident" segment of the population - who are excited and more familiar with biking and will therefore accept a higher level of traffic stress.
- StreetScore+ 4 (SS 4) - This is a very high level of traffic stress that does not work for approximately 99% of the population according to Geller's classification scheme. Only the "strong and fearless" cohort will feel comfortable riding on these facilities.

The Pedestrian StreetScore+ has a parallel structure to the Level of Traffic Stress approach for bicyclists, using a 1-4 scale:

- StreetScore+ 1 (SS 1) - Highly comfortable, pedestrian-friendly, and easily navigable for pedestrians of all ages and abilities, including seniors or school-aged children walking unaccompanied to school. These streets provide an ideal “pedestrian-friendly” environment.
- StreetScore+ 2 (SS 2) - Generally comfortable for many pedestrians, but parents may not feel comfortable with children walking alone. Seniors may have concerns about the walking environment and take more caution. These streets may be part of a “pedestrian-friendly” environment where it intersects with a more auto-oriented roadway or other environmental constraints.
- StreetScore+ 3 (SS 3) - Walking is uncomfortable but possible. Minimum sidewalk and crossing facilities may be present, but barriers are present that make the walking experience uninviting and uncomfortable.
- StreetScore+ 4 (SS 4) - Walking is a barrier and is very uncomfortable or even impossible. Streets have limited or no accommodation for pedestrians and are inhospitable and possibly unsafe environment for pedestrians.

3.8 SAFETY

3.8.1 SIGNIFICANCE CRITERIA

As described in the CEQA Guidelines (2016), the Project may cause a significant impact to safety if an element of the Project would:

- Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location results in substantial safety risks; or
- Substantially increase hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment); or
- Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

3.8.2 ANALYSIS METHODS

Safety of persons traveling by all modes – automobile, foot, and bicycle – is of paramount importance when designing and constructing all infrastructure projects. Given that the 2018 General Use Permit does not involve the design of individual facilities, any safety impacts will be evaluated based on whether any identified intersection mitigation measures causes an adverse safety effect for vehicles, transit, pedestrians, or bicyclists.

3.9 EMERGENCY ACCESS

3.9.1 SIGNIFICANCE CRITERIA

As described in the CEQA Guidelines (2016), the Project may cause a significant impact to emergency access if an element of the Project would:

- Result in inadequate emergency access.

3.9.2 ANALYSIS METHODS

Given that the 2018 General Use Permit does not involve the design of individual facilities, emergency access impacts will be evaluated based on whether any identified mitigation measures will cause an adverse effect for emergency access.



4. EXISTING CONDITIONS

This section describes the existing conditions of the roadway, pedestrian and bicycle networks, and transit service near the Project site. It also presents existing vehicle, bicycle, and pedestrian volumes and operations for study intersections and freeway segments.

4.1 EXISTING REGIONAL ROADWAY NETWORK

Primary regional automobile access to the Project site is provided by US Route 101 (US 101), Interstate 280 (I-280), El Camino Real (SR 82), Junipero Serra Boulevard/Foothill Expressway, University Avenue, Embarcadero Road, Sand Hill Road, and Page Mill Road. These roadways are described below and illustrated on **Figure 1-1**.

- **US 101 (Bayshore Freeway)** is an eight-to-ten lane divided freeway that runs from east San Jose to San Francisco along the west side of San Francisco Bay, connecting communities along the Peninsula. The freeway is a major commute route in Silicon Valley, providing access to businesses in downtown San Jose and technology employers within the South Bay and along the Peninsula. One to two High Occupancy Vehicle (HOV) lanes operate in both directions from 5:00 AM to 9:00 AM and from 3:00 PM to 7:00 PM, Monday through Friday south of Whipple Avenue. Access to the Project site from US 101 is primarily provided via University Avenue and Embarcadero Road.
- **I-280 (Junipero Serra Freeway)** is an eight-lane freeway that connects San Jose and San Francisco, located just to the west of the larger cities along the Peninsula east of the Santa Cruz Mountains. The

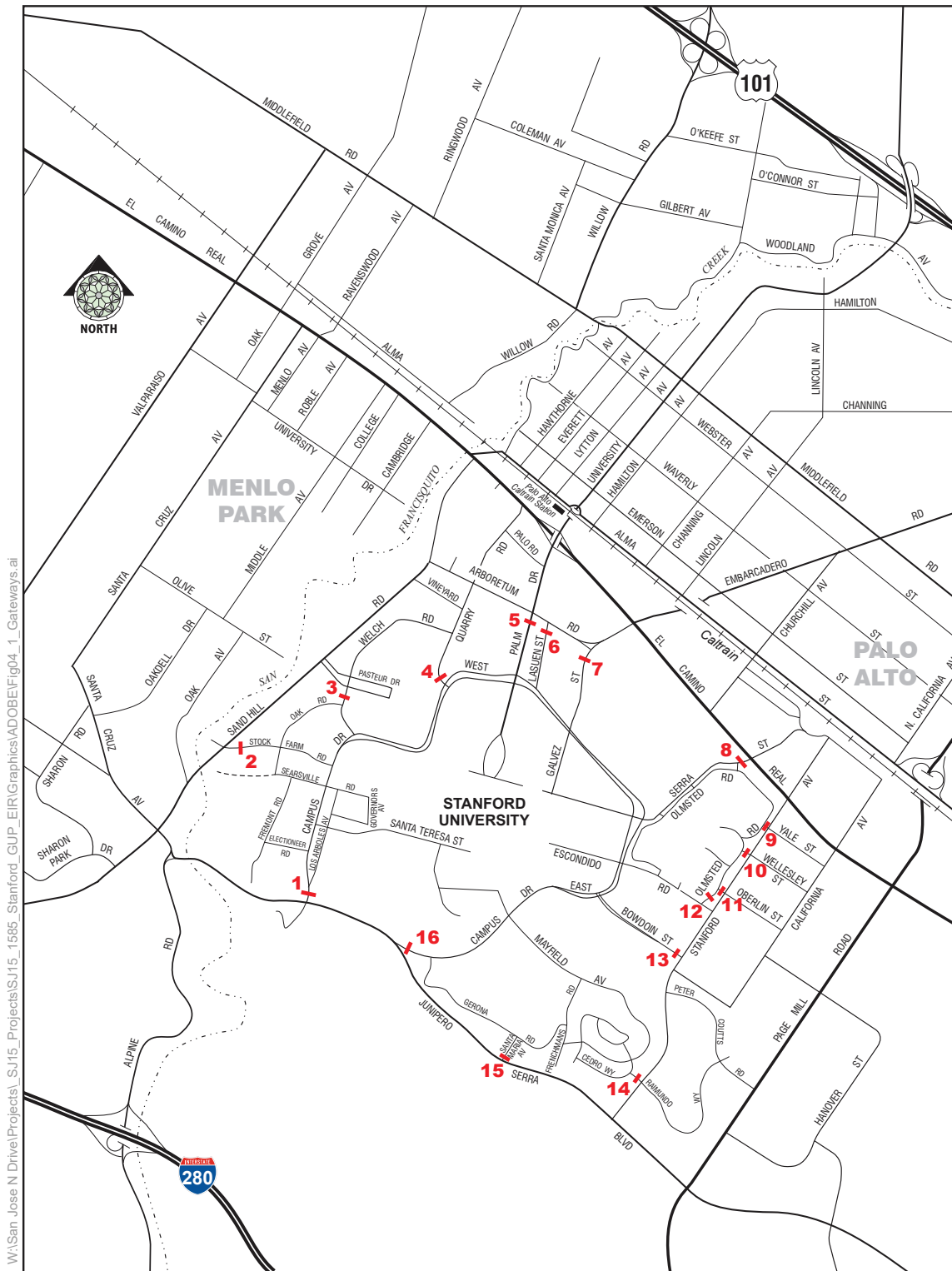
freeway is a major commute route in Silicon Valley, providing access to businesses in San Jose and technology employers within the South Bay and along the Peninsula. I-280 has interchanges serving Stanford University at Sand Hill Road, Alpine Road, and Page Mill Road. One HOV lane operates in both directions from 5:00 AM to 9:00 AM and from 3:00 PM to 7:00 PM, Monday through Friday south of Magdalena Avenue.

- **El Camino Real (SR 82)** is a highway that runs north-south from San Francisco to San Jose. In the study area, El Camino Real is a six-lane road south of Ravenswood Avenue, and a four-lane divided road from Ravenswood Avenue north to the Atherton border. El Camino Real parallels US 101 and I-280. The major intersections within the study area are controlled by traffic signals with the exception of the El Camino Real/Palm Drive/University Avenue interchange. This interchange is grade-separated and diamond-configured. The exit and entrance ramps at the interchange are controlled by traffic signals. In the City of Palo Alto's Comprehensive Plan, El Camino Real is classified as an arterial.
- **Junipero Serra Boulevard/Foothill Expressway** is a two-to-four-lane roadway that runs north-south and parallels I-280. Junipero Serra Boulevard runs from Alpine Road to Page Mill Road as a two-lane undivided road, at which point it widens to a four-lane divided facility, signed as Foothill Expressway. Junipero Serra Boulevard forms a portion of the southwesterly boundary of the Stanford University central campus. Junipero Serra Boulevard and Foothill Expressway is a County-maintained road.
- **University Avenue/Palm Drive** is a two- to four-lane road that runs east-west from the Dumbarton Bridge (SR 84) to the El Camino Real grade-separated interchange, where it becomes Palm Drive. From SR 84 to US 101, University Avenue is a four-lane arterial within the Cities of Menlo Park and East Palo Alto. South of US 101, in the City of Palo Alto, University Avenue is a two-lane arterial. Near the Caltrain overcrossing, University Avenue widens to four lanes until it becomes Palm Drive. Palm Drive remains four lanes until the intersection with Arboretum Road where it narrows to three lanes. At Campus Drive West, Palm Drive narrows again to two lanes until it terminates at the Stanford University Main Quad. Within Palo Alto, University Avenue is classified as an arterial between El Camino Real and Middlefield Road, and a residential arterial between Middlefield Road and the City boundary. Within East Palo Alto, University Avenue is classified as an arterial.
- **Embarcadero Road** is a four-lane arterial that runs east-west from the intersection of El Camino Real through the US 101 interchange, terminating near the Palo Alto Municipal Airport. West of El Camino Real, Embarcadero Road becomes Galvez Street, which provides a link to Arboretum Road and Campus Drive on the Stanford University campus. A short segment of Embarcadero Road underneath the Caltrain tracks is narrowed to three lanes. Embarcadero Road is classified by the City of Palo Alto as a residential arterial.
- **Sand Hill Road** is a two- to four-lane arterial that runs east-west. Sand Hill Road runs from Portola Road in the Town of Woodside to El Camino Real near the Stanford Shopping Center in the City of Palo Alto. Sand Hill Road is a two-lane road from Portola Road to the I-280 interchange, then it widens to four lanes to Arboretum Road, and then narrows to a two-lane road until it terminates adjacent to the Stanford Shopping Center at El Camino Real (SR 82). Within the study area, Sand Hill

Road provides connections to the Cities of Menlo Park and Palo Alto, as well as access to Stanford University. Sand Hill Road within Palo Alto is classified as an arterial.

- **Page Mill Road** is a two- to four-lane arterial which runs east-west from Skyline Boulevard (SR 35) to Alma Street in Palo Alto, where it becomes Oregon Expressway, and continues east to terminate at US 101. From I-280 to Alma Street, Page Mill Road is Santa Clara County Road G3. From Skyline Boulevard to the I-280 interchange, Page Mill Road is a narrow winding two-lane road. From I-280 to US 101, Page Mill Road/Oregon Expressway is a four-lane divided road. The City of Palo Alto classifies Page Mill Road an arterial.

Access to the campus as provided by sixteen "gateway" roadways ranging from two to four lanes, as shown in **Figure 4-1**.



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Source: AECOM Stanford University Traffic Monitoring Report



Figure 4-1
Stanford University Campus Gateways

4.2 EXISTING INTERSECTION VOLUMES AND LANE CONFIGURATIONS

For purposes of this report, Existing Conditions is defined as current (fall 2016) conditions based on intersection turning movement counts and intersection geometry.

4.2.1 EXISTING INTERSECTION VOLUMES

Intersection turning movement counts were conducted on a weekday morning (7:00 AM to 10:00 AM) and evening (4:00 PM to 7:00 PM) peak period on clear days with area schools in session. A summary of count data can be found in **Appendix E**. The single hour with the highest traffic volumes during each count period at each intersection was identified as its peak hour.

4.2.2 EXISTING INTERSECTION LANE GEOMETRIES

Existing lane configurations and signal phasing/timing were obtained through field observations and aerial photographs. Geometries and signal timings for County intersections within Santa Clara County were determined based on TRAFFIX output sheets received from staff at Santa Clara County Roads and Airports Department for use in this Project. Geometries for non-County, CMP intersections within Santa Clara County were determined from the *2014 Santa Clara County Annual Monitoring and Conformance Report* and associated TRAFFIX 8.0 network. The Existing Conditions lane configurations and traffic controls are shown in **Appendix E**.

4.3 EXISTING INTERSECTION OPERATIONS

Existing intersection lane configurations, signal timings, and peak hour turning movement volumes were used to calculate levels of service for the study intersections during the AM and PM peak hours for Existing Conditions. The LOS analysis was performed using the TRAFFIX 8.0 software with the VTA-required analysis settings, and the results are presented in **Table 4-1**. LOS calculation sheets are included in **Appendix F** and peak hour signal warrant calculations for unsignalized intersections which are significantly impacted are provided in **Appendix G**.

The results of the LOS calculations indicate that a majority of the study intersections are operating at acceptable levels under Existing Conditions, except the following study intersections:

- 13. I-280 Southbound Ramps / Page Mill Road – LOS F & Signal Warrant, AM and PM peak hours
- 17. Junipero Serra Boulevard-Foothill Expressway/Page Mill Road – LOS F, AM and PM peak hours
- 30. Foothill Expressway / Arastradero Road – LOS F, PM peak hour
- 32. Foothill Expressway/El Monte Avenue – LOS F, AM and PM peak hours

- 77. Woodland Avenue/University Avenue – LOS E+, PM peak hour
- 79. Donohoe Street/University Avenue – LOS E, AM peak hour

A graphical representation of the LOS results at each study intersection during the AM and PM peak hours may be found in **Figure 4-2**.

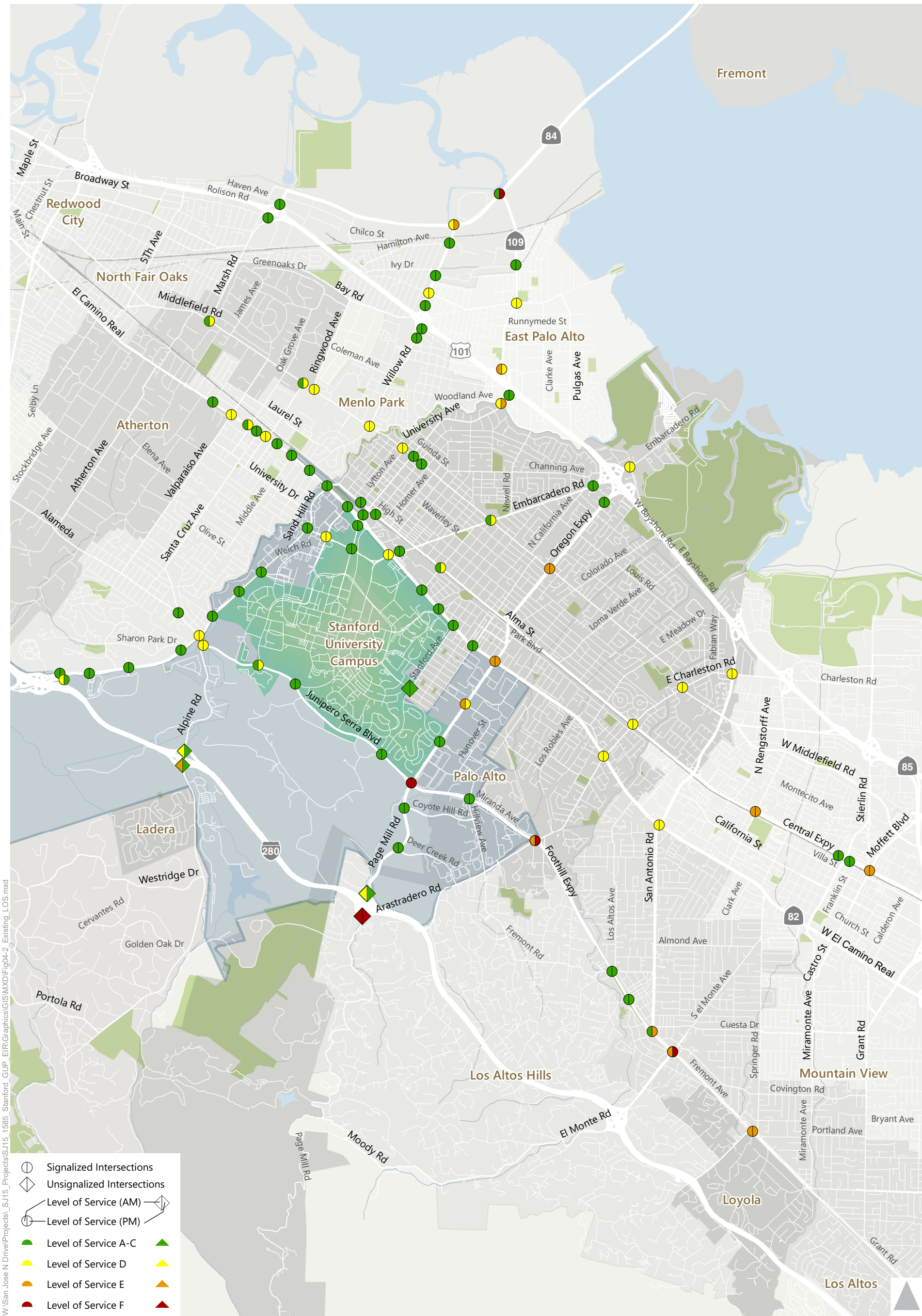


Figure 4-2
Stanford 2018 General Use Permit Existing Intersection Level of Service Results

TABLE 4-1: EXISTING INTERSECTION LEVEL OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold	Count Date	Peak Hour ²	Delay ³	LOS ⁴
1	I-280 NB On-Ramp / Sand Hill Rd	Menlo Park	LOS D	20-Oct-16	AM PM	10.6 10.2	B+ B+
2	I-280 NB Off-Ramp / Sand Hill Rd	Menlo Park	LOS D	20-Oct-16	AM PM	39.1 17.2	D B
3	Addison Wesley / Sand Hill Rd	Menlo Park	LOS D	4-Oct-16	AM PM	18.8 19.4	B- B-
4	Saga Ln / Sand Hill Rd	Menlo Park	LOS D	4-Oct-16	AM PM	13.6 19.0	B B-
5	Sharon Park Dr / Sand Hill Rd	Menlo Park	LOS D	4-Oct-16	AM PM	16.5 15.8	B B
6	Alameda de las Pulgas / Santa Cruz Ave	San Mateo County	LOS D	20-Oct-16	AM PM	13.9 13.8	B B
7	Santa Cruz Ave / Sand Hill Rd	Menlo Park	LOS D	4-Oct-16	AM PM	47.2 46.7	D D
8	Oak Ave / Sand Hill Rd	Menlo Park	LOS D	4-Oct-16	AM PM	10.5 3.8	B+ A
9	Stock Farm Rd / Sand Hill Rd	Palo Alto	LOS D	4-Oct-16	AM PM	20.0 25.9	C+ C
10	Pasteur Dr / Sand Hill Rd	Palo Alto	LOS D	4-Oct-16	AM PM	19.9 23.9	B- C
11	Arboretum Rd / Sand Hill Rd	Palo Alto	LOS D	4-Oct-16	AM PM	21.5 27.8	C+ C
12	El Camino Real / Sand Hill Rd	Palo Alto (SC CMP)	LOS E	20-Oct-16	AM PM	32.8 32.1	C- C-
13	I-280 SB Ramps / Page Mill Rd*	Santa Clara County	LOS E (warrant)	20-Oct-16	AM PM	93.4 72.0	F F
14	I-280 NB Ramps / Page Mill Rd*	Santa Clara County	LOS E (warrant)	20-Oct-16	AM PM	14.2 13.4	D B
15	Deer Creek Rd / Page Mill Rd	Santa Clara County	LOS E	6-Oct-16	AM PM	14.2 13.4	B B
16	Coyote Hill Rd / Page Mill Rd	Santa Clara County	LOS E	18-Oct-16	AM PM	7.5 8.6	A A
17	Junipero Serra Blvd - Foothill Expy / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	6-Oct-16	AM PM	93.6 93.0	F F
18	Peter Coutts / Page Mill Rd	Santa Clara County	LOS E	6-Oct-16	AM PM	20.0 28.4	C+ C
19	Hanover St / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	6-Oct-16	AM PM	60.1 48.6	E D
20	El Camino Real / Page Mill Rd - Oregon Expy	Santa Clara County (SC CMP)	LOS E	6-Oct-16	AM PM	57.9 62.2	E+ E

TABLE 4-1: EXISTING INTERSECTION LEVEL OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold	Count Date	Peak Hour ²	Delay ³	LOS ⁴
21	Middlefield Rd / Oregon Expy	Santa Clara County (SC CMP)	LOS E	9-Nov-16	AM PM	62.3 57.5	E E+
22	Oregon Expy / West Bayshore Rd	Santa Clara County	LOS E	11-Oct-16	AM PM	17.3 18.7	B B-
23	I-280 SB Ramps / Alpine Rd*	San Mateo County	LOS E (warrant)	20-Oct-16	AM PM	36.6 15.7	E C
24	I-280 NB Ramps / Alpine Rd*	San Mateo County	LOS E (warrant)	20-Oct-16	AM PM	25.1 24.2	D C
25	Junipero Serra Blvd / Alpine Rd	Menlo Park	LOS D	6-Oct-16	AM PM	41.9 47.4	D D
26	Junipero Serra Blvd / Campus Drive West	Santa Clara County	LOS E	6-Oct-16	AM PM	26.9 37.8	C D+
27	Junipero Serra Blvd / Campus Drive East	Santa Clara County	LOS E	6-Oct-16	AM PM	13.2 15.2	B B
28	Junipero Serra Blvd / Stanford Ave	Santa Clara County	LOS E	6-Oct-16	AM PM	18.8 19.9	B- B-
29	Foothill Expy / Hillview Ave	Santa Clara County	LOS E	6-Oct-16	AM PM	33.5 34.2	C- C-
30	Foothill Expy / Arastradero Rd	Santa Clara County (SC CMP)	LOS E	6-Oct-16	AM PM	66.9 83.6	E F
31	Foothill Expy / San Antonio Rd	Santa Clara County (SC CMP)	LOS E	11-Oct-16	AM PM	17.9 67.2	B E
32	Foothill Expy / El Monte Ave	Santa Clara County (SC CMP)	LOS E	13-Oct-16	AM PM	63.3 84.4	E F
33	Foothill Expy / Springer Road-Magdalena Ave	Santa Clara County (SC CMP)	LOS E	4-Oct-16	AM PM	58.8 70.2	E+ E
34	Bowdoin St / Stanford Ave*	Palo Alto	LOS E (warrant)	6-Oct-16	AM PM	13.1 16.8	B C
35	Arboretum Rd / Quarry Rd	Palo Alto	LOS D	4-Oct-16	AM PM	44.9 42.2	D D
36	Arboretum Rd / Palm Dr	Palo Alto	LOS D	6-Oct-16	AM PM	30.0 29.7	C C
37	El Camino Real / Encinal Ave	Menlo Park	LOS D	18-Oct-16	AM PM	16.8 29.5	B C
38	El Camino Real / Valparaiso Ave	Menlo Park	LOS D	18-Oct-16	AM PM	40.2 37.5	D D+
39	El Camino Real / Oak Grove Ave	Menlo Park	LOS D	18-Oct-16	AM PM	30.7 35.0	C D+
40	El Camino Real / Santa Cruz Ave	Menlo Park	LOS D	18-Oct-16	AM PM	13.6 19.7	B B-

TABLE 4-1: EXISTING INTERSECTION LEVEL OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold	Count Date	Peak Hour ²	Delay ³	LOS ⁴
41	El Camino Real / Ravenswood Rd	Menlo Park	LOS D	18-Oct-16	AM PM	41.2 44.6	D D
42	El Camino Real / Roble Ave	Menlo Park	LOS D	18-Oct-16	AM PM	12.9 13.4	B B
43	El Camino Real / Middle Ave	Menlo Park	LOS D	18-Oct-16	AM PM	27.1 27.1	C C
44	El Camino Real / Cambridge Ave	Menlo Park	LOS D	18-Oct-16	AM PM	13.2 19.1	B B-
45	El Camino Real / Quarry Rd	Palo Alto	LOS D	20-Oct-16	AM PM	15.2 33.1	B C-
46	El Camino Real (SB) / University Ave	Palo Alto (SC CMP)	LOS E	20-Oct-16	AM PM	21.0 20.0	C+ C+
47	El Camino Real (NB) / University Ave	Palo Alto (SC CMP)	LOS E	9-Nov-16	AM PM	18.7 26.3	B- C
48	El Camino Real / Embarcadero Rd	Palo Alto (SC CMP)	LOS E	6-Oct-16	AM PM	44.9 49.1	D D
49	El Camino Real / Churchill Ave	Palo Alto	LOS D	6-Oct-16	AM PM	23.1 25.9	C C
50	El Camino Real / Serra St	Palo Alto	LOS D	6-Oct-16	AM PM	22.3 25.8	C+ C
51	El Camino Real / Stanford Ave	Palo Alto	LOS D	6-Oct-16	AM PM	33.0 31.0	C- C
52	El Camino Real / California Ave	Palo Alto	LOS D	6-Oct-16	AM PM	23.6 28.5	C C
53	El Camino Real / Arastradero Rd - Charleston Rd	Palo Alto (SC CMP)	LOS E	11-Oct-16	AM PM	47.2 53.0	D D-
54	El Camino Real / San Antonio Rd	Mountain View (SC CMP)	LOS E	11-Oct-16	AM PM	52.7 53.0	D- D-
55	Alma St / Lytton Ave	Palo Alto	LOS D	6-Oct-16	AM PM	18.3 18.3	B- B-
56	Alma St / Hamilton Ave	Palo Alto	LOS D	6-Oct-16	AM PM	6.7 13.3	A B
57	Alma St / Churchill Ave	Palo Alto	LOS D	9-Nov-16	AM PM	26.9 46.5	C D
58	Alma St / Charleston Rd	Palo Alto	LOS D	11-Oct-16	AM PM	53.5 50.9	D- D
59	Middlefield Rd / Marsh Rd	Atherton	LOS D	13-Oct-16	AM PM	24.0 40.2	C D
60	Middlefield Rd / Ravenswood Ave	Menlo Park	LOS D	13-Oct-16	AM PM	31.3 36.1	C D+

TABLE 4-1: EXISTING INTERSECTION LEVEL OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold	Count Date	Peak Hour ²	Delay ³	LOS ⁴
61	Middlefield Rd / Ringwood Ave	Menlo Park	LOS D	13-Oct-16	AM PM	37.1 50.0	D+ D
62	Middlefield Rd / Willow Rd	Menlo Park	LOS D	13-Oct-16	AM PM	47.3 46.6	D D
63	Middlefield Rd / Lytton Ave	Palo Alto	LOS D	13-Oct-16	AM PM	36.3 43.7	D+ D
64	Middlefield Rd / University Ave	Palo Alto	LOS D	13-Oct-16	AM PM	29.0 33.7	C C-
65	Middlefield Rd / Hamilton Ave	Palo Alto	LOS D	13-Oct-16	AM PM	11.4 11.6	B+ B+
66	Middlefield Rd / Embarcadero Rd	Palo Alto	LOS D	9-Nov-16	AM PM	33.2 36.6	C- D+
67	Saint Francis Dr / Embarcadero Rd	Palo Alto	LOS D	29-Nov-16	AM PM	23.6 17.5	C B
68	E. Bayshore Rd / Embarcadero Rd	Palo Alto	LOS D	9-Nov-16	AM PM	44.1 53.6	D D-
69	Middlefield Rd / Charleston Rd	Palo Alto	LOS D	4-Oct-16	AM PM	49.8 52.4	D D-
70	US 101 SB Ramps / Marsh Rd	Menlo Park	LOS D	9-Nov-16	AM PM	21.0 24.7	C+ C
71	US 101 NB Ramps / Marsh Rd	Menlo Park	LOS D	18-Oct-16	AM PM	16.3 14.9	B B
72	Bay Rd / Willow Rd	Menlo Park	LOS D	20-Oct-16	AM PM	16.8 10.7	B B+
73	Newbridge St / Willow Rd	Menlo Park	LOS D	18-Oct-16	AM PM	42.7 40.6	D D
74	O'Brien Dr / Willow Rd	Menlo Park	LOS D	18-Oct-16	AM PM	11.0 11.8	B+ B+
75	Hamilton Ave / Willow Rd	Menlo Park	LOS D	18-Oct-16	AM PM	14.5 18.8	B B-
76	Bayfront Expy / Willow Rd	Menlo Park (SM CMP)	LOS F	18-Oct-16	AM PM	39.0 56.8	D+ E+
77	Woodland Ave / University Ave	East Palo Alto	LOS D	20-Oct-16	AM PM	48.1 58.9	D E+
78	US 101 SB Ramps / University Ave	East Palo Alto	LOS D	20-Oct-16	AM PM	26.7 25.0	C C
79	Donohoe St / University Ave	East Palo Alto	LOS D	20-Oct-16	AM PM	65.3 42.5	E D
80	University Ave / Bay Rd	East Palo Alto	LOS D	18-Oct-16	AM PM	38.0 47.1	D+ D

TABLE 4-1: EXISTING INTERSECTION LEVEL OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold	Count Date	Peak Hour ²	Delay ³	LOS ⁴
81	University Ave / Bayfront Expy	Menlo Park (SM CMP)	LOS F	18-Oct-16	AM PM	21.7 85.0	C+ F
82	Town & Country Driveway / Embarcadero Rd	Palo Alto	LOS D	18-Oct-16	AM PM	29.2 27.9	C C
83	Charleston Rd / San Antonio Rd	Mountain View (SC CMP)	LOS E	11-Oct-16	AM PM	54.5 51.6	D- D-
84	US 101 SB Ramps / Willow Rd	Menlo Park	LOS D	Oct-16 ⁵	AM PM	N/A ⁶	N/A ⁶
85	US 101 NB Ramps / Willow Rod	Menlo Park	LOS D	Oct-16 ⁵	AM PM	N/A ⁶	N/A ⁶
86	Central Expy / Rengstorff Ave	Santa Clara County (SC CMP)	LOS E	3-Jun-15 6-Oct-16	AM PM	76.7 62.1	E- E
87	Central Expy / Shoreline Blvd (N)	Santa Clara County (SC CMP)	LOS E	3-Jun-15 6-Oct-16	AM PM	3.2 5.4	A A
88	Central Expy / Shoreline Blvd (S)	Santa Clara County (SC CMP)	LOS E	3-Jun-15 6-Oct-16	AM PM	8.1 7.4	A A
89	Central Expy / Castro St-Moffett Blvd	Santa Clara County (SC CMP)	LOS E	3-Jun-15 6-Oct-16	AM PM	62.6 63.4	E E
90	Foothill Expy / Edith Ave	Santa Clara County	LOS E	9-May-17	AM PM	28.8 27.6	C C
91	Foothill Expy / Main St	Santa Clara County (SC CMP)	LOS E	9-May-17 6-Oct-16	AM PM	22.3 22.5	C+ C+
92	University Ave / O'Brien Dr	Menlo Park	LOS D	30-Sept-14	AM PM	7.8 12.5	A B
Additional Intersections							
93	University Ave / Adams Dr*	Menlo Park	LOS E (warrant)	30-Sept-14	AM PM	62.4 21.4	F7 C
94	University Ave / Runnymede St	East Palo Alto	LOS D	5-May-15	AM PM	14.9 19.8	B B-
95	University Ave / Bell St	East Palo Alto	LOS D	5-May-15	AM PM	14.5 17.7	B B

Notes: **Bold text** indicates intersection operates at unacceptable level of service.

*Indicates unsignalized intersection.

- Intersection jurisdiction and identification of CMP (Congestion Management Program) intersections.
(SC CMP) – CMP intersection in Santa Clara County
(SM CMP) – CMP intersection in San Mateo County
- AM = morning peak hour, PM = evening peak hour.
- Whole intersection weighted average control delay expressed in seconds per vehicle calculated using methods described in the 2000 *Highway Capacity Manual*, with adjusted saturation flow rates to reflect Santa Clara County Conditions for signalized intersections and all-way stop-controlled intersections. For side-street stop-controlled intersections, total delay for the worst movement is reported.

4. LOS = Level of Service. LOS calculations conducted using the TRAFFIX 8.0 analysis software packages, which apply the methods described in the 2000 *Highway Capacity Manual*.
5. Caltrans Performance Measurement System (PeMS) data during the month of October 2016 was used to determine existing ramp volumes on the Willow Road ramps.
6. The US 101 / Willow Road interchange reconfiguration is estimated to be constructed by 2020, and is denoted by "N/A" under Existing Conditions.
7. A signal warrant is not met for this intersection.

Source: Fehr & Peers, August 2017.

4.4 EXISTING FREEWAY SEGMENT OPERATIONS

4.4.1 SANTA CLARA COUNTY FREEWAY SEGMENTS

Table 4-2 contains the existing freeway segments level of service for the mixed-flow and HOV lanes based on the segment densities, calculated as described in Section 3.3. The following mixed-flow freeway segments within Santa Clara County exceed VTA's LOS E standard during the specified peak hour:

AM Peak Hour

SR 85 Northbound

- South De Anza Boulevard to Stevens Creek Boulevard
- Stevens Creek Boulevard to I-280

US 101 Northbound

- Moffett Boulevard to SR 85
- SR 85 to N. Shoreline Boulevard
- N. Shoreline Boulevard to Rengstorff Avenue

I-280 Northbound

- Lawrence Expressway to Wolfe Road
- Wolfe Road to De Anza Boulevard
- De Anza Boulevard to SR 85
- SR 85 to Foothill Expressway

PM Peak Hour

SR 85 Southbound

- Stevens Creek Boulevard to South De Anza Boulevard
- South De Anza Boulevard to Saratoga Avenue

US 101 Northbound

- N. Shoreline Boulevard to Rengstorff Avenue
- Rengstorff Avenue to San Antonio Road
- San Antonio Road to Oregon Expressway
- Oregon Expressway to Embarcadero Road

US 101 Southbound

- Embarcadero Road to Oregon Expressway
- Oregon Expressway to San Antonio Road
- San Antonio Road to Rengstorff Avenue
- SR 85 to Moffett Boulevard
- Moffett Boulevard to SR 237

I-280 Southbound

- Page Mill Road to La Barranca Road
- La Barranca Road to El Monte Road
- El Monte Road to Magdalena Avenue
- SR 85 to De Anza Boulevard
- De Anza Boulevard to Wolfe Road
- Wolfe Road to Lawrence Expressway

Additionally, the following HOV lane segments in Santa Clara County exceed VTA's LOS E standard during the specified peak hour:

- SR 85 Northbound
 - South De Anza Boulevard to Stevens Creek Boulevard (AM Peak Hour)
 - Stevens Creek Boulevard to I-280 (AM Peak Hour)
- SR 85 Southbound
 - I-280 to Stevens Creek Boulevard (PM Peak Hour)

All other Santa Clara County freeway segments operate at acceptable LOS E or better during both peak periods.

TABLE 4-2: EXISTING FREEWAY SEGMENT LEVEL OF SERVICE IN SANTA CLARA COUNTY

Freeway	Direction	Segment	Peak Hour	Number of Lanes		Density		LOS	
				Mixed	HOV	Mixed	HOV	Mixed	HOV
SR 85	NB	Saratoga Avenue to South De Anza Boulevard	AM PM	2	1	52 21	36 8	E C	D A
	NB	South De Anza Boulevard to Stevens Creek Boulevard	AM PM	2	1	65 22	64 9	F C	F A
	NB	Stevens Creek Boulevard to I-280	AM PM	2	1	124 13	108 6	F B	F A
	SB	I-280 to Stevens Creek Boulevard	AM PM	2	1	21 52	5 66	C E	A F
	SB	Stevens Creek Boulevard to South De Anza Boulevard	AM PM	2	1	18 90	5 47	B F	A E
	SB	South De Anza Boulevard to Saratoga Avenue	AM PM	2	1	21 62	8 52	C F	A E
US 101	NB	SR 237 to Moffett Boulevard	AM PM	3	1	49 36	35 22	E D	D C
	NB	Moffett Boulevard to SR 85	AM PM	3	1	66 52	33 16	F E	D B
	NB	SR 85 to N. Shoreline Boulevard	AM PM	4	1 ¹	79 47	34 15	F E	D B
	NB	N. Shoreline Boulevard to Rengstorff Avenue	AM PM	3	1 ¹	76 74	25 13	F F	C B
	NB	Rengstorff Avenue to San Antonio Road	AM PM	3	1 ¹	42 62	20 11	D F	C A
	NB	San Antonio Road to Oregon Expressway	AM PM	3	1 ¹	42 62	29 22	D F	D C
	NB	Oregon Expressway to Embarcadero Road	AM PM	3	1	46 62	38 36	D F	D D
	SB	Embarcadero Road to Oregon Expressway	AM PM	3	1	35 104	33 83	D F	D F
	SB	Oregon Expressway to San Antonio Road	AM PM	3	1 ¹	34 89	19 26	D F	C C
	SB	San Antonio Road to Rengstorff Avenue	AM PM	3	1 ¹	48 85	18 19	E F	B C
	SB	Rengstorff Avenue or N. Shoreline Boulevard	AM PM	3	1 ¹	40 49	21 20	D E	C C
	SB	N. Shoreline Boulevard to SR 85	AM PM	3	1 ¹	36 47	27 32	D E	D D
	SB	SR 85 to Moffett Boulevard	AM PM	3	1	31 103	28 35	D F	D D

TABLE 4-2: EXISTING FREEWAY SEGMENT LEVEL OF SERVICE IN SANTA CLARA COUNTY

Freeway	Direction	Segment	Peak Hour	Number of Lanes		Density		LOS	
				Mixed	HOV	Mixed	HOV	Mixed	HOV
	SB	Moffett Boulevard to SR 237	AM PM	3	1	33 70	22 36	D F	C D
I-280	NB	Lawrence Expressway to Wolfe Road	AM PM	3	1	81 23	46 10	F C	D A
	NB	Wolfe Road to De Anza Boulevard	AM PM	3	1	62 25	57 7	F C	E A
	NB	De Anza Boulevard to SR 85	AM PM	3	1	73 23	45 7	F C	D A
	NB	SR 85 to Foothill Expressway	AM PM	3	1	70 22	58 8	F C	E A
	NB	Foothill Expressway to Magdalena Avenue	AM PM	3	1	37 22	53 13	D C	E B
	NB	Magdalena Avenue to El Monte Road	AM PM	4	0	48 25	n/a n/a	E C	n/a n/a
	NB	El Monte Road to La Barranca Road	AM PM	4	0	39 21	n/a n/a	D C	n/a n/a
	NB	La Barranca Road to Page Mill Road	AM PM	4	0	32 25	n/a n/a	D C	n/a n/a
	NB	Page Mill Road to Alpine Road	AM PM	4	0	32 36	n/a n/a	C D	n/a n/a
	SB	Alpine Road to Page Mill Road	AM PM	4	0	25 32	n/a n/a	C D	n/a n/a
	SB	Page Mill Road to La Barranca Road	AM PM	4	0	21 68	n/a n/a	C F	n/a n/a
	SB	La Barranca Road to El Monte Road	AM PM	4	0	20 67	n/a n/a	C F	n/a n/a
	SB	El Monte Road to Magdalena Avenue	AM PM	4	0	20 81	n/a n/a	C F	n/a n/a
	SB	Magdalena Avenue to Foothill Expressway	AM PM	3	1	23 37	12 18	C D	B C
	SB	Foothill Expressway to SR 85	AM PM	3	1	33 40	14 14	D D	B B
	SB	SR 85 to De Anza Boulevard	AM PM	3	1	24 103	9 19	C F	A E
	SB	De Anza Boulevard to Wolfe Road	AM PM	3	1	36 77	10 30	D F	A E
	SB	Wolfe Road to Lawrence Expressway	AM PM	3	1	35 81	16 19	D F	B E

Note:

1. Data is provided from the 2014 Conformance and Monitoring Report, which specifies one HOV lane on the identified segments in the year 2014.

Source: VTA Monitoring and Conformance Report, 2014.

4.4.2 SAN MATEO COUNTY FREEWAY SEGMENTS

Unlike Santa Clara County, San Mateo County does not maintain an existing volume and LOS database from which to report comprehensive existing freeway service levels. However, the *Final San Mateo County Congestion Management Program 2015* report provides information on the worst-performing segments on each route. The LOS method used within the Congestion Management Program 2015 report is based on calculated volume-to-capacity (V/C) ratios and LOS criteria described in the *1994 Highway Capacity Manual*. **Table 4-3** contains the level of service results of the worst performing segment in the AM and PM peak hours, as presented in the Congestion Management Program 2015 report. Within San Mateo County, I-280 between SR 92 and SR 84 exceeds C/CAG's LOS standard during the AM and PM peak hours.

TABLE 4-3: EXISTING FREEWAY SEGMENT LEVEL OF SERVICE IN SAN MATEO COUNTY

Freeway	Roadway Segment	LOS Standard	AM LOS	PM LOS
I-280	SR 92 to SR 84	D	E	E
	SR 84 to Santa Clara County Line	F	A	F
US 101	Whipple Avenue to Santa Clara County Line	F	F	F

Notes: **Bold** indicates segment is operating at an unacceptable level.

Source: *Level of Service and Performance Measure Monitoring Report – 2015*, Jacobs, September 2015.

4.5 EXISTING FREEWAY RAMP OPERATIONS

Freeway ramp vehicle queuing analysis was conducted for the Project to evaluate any potential queues spillback onto the freeway or local streets. The operations of on- and off-ramps along US 101 and I-280 near the Project site were evaluated under Existing Conditions. Freeway ramps analyzed during the weekday morning and evening peak periods are listed in Section 1.2.3.

4.5.1 FREEWAY ON-RAMP OPERATIONS

Within the study area, some freeway on-ramps are equipped with ramp meters, and others are un-metered. Ramp metering rates are generally set between 240 vehicles per hour per lane (vphpl) and 900 vphpl for one-vehicle-per-green metering plans and between 600 vphpl and 1,050 vphpl for two-vehicles-per-green metering plans. Ramp metering rates change throughout the peak period based on queuing on the freeway and on the on-ramps. Therefore, a range is provided to capture the minimum and maximum queue spillback

that may occur. Currently, all metered on-ramps within the study are metered at one vehicle per green. Per Caltrans analysis methods, queue lengths were calculated using a vehicle length of 30 feet per vehicle.

Table 4-4 summarizes the on-ramp configuration (loop or diagonal), storage capacity, whether it has an HOV bypass lane, the percent of vehicles using that lane, and metering rates for the on-ramps evaluated as part of this study. Current ramp-metering rates provided by Caltrans were used to evaluate the existing range of on-ramp queues.

TABLE 4-4: EXISTING ON-RAMP CONFIGURATION AND METERING INFORMATION

Ramp Type	Storage Capacity (ft) ¹	Number of Lanes ²		HOV Bypass Percent ³	Vehicles/ Green	Metering Rate ⁴			
						AM Peak Period		PM Peak Period	
		SOV	HOV			Min.	Max.	Min.	Max.
US 101 Northbound On-Ramps									
Willow Road (loop)	650	1	0	N/A	N/A	Not Metered		Not Metered	
University Avenue (loop)	880	1	0	N/A	N/A	Not Metered		Not Metered	
US 101 Southbound On-Ramps									
Oregon Expressway (diagonal)	1,400	2	1	15%	1	250	900	250	900
Embarcadero Road (diagonal)	1,150	1	0	N/A	1	420	900	420	900
I-280 Northbound On-Ramps									
Sand Hill Road (diagonal)	1,460	1	0	N/A	N/A	Not Metered		Not Metered	
Alpine Road (diagonal)	1,000	1	0	N/A	N/A	Not Metered		Not Metered	
Page Mill Road (diagonal)	700	1	0	N/A	N/A	Not Metered		Not Metered	
I-280 Southbound On-Ramps									
Page Mill Road (loop)	1,500	2	0	N/A	N/A	Not Metered		Not Metered	
Alpine Road (loop)	650	1	0	N/A	N/A	Not Metered		Not Metered	
Sand Hill Road (loop)	800	1	0	N/A	N/A	Not Metered		Not Metered	

Notes:

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.
2. SOV= Single-occupant vehicle, HOV = High-occupancy vehicle (carpools and buses)
3. Percent of demand assumed in HOV lane (N/A = not applicable – no HOV bypass lane).
4. Metering rates presented in vehicle per hour per lane (vphpl).

Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

4.5.1.1 On-Ramp Analysis Results

The on-ramp queuing results for the AM and PM peak periods are presented in **Table 4-5** and the calculation sheets are provided in **Appendix H**. Caltrans operates dynamic ramp metering rates based on the queues on the freeways and on the ramps. Therefore, the on-ramp queues were evaluated at the minimum and maximum ramp metering rates to show the potential range of queues at the given ramp. The

results under the heading “Existing Conditions” represents the observed on-ramp queues with the counted volumes or PeMS data found on the Caltrans database and the ramp metering rates.

The US 101 / Embarcadero Road southbound diagonal and the US 101 / Oregon Expressway southbound diagonal on-ramps are the only metered on-ramps within the study area. As shown in **Table 4-5**, all queues will remain within the available storage when the ramp metering rate operates at the maximum, 900 vehicles per hour. All other queues are anticipated to remain within the available storage when operating at the maximum ramp metering rate. All queues are anticipated to exceed the available storage when using the minimum ramp metering rate (it is unlikely that the metering rate will remain at the minimum rate).

Volumes from all other on-ramps that provide access the Stanford University are shown in **Table 4-6**.

TABLE 4-5: EXISTING FREEWAY METERED ON-RAMP QUEUING EVALUATION

On-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Existing Conditions	
			Ramp Volume	“Min. / Max.” Queue (ft) ^{3, 4}
US 101 Southbound On-Ramps				
Oregon Expressway (diagonal)	1,400	AM PM	1,297 1,275	30 / 18,090 30 / 64,260
Embarcadero Road (diagonal)	1,150	AM PM	803 720	30 / 17,940 690 / 23,490

Notes: **Bold** text indicates conditions where the queue exceeds the available storage capacity.

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.
2. AM peak period – 6:00AM to 9:00AM. PM peak period – 3:00PM to 7:00PM.
3. Minimum queues estimated using the maximum metering rates as presented in **Table 4-4**. Maximum queues estimated using the minimum metering rates as presented in **Table 4-4**. The minimum queue is one vehicle, which is equal to 30 feet.
4. “N/A” = not applicable, ramp is not metered during that time period.

Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

TABLE 4-6: EXISTING FREEWAY NON-METERED ON-RAMP VOLUMES

On-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Existing Ramp Volume
US 101 Northbound On-Ramps			
Willow Road (loop)	650	AM PM	361 232
University Avenue (loop)	880	AM PM	357 119
I-280 Northbound On-Ramps			
Sand Hill Road (diagonal)	1,460	AM PM	509 974
Alpine Road (diagonal)	1,000	AM PM	350 691
Page Mill Road (diagonal)	700	AM PM	666 1,374
I-280 Southbound On-Ramps			
Page Mill Road (loop)	1,500	AM PM	585 902
Alpine Road (loop)	650	AM PM	364 546
Sand Hill Road (loop)	800	AM PM	325 954

Notes: **Bold** text indicates conditions where the queue exceeds the available storage capacity.

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.
2. AM peak period – 6:00AM to 9:00AM. PM peak period – 3:00PM to 7:00PM.

Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

4.5.2 FREEWAY OFF-RAMP OPERATIONS

Off-ramp queues that terminate at an intersection were evaluated using ramp-terminal intersection queue estimates from the intersection LOS calculations (using TRAFFIX 8.0 software package). Slip ramps where there is no control device (e.g., signal or stop sign) and the ramp merges with the local street were evaluated using V/C ratios. **Table 4-7** shows the off-ramp configurations for locations with signalized and unsignalized terminal intersections, including the type of ramp (diagonal or loop) and whether the off-ramp exits the freeway from an auxiliary lane or directly from the freeway mainline (diverge lane).

TABLE 4-7: EXISTING OFF-RAMP CONFIGURATION AND STORAGE CAPACITY

Off-Ramp	Freeway Exit Lane	Control Type	Storage Capacity ¹ (ft)
US 101 Northbound Off-Ramps			
Embarcadero Road (loop) ²	1 Auxiliary Lane	Uncontrolled	750
US 101 Southbound Off-Ramps			
Willow Road (diagonal)	1 Auxiliary Lane	Uncontrolled	1,200
University Avenue (loop)	1 Auxiliary Lane; 1 Diverge Lane	Signal	1,870 / 190
I-280 Northbound Off-Ramps			
Sand Hill Road (diagonal)	1 Diverge Lane	Signal	740 / 300
Alpine Road (diagonal)	1 Diverge Lane	Left-Turn Stop-Controlled Right-Turn Uncontrolled	1,360 / 280
Page Mill Road (diagonal)	2 Diverge Lanes	Left-Turn Stop-Controlled Right-Turn Uncontrolled	60 / 1,830
I-280 Southbound Off-Ramps			
Sand Hill Road (loop)	1 Diverge Lane	Uncontrolled	940
Alpine Road (diagonal)	1 Diverge Lane	Left-Turn Stop-Controlled Right-Turn Uncontrolled	1,370 / 450
Page Mill Road (diagonal)	1 Diverge Lane	Left-Turn Stop-Controlled Right-Turn Uncontrolled	150 / 1,940

Note:

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements (not necessarily the freeway/ramp gore point).

Storage Capacity for an Uncontrolled Ramp - ## = total storage capacity

Storage Capacity for a Controlled Ramp - ##/## = left-turn and (or) through pocket / right-turn pocket

2. Oregon Expressway off-ramp is not evaluated under this evaluation. The northbound Oregon Expressway off-ramp is the beginning of Oregon Expressway and enters directly onto the roadway without any conflicting movement.

Source: Fehr & Peers, August 2017.

4.5.2.1 Off-Ramp Analysis Results

This section summarizes the queues calculated using the 2000 HCM Methods within the TRAFFIX 8.0 software at the off-ramps with signalized terminal intersections for the AM and PM peak periods. **Table 4-8** presents the desired storage for the signalized turning movements that provide access to the Project site. Off-ramp calculation sheets are provided in **Appendix F**. Data for left-turning (and/or through) and right-turning vehicles are presented separately based on which turning movement serves the Project site. Queue lengths were calculated using a vehicle length of 30 feet. As shown in **Table 4-8**, all off-ramps are expected to serve vehicle queues within the available ramp storage.

However, the following turn queues are anticipated to exceed the available turn-pocket storage queue:

- US 101 / University Avenue southbound loop off-ramp – right-turn queue exceeds pocket storage length during the AM and PM peak periods;
- I-280 / Sand Hill Road northbound diagonal off-ramp – right-turn queue exceeds pocket storage length during the AM and PM peak periods;
- I-280 / Page Mill Road southbound diagonal off-ramp – left-turn queue exceeds pocket storage length during the AM and PM peak periods.

While these turn queues are anticipated to exceed the available turn pocket storage, the queue would be served within the total ramp storage (which includes the portion of the off-ramp between the freeway/ramp gore point and the ramp diverge gore point, where applicable), and would not spillback into the freeway mainline.

TABLE 4-8: EXISTING FREEWAY OFF-RAMP QUEUING EVALUATION – SIGNALIZED AND STOP-CONTROLLED TERMINAL INTERSECTIONS

Off-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Existing Conditions	
			Ramp Volume ³	Queue (ft) ⁴
US 101 Northbound Off-Ramps				
Embarcadero Road (loop) ⁵	See Table 4-9. ⁶			
US 101 Southbound Off-Ramps				
Willow Road (diagonal)	See Table 4-9. ⁶			
University Avenue (loop)	1,870 / 190	AM PM	260 / 249 184 / 529	480 / 480 270 / 630
I-280 Northbound Off-Ramps				
Sand Hill Road (diagonal)	740 / 300	AM PM	93 / 494 49 / 182	90 / 930 90 / 330
Alpine Road (diagonal) ⁸	1,360 / 280	AM PM	248 / 808 129 / 259	30 / ⁷ 30 / ⁷
Page Mill Road (diagonal)	60 / 1,830	AM PM	131 / 1,810 50 / 288	60 / ⁷ 30 / ⁷
I-280 Southbound Off-Ramps				
Sand Hill Road (loop)	See Table 4-9. ⁵			
Alpine Road (diagonal)	1,370 / 450	AM PM	381 / 453 154 / 243	210 / ⁷ 30 / ⁷
Page Mill Road (diagonal) ⁸	150 / 1,940	AM PM	1,025 / 453 791 / 44	330 / ⁷ 270 / ⁷

Notes: **Bold** text indicates conditions where the queue exceeds the turn pocket capacity.

- Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.
Storage Capacity for a Controlled Ramp - ##/## = left-turn and (or) through pocket / right-turn pocket
- AM peak period – 6:00AM to 9:00AM. PM peak period – 3:00PM to 7:00PM.
- Ramp volume by turning movement - ##/## = left-turn and (or) through movement / right-turn movement
- The queue indicated represents the 95th Percentile Queue for signalized movements and the Average Queue for stop-controlled movements - ##/## = left-turn and (or) through queue / right-turn queue
- Oregon Expressway off-ramp is not evaluated under this evaluation. The northbound Oregon Expressway off-ramp is the beginning of Oregon Expressway and enters directly onto the roadway without any conflicting movement.
- Table 4-9 includes the uncontrolled off-ramps.
- Only left-turn movement is stop-controlled. Free right-turn queues are not provided.
- For all-way stop-controlled ramp intersections, the average queue is reported due to the limitations of the 2000 HCM.

Source: Fehr & Peers, August 2017.

Table 4-9 summarizes the V/C ratios for the off-ramps with uncontrolled terminal intersections for the AM and PM peak periods. Most of the V/C ratios under Existing Conditions are less than 1.0, indicating that the off-ramps have sufficient capacity to accommodate the exiting volumes at these locations, with the

exception of the I-280 / Page Mill Road northbound diagonal on-ramp, which is anticipated to have a V/C ratio of 1.0 during the AM peak period.

TABLE 4-9: EXISTING FREEWAY OFF-RAMP QUEUING EVALUATION - UNCONTROLLED TERMINAL INTERSECTIONS

Off-Ramp	Maximum Vehicle Flow Rate - Capacity (vphpl) ¹	Peak Period ²	Existing Conditions	
			Ramp Volume	V/C ³
US 101 Northbound Off-Ramps				
Embarcadero Road (loop) ⁴	1,800	AM	727	0.40
		PM	409	0.23
US 101 Southbound Off-Ramps				
Willow Road (diagonal)	1,900	AM	423	0.22
		PM	394	0.21
University Avenue (loop)	See Table 4-8. ⁶			
I-280 Northbound Off-Ramps				
Sand Hill Road (diagonal)	See Table 4-8. ⁶			
Alpine Road (diagonal) ⁵	1,900	AM	808	0.43
		PM	259	0.14
Page Mill Road (diagonal) ⁵	1,900	AM	1,810	0.95
		PM	288	0.15
I-280 Southbound Off-Ramps				
Sand Hill Road (loop)	1,800	AM	1,361	0.76
		PM	523	0.29
Alpine Road (diagonal) ⁵	1,900	AM	453	0.24
		PM	243	0.13
Page Mill Road (diagonal) ⁵	1,900	AM	41	0.02
		PM	44	0.02

Notes: **Bold** text indicates the off-ramp does not have sufficient capacity to accommodate the exiting volumes.

1. Diagonal ramps were assumed to have a capacity of 1,900 vehicles per hour per lane (vphpl). Loop ramps were assumed to have a capacity of 1,800 vphpl.
 2. AM peak period – 6:00AM to 9:00AM. PM peak period – 3:00PM to 7:00PM.
 3. V/C = volume-to-capacity ratio.
 4. Oregon Expressway off-ramp is not evaluated under this evaluation. The northbound Oregon Expressway off-ramp is the beginning of Oregon Expressway and enters directly onto the roadway without any conflicting movement.
 5. The right-turn movement is uncontrolled. Therefore, the right-turn volume and V/C is the only ramp movement reported in the table.
 6. Table 4-8 includes the signalized and stop-controlled off-ramps.
- Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

4.6 EXISTING TRANSIT SERVICES

This section summarizes local and regional transit services within the study area, including bus, commuter rail, and public and private shuttles. An extensive public transit network of rail, buses, and ferries serves the greater San Francisco Bay Area. Many of these transit providers offer service near Stanford, offering regional transit mobility to employees, residents and visitors. The Palo Alto Transit Center is a point of convergence for Caltrain and several bus lines operated by VTA, San Mateo County Transit (SamTrans), Alameda-Contra Costa Transit District (AC Transit), and Stanford University Marguerite Shuttle. There are free shuttles operated by Stanford (the Marguerite), the City of Palo Alto, and the City of Menlo Park that offer service to Stanford and neighboring cities. **Figure 4-3** shows the existing transit facilities and routes in the study area, except the Marguerite Shuttle, which is discussed in Section 4.6.7 and shown in **Figure 4-4**. These routes include public/private shuttles, buses, and heavy rail services, including the location of stops in the area. Details of the different bus routes are presented in **Table 4-10**, which summarizes the weekday destinations, hours of operation, and service frequencies for transit services within a 2,000-foot walking distance⁷ of the Stanford University campus.

4.6.1 CALTRAIN

The Peninsula Corridor Joint Powers Board (JPB) rail service, Caltrain, runs north-south along the Peninsula from San Francisco to San Jose, with some service extending to Gilroy. Caltrain is managed by SamTrans and operates under the jurisdiction of the JPB. Stanford is primarily served by Caltrain stations at the Palo Alto Transit Center (east of El Camino Real at University Avenue) and at the California Avenue Station. There is an additional Caltrain station near Embarcadero Road that is only in service during days there is a Stanford football game and is not operational during typical peak periods.

The current weekday schedule consists of frequent train intervals (5 to 30 minutes) during commute hours, with hourly service provided during non-commute times. The earliest northbound train leaves Palo Alto at 5:02 AM. The last northbound train departs Palo Alto at 11:04 PM. The first southbound train is at 5:51 AM while the last southbound train departs Palo Alto at 12:59 AM. On weekends, the earliest hourly northbound train leaves Palo Alto at 7:31 AM (Saturday), the last northbound train departs Palo Alto at 11:01 PM (Saturday). The first southbound train leaves Palo Alto at 9:19 AM and the last southbound train departs Palo Alto at 1:05 AM (Saturday).

Caltrain provides Baby Bullet Express Service that allows under one-hour travel between San Jose and San Francisco. This service runs during both the AM and PM peak periods in both directions, a total of 22 trips each day. Six baby bullet trains stop at the Palo Alto Transit Center station in each of the northbound AM and PM, and southbound PM peak periods. Five baby bullet trains stop at the Palo Alto Transit center in the southbound AM peak period. Baby bullet trains do not stop at the California Avenue Station. In addition,

⁷ 2,000-foot walking distance is based upon VTA's TIA Guidelines (2014), page 25

Caltrain runs Limited-stop Service that serves fewer stations than local service throughout the day between San Jose and San Francisco.

4.6.2 SANTA CLARA VALLEY TRANSPORTATION AUTHORITY (VTA)

VTA operates fixed route, commuter, and paratransit bus service and light-rail service (LRT) in Santa Clara County. VTA serves the Palo Alto Transit Center with local routes 22, 35 and the limited-stop Bus Rapid Transit (BRT) route 522. Route 35 also serves the Stanford Shopping Center. Route 89 provides service between the Palo Alto Veteran's Hospital and California Avenue Caltrain station along Hanover Street in the northeastern corner of the study area. Express bus routes 101, 102, and 103 provide service along Page Mill Road and Hansen Street in the northeastern corner of the study area. Express bus route 104 provides service between the Penitencia Creek Transit Center to Palo Alto along Page Mill Road in the northeastern portion of the study area. Express bus route 182 provides service between IBM/Bailey Avenue and Palo Alto along California Avenue and Hanover Street in the northeastern corner of the study area.

4.6.3 SAN MATEO COUNTY TRANSIT (SAMTRANS)

SamTrans operates fixed route, commuter and paratransit bus service in San Mateo County. SamTrans currently serves the Palo Alto Transit Center with local lines 280, 281, the BART/Caltrain connector routes 297 and 397, and route ECR, which provides service along El Camino Real, making multiple stops at Caltrain and BART stations along the way. Connections to Stanford Shopping Center, which is located one-quarter mile northwest of the Palo Alto Transit Center, are provided by local lines 280, 281, and ECR.

4.6.4 ALAMEDA-CONTRA COSTA TRANSIT DISTRICT (AC TRANSIT)

AC Transit operates fixed route, commuter, and paratransit bus services in the counties of Alameda and Contra Costa. AC Transit currently serves Stanford University with the Dumbarton Express and Line U. The Dumbarton Express is a joint BART/VTA/Caltrain/SamTrans/AC Transit/Union City Transit line that is administered and governed by AC Transit, and operated by MV Transportation. The Dumbarton Express operates two lines, Line DB and Line DB1, which provide service between the Union City BART station and Palo Alto utilizing the Dumbarton Bridge. Line DB serves the Palo Alto Caltrain station and the Stanford Oval, and Line DB1 serves the Stanford Research Park and Veterans Hospital. Line U provides connection between the Fremont BART station, the Stanford Oval and Stanford Shopping Center, with additional stops in the cities of Fremont, Palo Alto and Stanford's campus including the Fremont/Centerville Amtrak Station and Ardenwood Park & Ride.

4.6.5 CITY OF PALO ALTO SHUTTLE

The City of Palo Alto Shuttle provides two routes: the Crosstown Shuttle and the Embarcadero Shuttle. On weekdays, both routes serve the Palo Alto Transit Center. The City of Palo Alto's Shuttle is free and open to

everyone. Bus stops are marked with a "Palo Alto Shuttle" sign, a sticker on a regular VTA bus stop sign, or a shuttle decal on a stop sign pole. The Embarcadero Shuttle provides peak hour service between the Palo Alto Caltrain Station and the Baylands Business Parks east of US 101/Embarcadero Road. It is coordinated with the Caltrain schedule, serving employers in the East Bayshore area, residents in the Embarcadero Road corridor, and students at Palo Alto High School and Castilleja School. The Crosstown Shuttle connects the University Avenue/Downtown to south Palo Alto and Charleston Road. The Crosstown Shuttle provides access residential neighborhoods, senior residences and services, libraries, recreation centers and commercial districts, and operates a Special School shuttle to help encourage more alternative transportation by students.

4.6.6 CITY OF MENLO PARK SHUTTLE

The Midday Shuttle Service is operated by City of Menlo Park and provides service between the Palo Alto Transit Center and the Menlo Park Senior Center. The Shuttle is a free community service route open to the general public that is especially popular with seniors. Its key stops include Menlo Park Library, Belle Haven Library, Menlo Park Senior Center, downtown Menlo Park, Menlo Park Caltrain station, Menlo Medical Clinic, and Stanford Shopping Center. The Shuttle also connects with the Menlo Park Caltrain Station, SamTrans routes 296, ECR, and KX, and the Stanford Marguerite BOH and X lines.

4.6.7 STANFORD UNIVERSITY MARGUERITE SHUTTLE

Stanford University's Marguerite Shuttle provides free service to the public accessing many locations on the university campus, as well as the Medical Center, Stanford Shopping Center, SLAC National Accelerator Laboratory, Palo Alto Transit Center, California Avenue Caltrain Station and downtown Palo Alto. All of the shuttle vehicles are wheelchair accessible and most have bike racks. These shuttles are subject to change per the discretion of Stanford University in order to best accommodate users and changes in ridership demand. **Figure 4-4** shows the existing Marguerite Shuttle routes, which are also described in more detail below. **Table 4-10** describes the service hours and route headways.

- **1050 Arastradero** operates between the Li Ka Shing Center on Campus Drive and 1050/1070 Arastradero, with stops at 3170 Porter Drive, and additional stops along the route.
- **Bohannon (BOH)** provides service between 4100/4700 Bohannon Drive and the Stanford Medical Center (Quarry Extension), with stops at Stanford Barn, the Psychiatry building, Menlo Park Caltrain, Staples, Safeway on El Camino Real, and other stops along the route.
- **East Bay Express** provides service between Campus Oval and the Fremont BART Station with stops at the Union City BART Station, Ardenwood Park & Ride, and the Stanford Medical Center.
- **Hospital: Direct (HD)** travels between Searsville Lot on Searsville Road and Hoover Pavilion Garage inside Lot 1, with stops at Stanford Hospital, Crate & Barrel, and other stops along the route.

- **Line AE-F** operates between the Fremont BART station and the Stanford Campus Oval, with stops at the Fremont Wells Fargo lot (3440 Walnut Avenue), ACE/Amtrak Fremont station (37260 Fremont Boulevard), Kaiser Park & Ride lot, Ardenwood Park & Ride lot, Embarcadero Road and Wildwood Avenue intersection, Embarcadero Road and N. California Avenue intersection, and additional stops along the route.
- **Line C** operates between Vi at Palo Alto on Sand Hill Road and Escondido Village, with stops at Lucas Center, Parking Structure 5, Serra Mall, and other stops along the route. Line C Limited provides supplemental service between LKSC and Escondido Village via Serra Mall/Serra Street during morning and afternoon peak hours.
- **Line N** (counter-clockwise) and **Line O** (clockwise) travel around campus and Downtown Palo Alto, serving the Lytton Plaza, Campus Oval, Medical Center, Palo Alto Transit Center, and other stops along the routes.
- **Line P** provides service between the Palo Alto Transit Center and the Stanford Oval during morning and afternoon peak hours. The Line P mid-day route provides service between the Palo Alto Transit Center and the Stanford Oval, with additional stops along the route.
- **Line S** operates between the Rosewood Hotel and Palo Alto Transit Center, with stops at Sharon Park Shopping Center, Oak Creek Apartments, Stanford West Apartments, Crate & Barrel, and other stops along the route.
- **Line X** serves the Palo Alto Transit Center and circulates counter-clockwise through campus, with stops at Stanford Shopping Center, the Medical Center via Quarry Extension, Tresidder, Vaden Health Center, Schwab and Knight Centers, Alumni Center, Town & Country Village, Palo Alto Medical Foundation, and other stops along the route. The Line X Limited shuttle provides supplemental service during the morning and afternoon peak times.
- **Line Y** serves the Palo Alto Transit Center and circulates clockwise through campus, with stops at Galvez Street and El Camino Real, Alumni Center, Schwab and Knight Centers, Tresidder, Green Earth Sciences, Y2E2, Stanford Medical Center via Quarry Extension, Stanford Shopping Center, and other stops along the route. The Line Y Limited shuttle provides supplemental service during the morning and afternoon peak times.
- **Medical Center (MC)** provides service between the Palo Alto Transit Center and Lucas Center on Welch Road, with stops at Stanford Shopping Center, Crate & Barrel, and other stops along the route. The MC AM and PM route provides supplemental service during the morning and afternoon peak times along Campus and Palm Drives. Peak hour service is designed to align with the majority of the northbound and southbound trains. Mid-day service is coordinated to trains arriving from between 10:00 AM and 3:00 PM.
- **Oak Creek Apartments (OCA)** operates between Tresidder Union on Lagunita Drive and the Oak Creek Apartments Club House with stops through the West Residences, at Sand Hill Road and Stock Farm Road, and other stops along the route.

- **Research Park** operates between the Palo Alto Transit Center and the Research Park during the AM commute times and brings riders back to the Palo Alto Transit Center during the PM commute times, with stops at Wells Fargo at El Camino Real and California Avenue, Page Mill Road and El Camino Real, Hillview Avenue and Coyote Hill Road, and other stops along the route.
- **Shopping Express** operates between the Palo Alto Transit Center and the San Antonio Center, with stops at Medical Center, Well Fargo, Zen Hotel, Walmart, and other stops along the route.
- **SLAC** operates between SLAC National Accelerator Laboratory and Hoover Tower, with stops at Oak Creek Apartments located on Sand Hill Road, West Campus Residences, the Science & Engineering Quad, and other stops along the route.
- **VA** provides service between Stanford Hospital and the Veterans Administration (VA) Hospital in Palo Alto, with stops at 801 Welch Road, Quarry Extension at the Emergency Room, and the VA hospital.

TABLE 4-10: EXISTING WEEKDAY TRANSIT SERVICE SUMMARY

Route	Description	Hours of Operation	Average Daily Headway	Peak Headway
VTA Bus Service				
22	Palo Alto Transit Center to Eastridge Transit Center via El Camino	24 hours	15-60 minutes	15 minutes
35	Downtown Mountain View to Stanford Shopping Center	Northbound: 6:30 AM to 10:00 PM Southbound: 5:45 AM to 10:00 PM	30-70 minutes	30 minutes
89	California Avenue Caltrain Station to Palo Alto Veterans Hospital	Northbound: 9:30 AM to 6:30 PM Southbound: 6:30 AM to 3:30 PM	15-45 minutes	15 minutes
101	Camden & Highway 85 to Palo Alto	Northbound: 6:15 AM to 8:30 AM Southbound: 3:15 PM to 7:00 PM	45-60 minutes	45 minutes
102	South San Jose to Palo Alto	Northbound: 5:50 AM to 9:00 AM Southbound: 7:00 to 10:00 PM	15-30 minutes	15 minutes
103	Eastridge Transit Center to Palo Alto	Eastbound: 2:40 PM to 6:35 PM Westbound: 5:10 AM to 8:30 AM	30-60 minutes	30 minutes
104	Penitencia Creek Transit Center to Palo Alto	Eastbound: 4:10 PM to 6:15 PM Westbound: 5:55 AM to 7:55 AM	30-60 minutes	30 minutes
182	Palo Alto to IBM/Bailey Ave	Northbound: 5:10 PM to 6:15 PM Southbound: 7:30 AM to 8:30 AM	N/A	N/A
522	Palo Alto Transit Center to Eastridge Transit Center	Eastbound: 5:10 AM 11:25 PM Westbound: 4:40 AM to 11:05 PM	15-30 minutes	15 minutes
SamTrans Bus Service				
280	Purdue and Fordham to Stanford Shopping Center	Eastbound: 6:05 AM to 10:30 PM Westbound: 5:20 AM to 10:05 PM	45-80 minutes	45 minutes
281	Onetta Harris Center to Stanford Shopping Center	Eastbound: 5:55 AM to 10:45 PM Westbound: 6:00 AM to 10:40 PM	15 to 30 minutes	15 minutes

TABLE 4-10: EXISTING WEEKDAY TRANSIT SERVICE SUMMARY

Route	Description	Hours of Operation	Average Daily Headway	Peak Headway
297	Redwood City Transit Center to Palo Alto Transit Center	Northbound: 3:45 AM to 5:20 AM and 10:45 PM to 12:20 AM Southbound: 12:45 AM to 2:15 AM and 10:45 PM to 12:20 AM	60 minutes	60 minutes
397	San Francisco to Palo Alto Transit Center	Northbound: 12:45 AM to 4:55 AM Southbound: 1:05 AM to 6:25 AM	60 minutes	60 minutes
ECR	Palo Alto Transit Center to Daly City BART	Northbound: 3:55 AM to 2:10 AM Southbound: 4:40 AM to 2:20 AM	15-60 minutes	15 minutes
Alameda-Contra Costa Transit District (AC Transit)				
Dumbarton Express	Union City BART to Stanford Oval	Eastbound: 6:15 AM to 8:50 PM Westbound: 5:20 AM to 7:55 PM	15-60 minutes	15 minutes
U-Line	Fremont BART to Stanford	Eastbound: 5:55 AM to 9:25 AM Westbound: 2:45 to 7:00 PM	30-60 minutes	30 minutes
City of Palo Alto Shuttle				
Embarcadero Shuttle	Palo Alto Caltrain Station to Embarcadero and Baylands	Northbound: 7:05 AM to 9:40 AM and 3:10 PM to 6:55 PM Southbound: 6:55 AM to 9:25 AM and 3:00 PM to 6:50 PM	15-30 minutes	15 minutes
Crosstown Shuttle	Downtown Station to Stevenson House	Northbound: 8:00 AM to 5:30 PM Southbound: 7:50 AM to 5:05 PM	30-60 minutes	30 minutes
City of Menlo Park Shuttle				
Midday Shuttle	Palo Alto Transit Center to Menlo Park Senior Center	Eastbound: 10:30 AM to 2:20 PM Westbound: 10:30 AM to 2:25 PM	60 minutes	60 minutes
Stanford University Marguerite Shuttle^{1,2}				
1050 Arastradero	Li Ka Shing Center to 1050 Arastradero	7:00 AM to 7:10 PM	20 minutes	20 minutes
BOH	4100/4700 Bohannon Drive to Stanford Medical Center	7:20 AM to 6:15 PM	10 to 30 minutes	10 minutes
Hospital: Direct	Searsville Lot to Medical Center to Hoover Pavilion	4:00 AM to 1:45 AM	10 minutes	10 minutes
Line AE-F	Fremont BART to Stanford	Eastbound: 3:25 PM to 7:45 PM Westbound: 5:25 AM to 8:35 AM	10 to 20 minutes	10 minutes
Line C	Vi at Palo Alto to Escondido Village	5:35 AM to 9:20 PM	30 minutes	30 minutes
Line N	Counter-Clockwise around Campus	8:15 PM to 2:20 AM	40 minutes	40 minutes
Line O	Clockwise around Campus	8:30 PM to 2:35 AM	40 minutes	40 minutes

TABLE 4-10: EXISTING WEEKDAY TRANSIT SERVICE SUMMARY

Route	Description	Hours of Operation	Average Daily Headway	Peak Headway
Line P	Palo Alto Transit Center to Campus Oval	6:15 AM to 10:20 AM	10 minutes	10 minutes
Line S	Palo Alto Transit Center to Rosewood Hotel	6:25 AM to 9:25 AM and 4:35 PM to 6:40 PM	45 minutes	45 minutes
Line X	Counter-Clockwise around Campus to and from Palo Alto Transit Center	5:55 AM to 9:10 PM	5-20 minutes	5 minutes
Line Y	Clockwise around Campus to and from Palo Alto Transit Center	6:15 AM to 9:10 PM	5-30 minutes	5 minutes
Medical Center	Palo Alto Transit Center to Lucas Center	5:10 AM to 9:00 PM	10-15 minutes	10 minutes
OCA	Tresidder Union to Oak Creek Apartments	9:00 PM to 2:10 AM	20 minutes	20 minutes
Research Park	Palo Alto Transit Center to Research Park	6:30 AM to 10:20 AM and 3:25 PM to 7:35 PM	15-45 minutes	15 minutes
Shopping Express	Palo Alto Transit Center to Walmart	3:15 PM to 10:35 PM	30-60 minutes	30 minutes
SLAC	SLAC to Hoover Tower	6:30 AM to 9:05 PM	30 minutes	30 minutes
VA	Stanford Hospital to Veterans Administration Hospital	6:40 AM to 5:30 PM	20-25 minutes	20 minutes

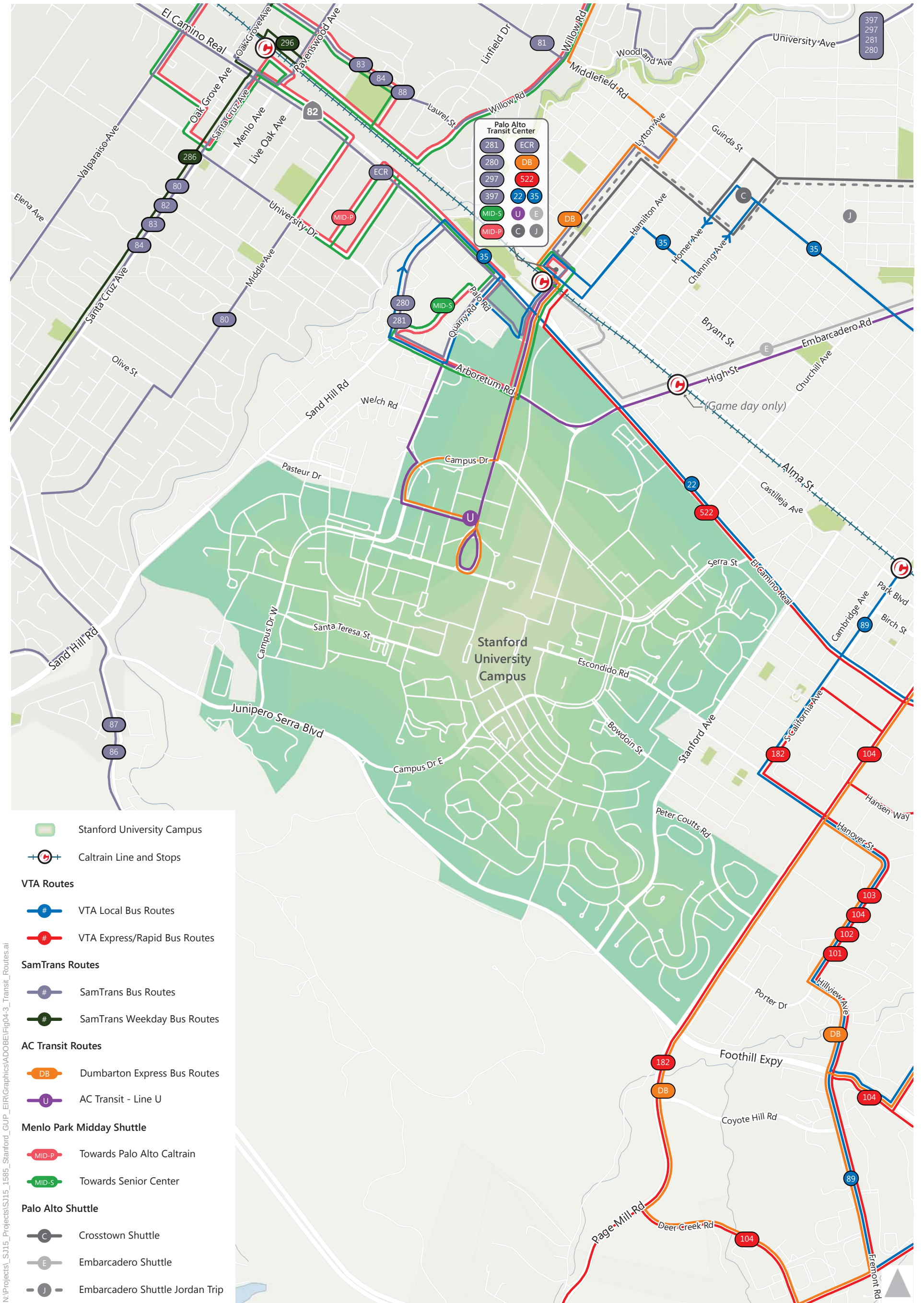
Notes:

1. These shuttles are subject to change per the discretion of Stanford University in order to best accommodate users and changes in ridership demand.
2. East Bay Express is not shown in the table since it operates only one bus run in the morning (4:45 A.M. departure from Fremont BART station) and one bus run in the evening (11:42 P.M. departure from Stanford).

Source: VTA (May 2017), SamTrans (December 2016), AC Transit (December 2016), City of Palo Alto Shuttle (December 2016), City of Menlo Park Shuttle (December 2016) Marguerite Shuttle (December 2016).



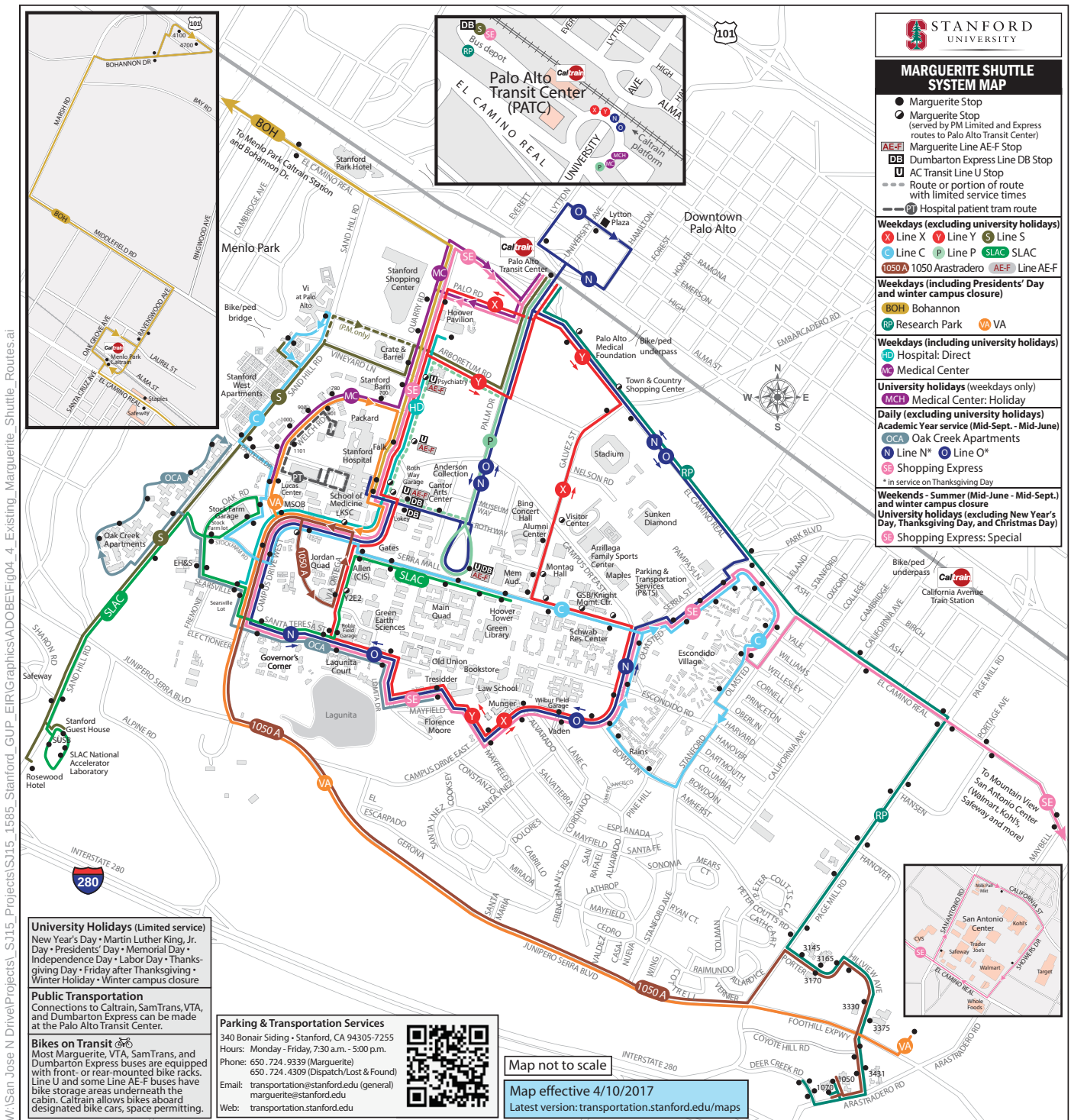
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Figure 4-3
Existing Regional Transit Routes



Source: Stanford University, May 17, 2017

Figure 4-4
Existing Marguerite Shuttle Routes

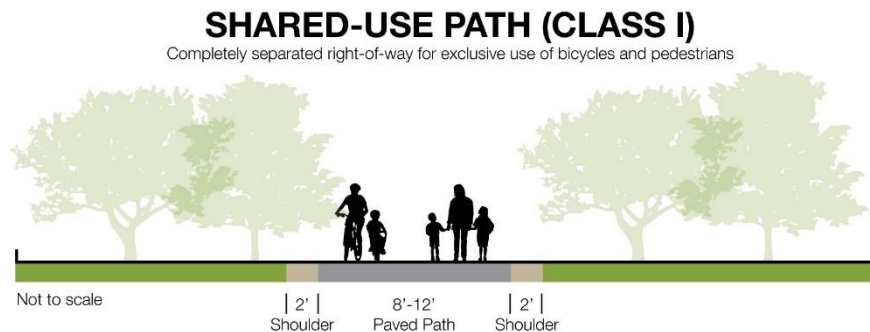
4.7 EXISTING BICYCLE AND PEDESTRIAN FACILITIES

This section summarizes the existing bicycle and pedestrian facilities on campus and in the vicinity of Stanford University, within the defined bicycle and pedestrian study areas consistent with the VTA TIA Guidelines.

4.7.1 BICYCLE FACILITIES

Bikeway planning and design in California typically relies on guidelines and design standards established by Caltrans in the *Highway Design Manual* (Chapter 1000: Bikeway Planning and Design). The *VTA Bicycle Technical Guidelines* (December 2012) recommends that Caltrans standards regarding bicycle facility dimension be used as a minimum and provides supplemental information and guidance on when and how to better accommodate the many types of bicyclists. Caltrans standards provide for four distinct types of bikeway facilities, as generally described below and shown on the accompany figures.

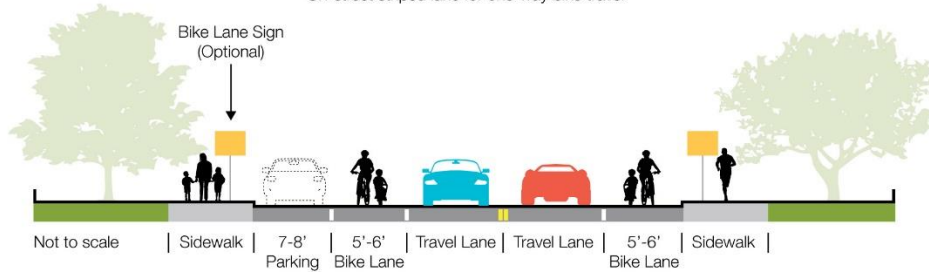
- **Class I Bikeway (Bike Path)** provides a completely separate right-of-way and is designated for the exclusive use of bicycles and pedestrians with vehicle and pedestrian cross-flow minimized. In general, bike paths serve corridors not served by streets and highways or where sufficient right-of-way exists to allow such facilities to be constructed away from the influence of parallel streets and numerous vehicle conflicts.



- **Class II Bikeways (Bike Lanes)** are lanes for bicyclists adjacent to the outer vehicle travel lanes. These lanes have special lane markings, pavement legends, and signage. Bicycle lanes are generally five (5) feet wide. Adjacent vehicle parking and vehicle/pedestrian cross-flow are permitted.

BICYCLE LANE (CLASS II)

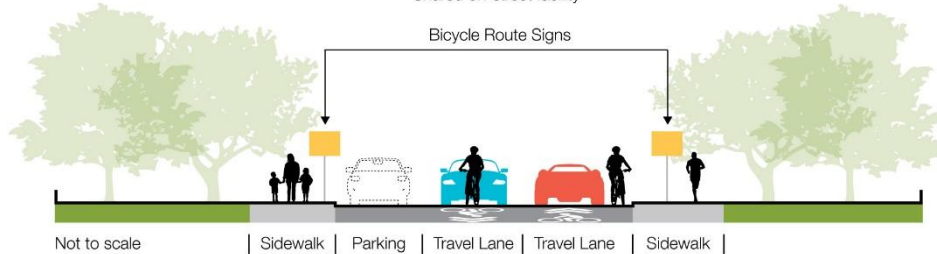
On-street striped lane for one-way bike travel



- **Class III Bikeways (Bike Routes)** are designated by signs or pavement markings for shared use with pedestrians or motor vehicles, but have no separated bike right-of-way or lane striping. Bike routes serve either to: a) provide continuity to other bicycle facilities, or b) designate preferred routes through high demand corridors.

BICYCLE ROUTE (CLASS III)

Shared on-street facility



- **Class IV Bikeways (cycle tracks or “separated” bike lanes)** provide a right-of-way designated exclusively for bicycle travel within a roadway and are protected from other vehicle traffic with devices, including, but not limited to, grade separation, flexible posts, inflexible physical barriers, or parked cars.

CYCLE TRACK/SEPARATED BIKEWAY (CLASS IV)

Physically separated bike lane

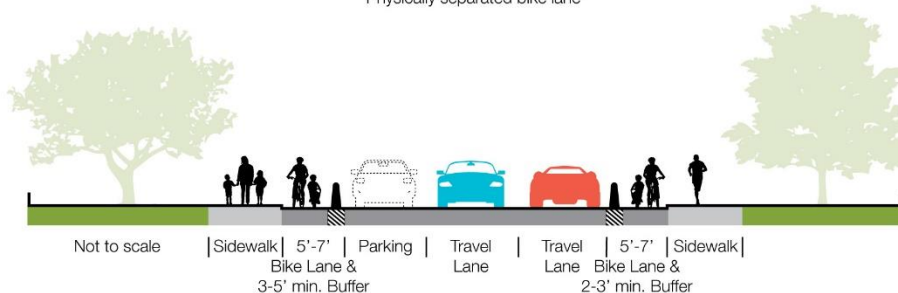


Figure 4-5 illustrates the location of bicycle facilities on and within 2,500 feet of Stanford University's main campus boundaries.

4.7.1.1 On-Campus Bicycle Facilities

Bicycle facilities on and directly adjacent to campus include a combination of all Class I, II, III, and IV facilities. A bicycle path (Class I) is present along Palm Drive between the El Camino Real southbound ramps intersection and Campus Drive. The Stanford Perimeter Trail is a 3.4-mile-long, shared-use recreational trail (Class I) that runs along Junipero Serra Boulevard, Stanford Avenue, and El Camino Real. The Stanford Perimeter Trail provides connections to trails in adjacent jurisdictions, parks, schools, and other destinations commuting from off-campus residences or traveling to off-campus amenities. Bicycle lanes (Class II) are present along:

East-West Direction

- Sand Hill Road
- Quarry Road
- Welch Road
- Galvez Street
- Serra Street
- Stanford Avenue
- Raimundo Way

North-South Direction

- Palo Road
- Arboretum Road
- Vineyard Lane
- Pasteur Drive
- Stock Farm Road
- Panama Street
- Santa Teresa Street
- Escondido Road
- Bowdoin Street
- Peter Coutts Road

On Campus Drive, which forms a near-complete loop around the campus, bicycle lanes are provided everywhere except on Campus Drive East between Mayfield Avenue and Junipero Serra Boulevard. Escondido Road and Escondido Mall is a bicycle priority street connecting the East Campus residential areas to the campus core. Santa Teresa Street performs a similar function for the West Campus and Lagunita District residential areas. Bicycle roundabouts are present at the intersections of Escondido Mall/Lasuen Mall and Serra Mall/Lasuen Mall to accommodate these high bicycle volumes.

Several key roadways that provide vehicle access to parking lots and structures near Campus Drive convert to non-auto streets on-campus, providing safe and efficient bicycle travel. These facilities include Escondido Mall, Serra Mall, Panama Mall, Lasuen Mall, Lomita Mall, and the pathway network through White Plaza and Meyer Green. In addition, there are several bicycle/pedestrian/transit only routes in the Stanford University campus, such as Serra Mall, which runs in a north/south direction. The other key bicycle routes used to access the campus core include Mayfield Avenue, Via Ortega, and Panama Street.



4.7.1.2 Off-Campus Bicycle Facilities

Both City of Palo Alto and City of Menlo Park maintain a system of on- and off-road bicycle lanes, routes and paths, which include underpasses or bridges. Bicycles are legal on all streets in Palo Alto and Menlo Park, except freeways, though there are some major streets with narrow lanes that are not easily shared by bicyclists and motor vehicles.

Among the gateways to the Stanford Campus, bicycle lanes (Class II) along Serra Street and Escondido Road, and the bike path (Class I) on Palm Drive, provide connections to key off-campus bicycle and transit facilities, including Park Avenue, Hanover Street and the Palo Alto Transit Center, respectively. Other notable bicycle gateways include Welch Road, Stock Farm Road, Bowdoin Street and Quarry Road.

The City of Palo Alto has several bicycle paths (Class I) within the study area, notably along portions of Sand Hill Road, Alpine Road, and along the Bol Park Bike Path, which provides connection to Stanford’s Research Park and Arastradero Road. In addition, the Embarcadero Bike Path (Class I) provides an east-west connection parallel to the Caltrain Corridor between facilities along Sand Hill Road, Palm Avenue, Embarcadero Road and Churchill Avenue.

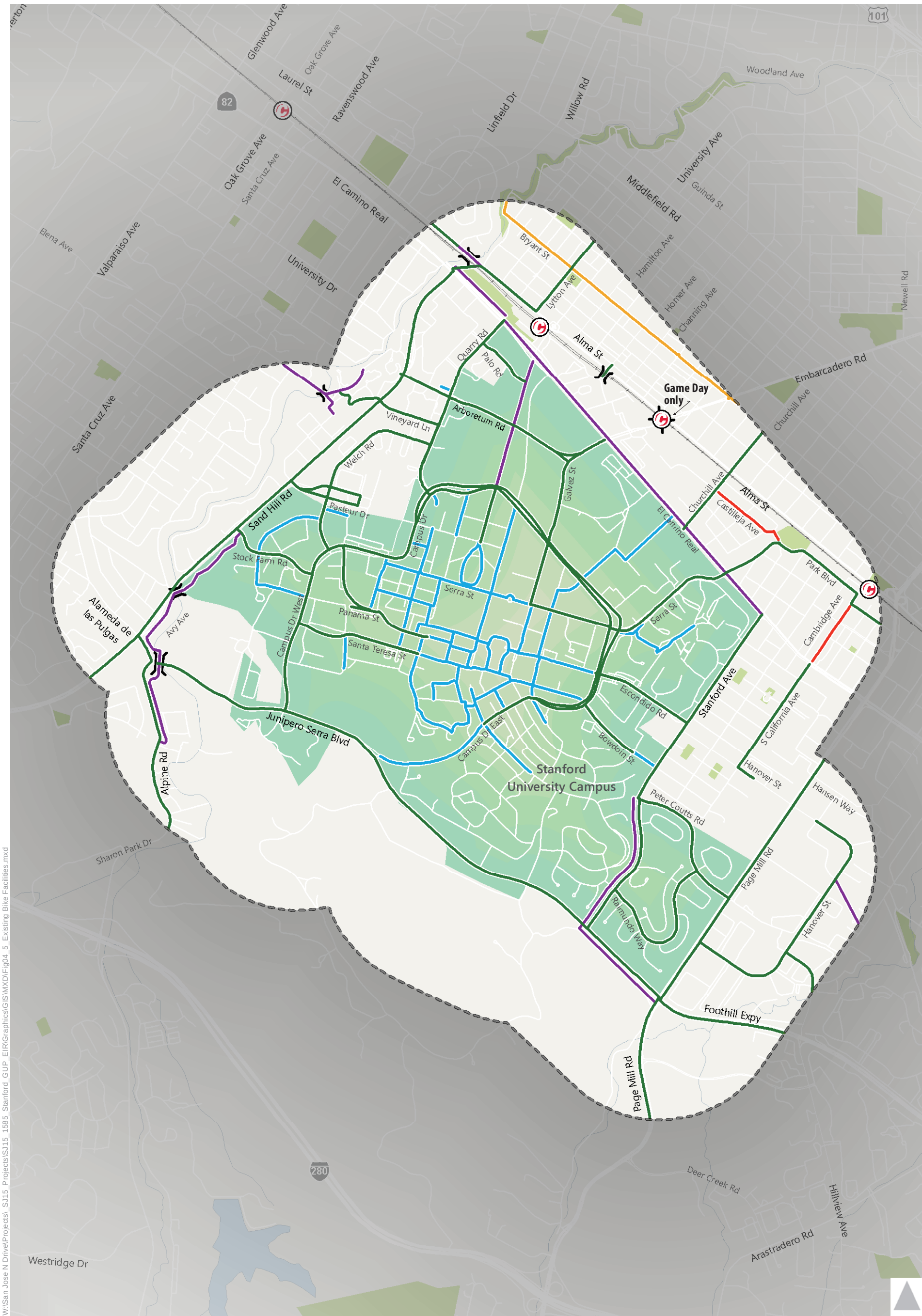
Within the study area and the City of Palo Alto, bicycle lanes (Class II) are present along the following corridors:

East-West Direction	North-South Direction
- Sand Hill Road - Lytton Avenue - Churchill Avenue - California Avenue - Page Mill Road - Hanover Street	- Alpine Road - Junipero Serra Boulevard/Foothill Expressway - Alma Street - Park Boulevard - Hanover Street -

Stanford Avenue is an important facility for commuters and local residents alike, and features bicycle lanes (Class II) on both sides of the roadway with green bicycle lanes where potential conflict zones emerge. The City of Menlo Park has several bike lanes (Class II) within the study area, notably along Alma Street, Alpine Road, Santa Cruz Avenue, and Sand Hill Road.

The City of Palo Alto has designated certain streets as bicycle boulevards. Bike boulevards are bicycle routes with high bicycle usage and relatively low vehicle traffic, and often include special signs, traffic calming devices which slow vehicles, and partial roadway closures that permit only bicycles to travel through. Bryant Street is a bike boulevard that provides north/south connectivity through the City of Palo Alto to serve Stanford students and faculty. Several additional bicycle routes (Class III) exist within the study area, notably along Clark Way, and portions of California Avenue and Hanover Street.

There are three bicycle and pedestrian overcrossings along San Francisquito Creek that connect Menlo Park and Palo Alto: on San Mateo Drive, Alma Street and Willow Place. These facilities provide important off-street connections for cyclists and pedestrians, allowing them to avoid the busy roadway crossings at Middlefield Road and El Camino Real. In addition, two bicycle and pedestrian undercrossings provide important connections for bicyclists in the study area. One undercrossing is located beneath Junipero Serra Boulevard just east of Alpine Road and adjacent to the Stanford Golf Course, providing a connection to Sand Hill Road. The Palo Alto Transit Center features another bicycle and pedestrian undercrossing to provide users of the system with a connection across the Caltrain Corridor.



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- Existing Bike Facilities**

 - Class I - Bicycle Path
 - Class II - Bicycle Lane
 - Class III - Bicycle Route
- Bicycle Boulevard
 - Bicycle/Pedestrian Bridge
- Stanford Suggested Travel Route
- 2,500 foot bicycle buffer from Stanford Campus Boundary
 - Stanford University Campus



Figure 4-5
Existing Bicycle Facilities

4.7.2 PEDESTRIAN FACILITIES

The pedestrian environment is described on roadways within 1,000 feet of the Stanford campus. Pedestrian facilities consist of sidewalks, crosswalks, and shared use paths.

Pedestrian connectivity immediately surrounding the Stanford campus is provided by a mostly complete network of sidewalks and crosswalks. Sidewalks are present on both sides of the street along University Avenue, Embarcadero Road, Churchill Avenue, Park Boulevard, Yale Street, Wellesley Street, Oberlin Street, Bowdoin Street, and Peter Coutts Road. Sidewalks also exist along both sides of Stanford Avenue, Welch Road, Vineyard Lane, and Arboretum Road. Signalized crossings on El Camino Real, which have pedestrian signals to provide safe pedestrian/bicycle crossings, are provided at numerous locations in the study area including Sand Hill Road, Quarry Road, University Avenue/Palm Drive, and Embarcadero Road.

Given that most of the pedestrian network surrounding campus is mostly built-out, there are only minor sidewalk gaps as stated below. Sidewalks are present in most parts of Palo Alto and Menlo Park. On the unincorporated Santa Clara County lands, Stanford recently constructed a new pedestrian pathway along Junipero Serra Boulevard between Page Mill Road and Stanford Avenue. There is no sidewalk along Junipero Serra Boulevard between Stanford Avenue and Sand Hill Road due to right-of-way constraints. Palo Road provides a shared-use path on the east side of the road and directs foot traffic away from Stanford University toward El Camino Real. Crosswalks are also present in many locations of the study area. High vehicle volumes and roadway speeds, coupled with long distances between protected pedestrian crossings, create barriers for pedestrian connectivity to Stanford along portions of El Camino Real, Page Mill Road, and Sand Hill Road. Other major barriers for pedestrians in the study area include the Caltrain tracks that parallel Alma Street.

4.7.3 PLANNED OR PROGRAMMED BICYCLE AND PEDESTRIAN IMPROVEMENTS

Bicycle and pedestrian improvement projects represent the largest set of transportation projects for the areas surrounding the Stanford University campus. Santa Clara County and the Cities of Palo Alto and Menlo Park have all prepared detailed bicycle plans, which form a foundation for future improvements to the bicycle and pedestrian networks. Stanford, along with the Cities of Palo Alto, Menlo Park, Redwood City, and Mountain View have formed the "Mobility Partnership" to work together towards common goals of developing more bicycle and pedestrian routes. Additionally, multi-modal considerations have been incorporated into several major roadway projects from the Santa Clara County Long Range Transportation Plan (LRTP).

4.7.3.1 Santa Clara Countywide Bicycle Plan

The VTA's Bicycle Expenditure Program (BEP) was created to provide a funding stream to implement the *Santa Clara Countywide Bicycle Plan* (SCCBP). In May 2013, the VTA Board adopted the BEP Project List for inclusion in the 2040 Santa Clara County LRTP. The LRTP identifies seven specific bicycle infrastructure projects near the Stanford Campus. These projects are:

- **Palo Alto Bicycle Boulevard Network Project:** Expand the Bicycle Boulevard Network pursuant to the adopted bicycle plan.
- **Palo Alto Transit Center/University Avenue Undercrossing:** Construct a new bicycle/pedestrian undercrossing of Caltrain tracks, near Everett Street or Lytton Street in order to connect Downtown with Stanford University and Medical Center, and the multi-modal transit center.
- **Sand Hill Road/I-280 Interchange Bicycle Improvements:** Provide general multi-modal access improvements at the Sand Hill Road / I-280 Interchange. This bicycle improvement project is taken from the Draft *Expressway Plan 2040*.
- **Page Mill Road/I-280 Interchange Modification:** Modify the ramp configurations from Old Page Mill Road to Arastradero Road in order to enhance safe passage for bicyclists through the interchange area.
- **California Avenue Caltrain Undercrossing:** Replace the California Avenue bicycle/pedestrian undercrossing of Caltrain tracks with a new ADA compliant structure.
- **South Palo Alto Caltrain Pedestrian/Bicycle Grade Separation:** Construct a grade separated bicycle/pedestrian crossing between the California Avenue Caltrain station and the at-grade crossing on East Meadow Drive.
- **US 101/Adobe Creek Bicycle-Pedestrian Bridge and Adobe Creek Trail Extension:** Construct a year-round, Class I overcrossing of Highway 101 to replace the existing, seasonal Lefkowitz Tunnel. Extend Adobe Creek Trail between West Bayshore Road and Louis Road.

Implementation timeframes for these projects vary based upon the agencies involved; however, all are anticipated to be fully programmed and/or completed by 2040, per the VTA's 2040 LRTP.

4.7.3.2 San Mateo County Comprehensive Bicycle and Pedestrian Plan

C/CAG developed the *San Mateo County Comprehensive Bicycle and Pedestrian Plan* (CBPP) as an update to the 2000 *San Mateo County Comprehensive Bicycle Route Plan* and expands the earlier plan by adding a pedestrian component. The CBPP identifies five specific bikeway and pedestrian network projects, which includes over/undercrossing, arterial crossing and interchange improvement projects, near the Stanford Campus and in the City of Menlo Park. These projects were categorized based on criteria used to score and

sort each project: collision history, transit access, population and employment density, and location in an underserved community. These projects are:

- **El Camino Real:** Construct a Class II linear bikeway along El Camino Real for 0.33 miles between Alejandra Avenue and Valparaiso Avenue.
- **El Camino Real:** Construct a Class III linear bikeway along El Camino Real for 1.05 miles between Valparaiso Avenue and Santa Clara County Line.
- **University Drive:** Construct a Class III linear bikeway along University Drive for 1.08 miles between Valparaiso Avenue to Santa Clara County.
- **Near Middle Avenue at Highway 82:** Construct an undercrossing near Middle Avenue at Highway 82/El Camino Real.
- **San Mateo Drive:** Construct a Class III linear bikeway along San Mateo Drive between Valparaiso Avenue to Santa Clara County Line.

4.7.3.3 City of Palo Alto Bicycle Plan

The City of Palo Alto adopted its *Bicycle + Pedestrian Transportation Plan* in July 2012, as an update to its 2003 *Bicycle Transportation Plan*. The *Bicycle + Pedestrian Transportation Plan* contains the policy vision, design guidance, and specific recommendations to increase walking and biking rates over the next decade; specifically setting a goal of doubling the rate of bicycling for both local and regional work commutes by the year 2020.

The plan also includes a commitment to “plan, construct, and maintain Complete Streets,” which includes identifying pedestrian and bicycle improvements that increase the accessibility of streets to various modes, as well as people of all ages and abilities.

While it identifies and recommends around 52 miles of new or enhanced bicycle facilities, the *Bicycle + Pedestrian Transportation Plan* does not dedicate funding to any individual project. However, several of the key facilities identified in the *Bicycle + Pedestrian Transportation Plan* are included in the Santa Clara County LRTP, such as the Adobe Creek Crossing and the Bicycle Boulevard Network expansion.

4.7.3.4 City of Menlo Park Bicycle Plan

The 2005 *Menlo Park Comprehensive Bicycle Development Plan* recommends the addition to the existing network of approximately 0.3 miles of new Class I Bike Paths, approximately five miles of new Class II Bike Lanes, and approximately 15 miles of new Class III Bike Routes. Several long-term projects are also identified. These include two Class I connector segments near the Bayfront Expressway and two new bicycle/pedestrian undercrossings, including the Caltrain crossing near Middle Avenue. The prioritization and budgeting of individual bicycle improvements takes place through the Menlo Park City Council approval of the five-year Capital Improvement Program (CIP). No bicycle or pedestrian capital projects are currently included in the

most recent CIP. The City has estimated the cost of completing the recommended bicycle network additions at around \$4 million.

4.7.3.5 City of East Palo Alto Bicycle Plan

The City of East Palo Alto adopted its *Bicycle Transportation Plan* (Bike Plan) in March 2011, as the guiding document for implementing the twenty-five (25) bicycle segments defined in the Circulation Element from the 1999 General Plan. The Bike Plan specifically identifies its goal of a 0.25% yearly increase in bicycle commuting rates, or 1.25% for the five-year term. The Bike Plan recommends the addition of approximately 3.3 miles of new Class I Bike Paths, 4.5 miles of Class II Bike Lanes and 6.8 miles of Class III Bike Routes to the existing network, plus additional bicycle parking locations and facility upgrades, and new multi-modal bus shelter connections. According to the Bike Plan, a proposed Class I bike and pedestrian overcrossing is the most significant investment in reaching the City's goal of a 1.25% increase in bicycle commuting rates. The City has estimated the design and construction cost of the pedestrian overcrossing to be between \$1.8 million and \$5 million. The City has not estimated the cost of completing the other bicycle and pedestrian network additions.

4.8 FIELD OBSERVATIONS

Field observations at Stanford University and intersections within close proximity to the campus were conducted on a Tuesday, Wednesday, or Thursday in October 2016 to verify signal timing that is input into the TRAFFIX 8.0 software, to confirm LOS/delay results produced by the TRAFFIX 8.0 model, and observe the overall transportation characteristics.

Field observations were conducted at all intersections to confirm lane geometries and operational characteristics including cycle lengths, using signal timing sheets for preliminary review before the field work, where possible. Most signals within the study area are actuated and operating at full capacity; therefore, the observed cycle length was used for analysis. Certain key roadway and intersection observations are described below based on the four major roadways that border Stanford University.

4.8.1 SAND HILL ROAD (NORTHERN BORDER)

On Sand Hill Road, vehicles were traveling from I-280 in the morning to access Stanford University and employment-based land uses on the east side of El Camino Real and vice versa in the evening. Adjacent to the Stanford campus, there were no discernable queues observed in the morning peak period. In the evening, westbound queues formed as a result of a bottleneck at the I-280 northbound ramp intersections, extending past Sharon Park Drive. The Sand Hill Road/Santa Cruz Avenue intersection also acted as a bottleneck for traffic traveling westbound in the evening with queues extending past Stock Farm Road.

There were many people observed bicycling and walking to the campus in the morning and from the campus in the evening at the Pasteur Drive intersection. There is a pedestrian/bicycle bridge over the San Francisquito Creek that provides access to the neighborhoods in Menlo Park from Sand Hill Road. There is a separated bicycle/pedestrian path located on the south side of Sand Hill Road that was observed to have a high volume of bicycle and pedestrian activity, including recreational use. Oak Avenue also served a relatively high bicycle volume. Bicyclists at the Oak Avenue intersection crossed Sand Hill Road to access the separated bicycle/pedestrian path.

4.8.2 PAGE MILL ROAD (SOUTHERN BORDER)

During the morning peak period, the majority of vehicles were traveling eastbound from I-280 toward the City of Palo Alto. Traffic on Page Mill Road in between Junipero Serra Boulevard and El Camino Real is metered by the signals at these two intersections. Traffic was observed traveling towards the City of Palo Alto in the morning and vice versa in the evening resulting in congestion on Page Mill Road attempting to proceed past the Junipero Serra Boulevard and El Camino Real intersections. During the morning peak period, very few vehicles were observed traveling from minor cross streets onto Page Mill Road resulting in a large portion of the green time allocated to Page Mill Road, whereas in the evening, the side streets were provided with more green time to accommodate vehicles leaving the Stanford Research Park and other minor streets.

There were many bicycle commuters riding along Page Mill Road, as well as student bicyclists crossing Page Mill Road at the Peter Coutts Road and Hanover Street intersections to get to Barron Park Elementary School and Henry M Gunn High School, located on the south side of Page Mill Road. Very few pedestrians were observed walking along Page Mill Road during the peak periods except to access the bus stops on Page Mill Road.

4.8.3 EL CAMINO REAL (EASTERN BORDER)

Southbound vehicle traffic along El Camino Real within the study area was heavier in the morning and the northbound direction in the evening. Several key intersections also had sizeable volumes turning onto El Camino Real from minor streets. The land uses along this segment of El Camino Real are varied and include retail (the majority of which are shops along the road rather than “big-box” stores), residential (apartments, etc.), hotel, and university/schools.

Major queuing resulted in spillback for southbound and northbound movements at El Camino Real/Encinal Avenue, El Camino Real/Santa Cruz Avenue, and El Camino Real/Cambridge Avenue. At El Camino Real/Cambridge Avenue, southbound through vehicles queue in the intersection and block vehicles on Cambridge Avenue from traveling through the intersection. A high number of northbound U-turns movements were observed at El Camino Real/Cambridge Avenue, which often conflicted with the eastbound right-on-red movement. High volumes of pedestrians and bicyclists were observed at El Camino

Real/Santa Cruz Avenue, El Camino Real/Ravenswood Avenue, El Camino Real/University Avenue Northbound On/Off-Ramps, and El Camino Real/Palm Drive Southbound On/Off-Ramps.

4.8.4 JUNIPERO SERRA BOULEVARD (WESTERN BORDER)

On Junipero Serra Boulevard, traffic flowed through the corridor during peak commute hours with minimal delay. Side street traffic was low during the morning and evening peak hours which generally resulted in longer green times for the north/south traffic along Junipero Serra Boulevard. There are very few signals along Junipero Serra Boulevard reducing the amount of queue spillback caused by signal delay. Minor queuing for the major movements was observed when minor street movement phases were activated. The queues quickly dissipated once the major movement received the green indication.

Bicycle lanes are provided on both sides of the two-lane roadway. Low to moderate numbers of bicyclists and pedestrians were observed using these lanes to ride or jog during the commute periods. However, during the weekends, there is a large number of pedestrians and bicyclists along Junipero Serra Boulevard traveling to the recreational area west of Junipero Serra Boulevard or traveling along the scenic roadway.



5. TRAFFIC FORECASTING

This section describes the overall approach and basic steps used to prepare future conditions traffic volumes for the intersections and freeways in this chapter.

5.1 OVERVIEW OF FORECASTING APPROACH

The traffic forecasting process included use of the Santa Clara VTA Countywide Travel Demand Model (VTA Model) as well as a direct (or “manual”) trip generation and distribution for Stanford trip growth using TRAFFIX 8.0 modeling software. The following future scenarios were assessed:

- Background (2018) No Project Conditions – Year 2018 with the completion of the existing 2000 General Use Permit (with the exception of Escondido Village Graduate Residences) and other local approved projects which would be built and fully occupied by fall 2018;
- Background (2018) With Project Conditions - Background (2018) Conditions with completion and occupancy of the development proposed for the 2018 General Use Permit;
- Cumulative (2035) No Project Conditions – Year 2035 with the completion of the existing 2000 General Use Permit (including Escondido Village Graduate Residences), background growth and reasonably foreseeable projects;
- Cumulative (2035) With Project Conditions - Cumulative (2035) No Project Conditions with completion and occupancy of the development proposed for the 2018 General Use Permit.

The following sections outline the basic steps in the forecasting process. The steps described in Sections 5.2 and 5.3 were previously documented in *2018 General Use Permit: TIA Part 1*. **Appendix I** provides a more detailed description of the technical steps described in Section 5.4.

5.2 STANFORD VEHICLE TRIP GENERATION

This section summarizes information that was previously presented in *2018 General Use Permit: TIA Part 1*. All supporting data is included in that document, and the supplemental memorandum *Stanford 2018 General Use Permit: Peak Hour Trip Generation Analysis Methodology* (Fehr & Peers, May 16, 2017).

Note that this section focuses on vehicle (specifically, automobile) trip generation to and from off-campus destinations. Many trips are made by campus residents and commuters to and from off-campus destinations by other modes, including walking, bicycling, and transit (Caltrain, bus, and Marguerite shuttle). Furthermore, many internal campus trips are made by bicycling, walking, and Marguerite; some internal campus trips are also made by automobile.

5.2.1 EXISTING CAMPUS VEHICLE TRIP GENERATION RATES

The following inputs were used to estimate current Stanford University vehicle trip generation rates and to project future traffic growth:

- 2015 peak hour campus cordon vehicle counts conducted for the 2000 General Use Permit annual monitoring program;
- Vehicle trip counts, conducted in 2015 and 2016, of representative graduate student housing sites (Escondido Village) and faculty housing sites Peter Coutts Circle and Mears Court;
- 2015 student beds and housing units;
- 2015 academic and academic support square footage for the entire campus;
- Projections for changes in housing and academic and academic support square footage for the period from December 2015 through the fall 2018 under the 2000 General Use Permit, and from fall 2018 through fall 2035 under the proposed 2018 General Use Permit.

Multiple methods for estimating existing peak hour vehicle trip generation rates for the campus were considered. The selected method uses total academic and academic support square footage as the overall vehicle trip generation variable, with an additional step that separates resident vehicle trip generation out so that resident and non-resident vehicle trip generation can be distributed to the roadway network using unique trip distribution patterns for the two types of trips (commuter/other, and resident).

Table 5-1 shows the observed total campus vehicle trip generation rates based on the 2015 measured traffic generation of the entire campus, in the first row. Resident-specific trip rates are then provided for faculty/staff residents, and for student residents, using the housing count data described above. The student

resident rates represent both graduate and undergraduate residents, and include the trips made by spouses of resident graduate students that may not be affiliated with Stanford. The student rates were developed by weighting the graduate and undergraduate rates based on the total beds on campus in fall 2015.

TABLE 5-1: CAMPUS VEHICLE TRIP GENERATION RATES - 2015

Component (variable)	AM Peak Hour		PM Peak Hour	
	Inbound	Outbound	Inbound	Outbound
All Campus Trips (per ksf of academic and academic support space)	0.330	0.188	0.264	0.342
Student Residents (per bed)	0.028	0.037	0.077	0.066
Faculty/Staff Residents (per residential unit)	0.15	0.28	0.26	0.19

For detailed supporting calculations, refer to the Technical Memorandum, *Stanford 2018 General Use Permit: Peak Hour Trip Generation Analysis Methodology* (May 16, 2017).

Source: Fehr & Peers, August 2017

5.2.2 VEHICLE TRIP GENERATION: NO PROJECT

The Stanford Community Plan, which is part of the Santa Clara County General Plan, establishes a goal for the Stanford campus of No Net New Commute Trips (specifically applied to vehicle trips). To date, Stanford has achieved the No Net New Commute Trips standard each year, meaning that there has not been an increase in peak hour, peak direction commute trips compared to measured baseline conditions. Per Stanford Community Plan policy, the goal has been achieved through a combination of onsite trip reduction programs and offsite programs that have removed trips from the roads nearest to the campus (the impact area identified in the Environmental Impact Report for the 2000 General Use Permit).

Stanford intends to continue to implement programs to achieve the No Net New Commute Trips goal during the remainder of the 2000 General Use Permit and to expand those programs throughout the life of the proposed 2018 General Use Permit. However, to provide a conservative analysis similar to the analysis performed for the 2000 General Use Permit, this TIA assumes Stanford does not increase its trip reduction efforts beyond the existing programs, and growth in trips above baseline conditions occurs both under No Project Conditions through the remainder of the 2000 General Use Permit and under With Project Conditions.

The No Project vehicle trip generation represents the trips generated by completion of the remaining development allocation in the 2000 General Use Permit. The No Project vehicle trip generation was calculated separately for Background (2018) Conditions and Cumulative (2035) Conditions because the Escondido Village Graduate Residences project would not be completed and occupied by 2018. It would be

completed and occupied in 2035. The following discussion describes the process for estimating the No Project trips, for both time horizons.

The number of residential and non-residential vehicle trips for the period between December 2015 and fall 2018/fall 2035 were estimated via the following process:

Step A: Total new vehicle trip generation = (Growth in academic and academic support square footage) x (2015 campus trip generation rates)

Step B: Faculty/staff resident vehicle trip generation = (New residential units) x (2015 faculty/staff residential trip generation rates)

Step C: Student resident vehicle trip generation = (New student beds) x (2015 student residential trip generation rates)

Step D: Non-resident vehicle trip generation = Total campus trip generation – resident trip generation

Table 5-2A presents the remaining development authorized under the 2000 General Use Permit and assumed to be constructed by fall 2018 when the 2018 General Use Permit is anticipated to begin. The approved Escondido Village Graduate Residences project is not included in **Table 5-2A**, since it will not be occupied by fall 2018. This analysis assumes that the net new academic and academic support square footage generates trips at the existing trip generation rate.

TABLE 5-2A: DECEMBER 2015 – FALL 2018 DEVELOPMENT SUMMARY

Component	Beds / Units ¹	Academic Space (ksf) ¹
Academic and Academic Support Space	---	769.354
Student (Beds)	416	---
Faculty / Staff (Dwelling Units)	0	---

Notes:

1. This land use will be completed by fall 2018 and is therefore included in the Background (2018) No Project and With Project Conditions.

Source: Stanford, February 2017.

Table 5-2B presents the remaining development authorized under the 2000 General Use Permit, with the inclusion of the Escondido Village Graduate Residences project. This is the development level that would be in place under the Cumulative (2035) No Project Conditions, without the 2018 General Use Permit.

TABLE 5-2B: DECEMBER 2015 – FALL 2035 DEVELOPMENT SUMMARY

Component	Beds / Units ¹	Academic Space (ksf) ¹
Academic and Academic Support Space	---	769.354
Student (Beds)	2,436	---
Faculty / Staff (Dwelling Units)	0	---

Notes:

1. This land use will be completed by fall 2035 and is therefore included in Cumulative (2035) No Project and With Project Conditions.

Source: Stanford, February 2017.

Table 5-3A and 5-3B present the total trip generation for these two periods using the trip generation rates presented in **Table 5-1**. Note that the trips are broken down into resident and non-resident trips, so that unique trip distribution characteristics can be applied to each component.

TABLE 5-3A: DECEMBER 2015 - FALL 2018 (NO PROJECT) VEHICLE TRIP GENERATION ESTIMATES

Generator	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Total Campus Trips (based on academic space growth)	254	145	399	203	263	466
Student Residents	11	15	26	32	27	59
Faculty / Staff Residents	0	0	0	0	0	0
<i>Total Resident Trips</i>	<i>11</i>	<i>15</i>	<i>26</i>	<i>32</i>	<i>27</i>	<i>59</i>
<i>Non-Residential Generators</i> <i>(Commuters, visitors, others)</i>	<i>243</i>	<i>130</i>	<i>373</i>	<i>171</i>	<i>236</i>	<i>407</i>

Source: Fehr & Peers, August 2017.

TABLE 5-3B: DECEMBER 2015 – FALL 2035 (NO PROJECT) VEHICLE TRIP GENERATION ESTIMATE

Generator	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Total Campus Trips (based on academic space growth)	254	145	399	203	263	466
Student Residents	66	90	156	188	161	349
Faculty / Staff Residents	0	0	0	0	0	0
<i>Total Resident Trips</i>	<i>66</i>	<i>90</i>	<i>156</i>	<i>188</i>	<i>161</i>	<i>349</i>
<i>Non-Residential Generators (Commuters, visitors, others)</i>	<i>188</i>	<i>55</i>	<i>243</i>	<i>15</i>	<i>102</i>	<i>117</i>

Source: Fehr & Peers, August 2017.

5.2.3 VEHICLE TRIP GENERATION: 2018 GENERAL USE PERMIT

The number of residential and non-residential vehicle trips generated by the 2018 General Use Permit (expected to be completed by 2035) were estimated using the same process identified for the No Project growth as seen in Section 5.2.2.

The development proposal included in the 2018 General Use Permit application is shown in **Table 5-4**. The resulting AM and PM peak hour vehicle trip generation using the 2015 trip rates is shown in **Table 5-5**. Note that, as in **Table 5-3A / 5-3B**, **Table 5-5** shows the trips broken down into resident and non-resident trips, so that unique trip distribution characteristics can be applied to each component.

TABLE 5-4: 2018 GENERAL USE PERMIT DEVELOPMENT PROPOSAL

Component	Beds/Units	Academic Space (ksf)
Academic and Academic Support Space	---	2,275
Student (Beds)	2,600	---
Faculty / Staff (Dwelling Units)	550	---

Source: Stanford, November 2016.

TABLE 5-5: 2018 GENERAL USE PERMIT VEHICLE TRIP GENERATION ESTIMATES

Generator	AM Peak Hour			PM Peak Hour		
	In	Out	Total	In	Out	Total
Total Campus Trips (based on academic and academic support space growth)	751	428	1,179	600	779	1,379
Student Resident Trips	70	96	166	200	172	372
Faculty/Staff Resident Trips	83	154	237	143	105	248
<i>Total Resident Trips</i>	<i>153</i>	<i>250</i>	<i>403</i>	<i>343</i>	<i>276</i>	<i>619</i>
<i>Non-Residential Trips</i> (Commuters, visitors, others)	<i>598</i>	<i>178</i>	<i>776</i>	<i>257</i>	<i>502</i>	<i>759</i>

Source: Fehr & Peers, August 2017.

As with the No Project trip generation estimates, the 2018 General Use Permit trip generation estimates are based on the assumption that the net new academic and academic support square footage generates trips at the existing 2015 trip generation rates. This is a conservative assumption given that Stanford has stated in its application for the 2018 General Use Permit that it intends to continue to achieve the No Net New Commute Trips goal.

Without further expansion of existing programs to reduce external vehicle trips, the 2018 General Use Permit would be expected to generate a total of 751 additional inbound vehicle trips in the AM peak hour and 779 additional vehicle outbound trips in the PM peak hour. **Table 5-5** includes detailed information about the directionality of trips and how many are attributable to residential units, academic and academic support space growth.

5.3 STANFORD TRIP DISTRIBUTION

This section summarizes information that was previously presented in *2018 General Use Permit: TIA Part 1*. All supporting data is included in that document, and the supplemental memorandum *Stanford 2018 General Use Permit: Trip Distribution Analysis Methodology* (Fehr & Peers, May 16, 2017).

Separate trip distribution estimates were developed for commuters and campus residents, as described below.

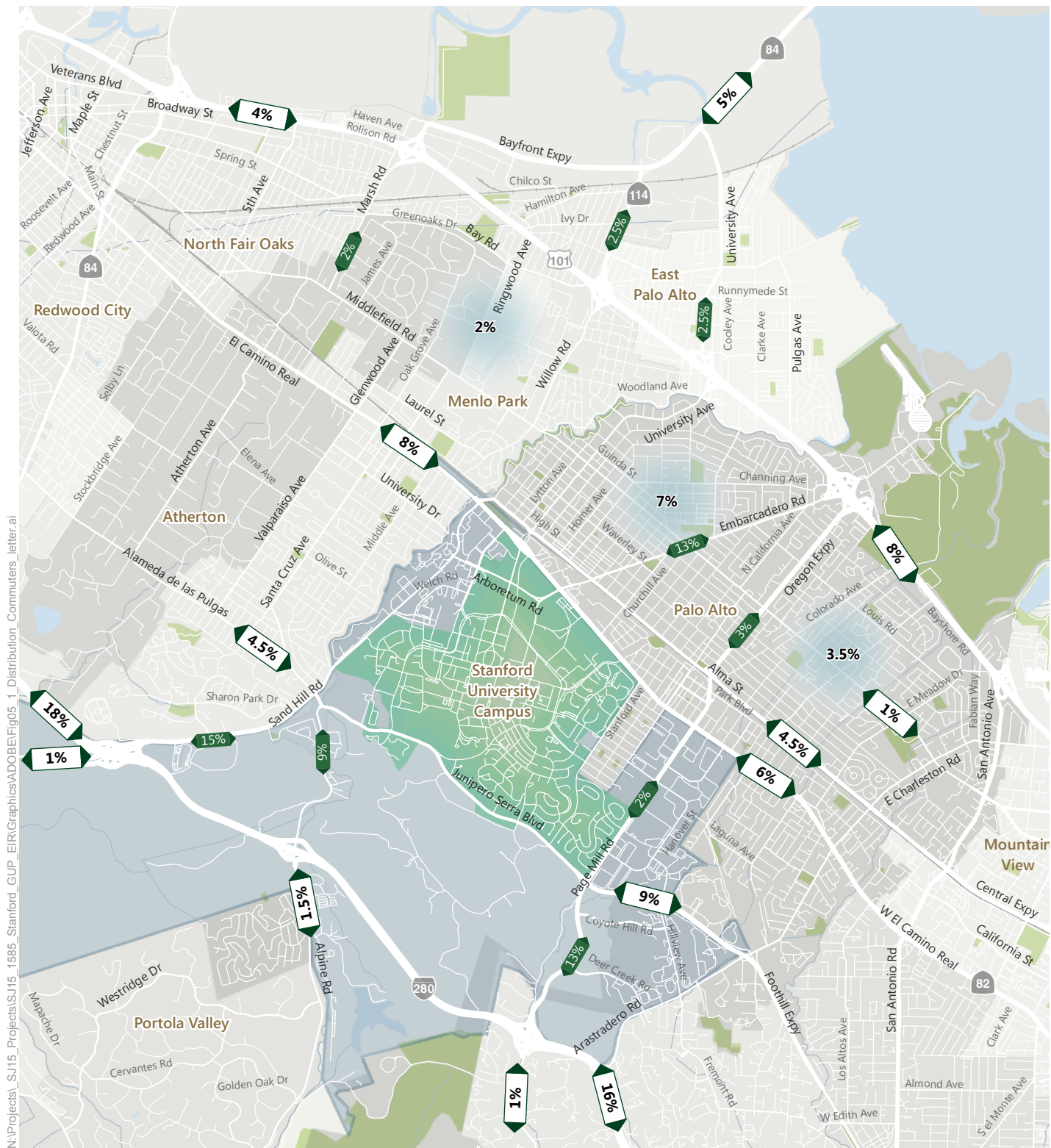
5.3.1 OFF-CAMPUS COMMUTER DISTRIBUTION

Stanford's annual commuter travel survey (2015) and information on commuter place of residence were used to develop a commuter vehicle trip distribution for the campus. The commuter mode choice (drive-alone or rideshare) by geography was combined with the total number of commuters within a geographic area to estimate the number of drivers from each area. 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 General use Permit: TIA Part 1.

The resulting trip distribution for Stanford off-campus commuters is shown in **Figure 5-1**. The primary directions of approach are shown in the boxes with the white backgrounds. These percentages add up to 100 percent and would be applied to the total net new trips generated by the Project. The green arrows indicate the percent of the total trips what would be assigned to these local roadways based on the paths throughout the study area.

For Cumulative (2035) Conditions, the potential for changes in commuter residences was considered, and reviewed as described in Section 5.4. After this review, the trip distributions shown in **Figure 5-1** were used for the Cumulative (2035) analysis.



5.3.2 CAMPUS RESIDENT TRIP DISTRIBUTION

The trip distribution for Stanford residents (faculty, staff and students) was developed using data from the Census Transportation Planning Package (CTPP)⁸. Three, primarily housing, census tracts surrounding Stanford University to estimate trip distributions for on-campus residents/spouses traveling off-campus.

The data for these census tracts were combined to develop an off-campus distribution for all Stanford resident trips. The off-campus travel trip distribution was calculated by removing internal trips between the Stanford campus census tracts, which represented approximately 44 percent of the total trips. The remaining trips were used to calculate the percent of trips to each destination (city or county).

Table 5-6 summarizes the distribution of trips base on the CTPP data for Stanford residents. After making the off-campus adjustment described above, approximately 55 percent of the remaining resident trips were assigned to destinations within the City of Palo Alto. The CTPP data provided some detail regarding the trips to specific census tracts within the City of Palo Alto; therefore, trips within Palo Alto were assigned to four geographic areas:

- Downtown and northern Palo Alto – north of Oregon Expressway and east of El Camino Real
- Southeast Palo Alto – south of Oregon Expressway and east of El Camino Real
- Southwest Palo Alto – south of the campus and west of El Camino Real (includes research park)
- Medical center and shopping center

The “Roadways” column in **Table 5-6** identifies the primary roadways that would be used by Stanford residents. These roadways were selected based on engineering judgment and local knowledge of area congestion.

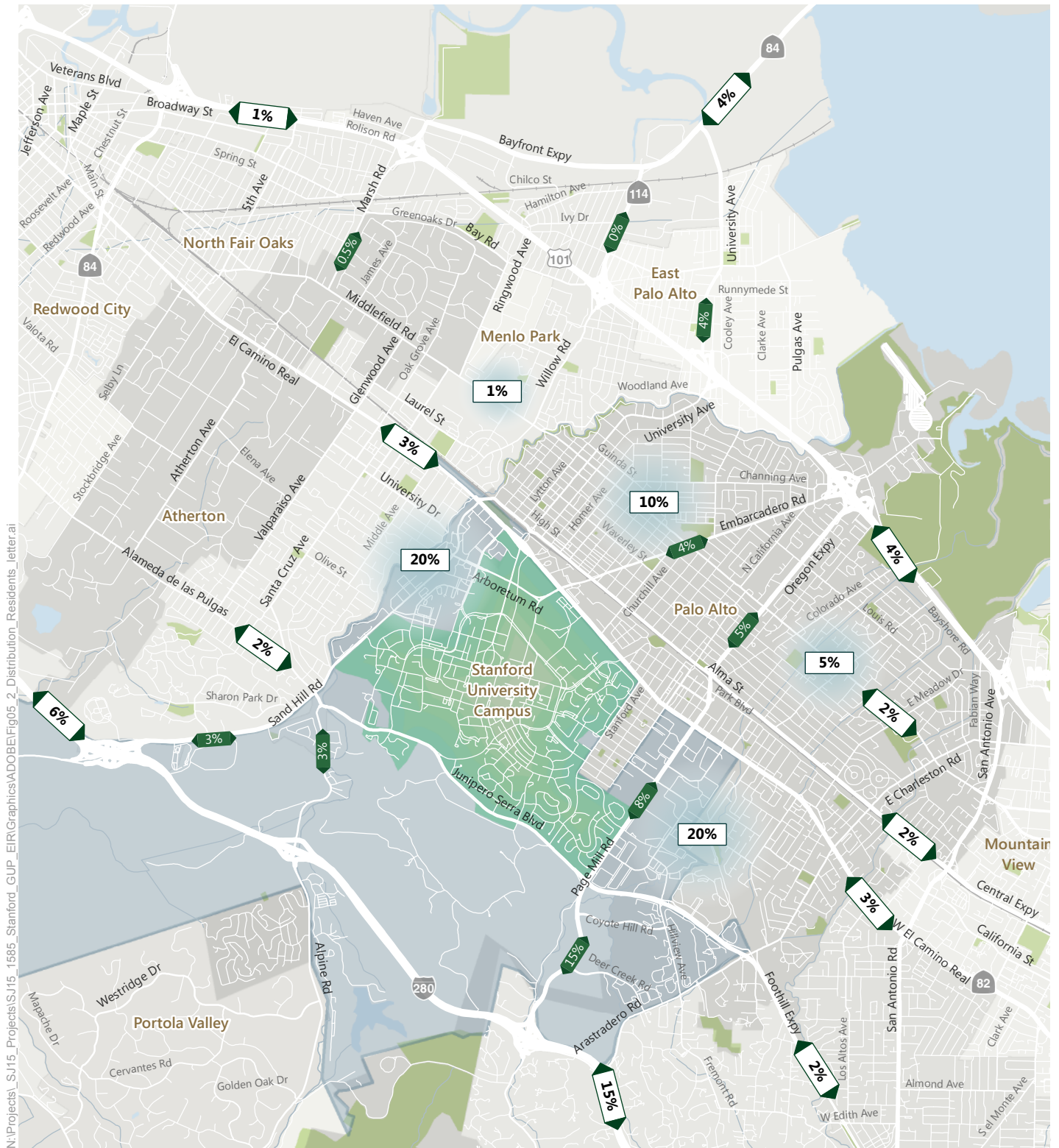
⁸ US Census Transportation Planning Products Journey to Work from Place of Residence.
<http://ctpp.transportation.org/Pages/5-Year-Data.aspx>

TABLE 5-6: STANFORD RESIDENTS - OFF-CAMPUS DESTINATIONS

Location	Roadways	Percent	
Palo Alto	Local		
Palo Alto – Downtown	University, Embarcadero	10.0%	
Palo Alto – Medical Center / Shopping Center	Campus Dr., ECR, Junipero Serra	20.0%	
Palo Alto – South of Oregon / East of ECR	Oregon, ECR, Alma	5.0%	
Palo Alto – California Avenue / Research Park	ECR, Foothill	20.0%	55.0%
North of Campus	Local		
Menlo Park, Atherton	ECR North	3.9%	
Redwood City / San Carlos	ECR North, Santa Cruz	3.4%	7.3%
	Regional		
Northern Peninsula – Belmonte to Millbrae	I-280, Alpine, Sand Hill	1.8%	
San Francisco	I-280	4.1%	
South San Francisco / Daly City	I-280, Alpine, Sand Hill	0.6%	6.5%
South of Campus	Local		
Los Altos	Foothill	0.4%	
Mountain View	ECR South, Foothill, Alma Street/Central Expressway	6.8%	7.2%
	Regional		
Santa Clara County	I-280, US 101	0.8%	
Santa Cruz County	I-280, US 101	1.0%	
Santa Clara, Sunnyvale, North San Jose	US 101, Alma Street, ECR South	6.2%	
Campbell / Central San Jose	I-280	0.2%	
Cupertino / Saratoga / Los Gatos	I-280, Foothill	1.1%	
Downtown – East San Jose	US 101, I-280	8.3%	
South San Jose	I-280	0.5%	18.1%
East of Campus	Local		
East Palo Alto	University, Embarcadero	0.6%	0.6%
	Regional		
Alameda County	Dumbarton, US 101	3.3%	
Contra Costa County	Dumbarton, US 101	1.1%	
Fremont / Milpitas	Dumbarton, US 101	0.7%	5.1%
West of Campus	Local		
Portola Valley, Woodside	Alpine Road, Sand Hill	0.4%	0.4%
		100%	100%

Source: US Census Transportation Planning Products & Fehr & Peers, March 2017.

Figure 5-2 shows the trip distribution for Stanford residents. This distribution is used for both the Background (2018) and Cumulative (2035) analyses.



N:\Projects\ SJ15_P\Projects\SJ15_1585_Stanford_GUP_EIR\Graphics\ADOBE\Fig05_2_Distribution_Residents_letter.ai

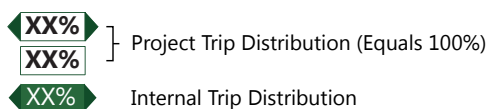


Figure 5-2

Distribution of Stanford Residents Using Auto Off-Campus



5.4 FORECASTING PROCESS

The information presented below summarizes the forecasting process. **Appendix I – Forecasting Report** discusses, in detail, the model validation and calibration of the 2016 VTA model, the development of the 2020 and 2040 models used to forecast future traffic volumes, and the development of the intersection and freeway forecasts. Note that, while the near-term and cumulative years are defined as 2018 and 2035, respectively, the use of the VTA 2020 and 2040 models were used as approximations of those years, with adjustments as described in **Appendix I** to more accurately reflect the local study area network and land uses.

5.4.1 EXISTING CONDITIONS MODEL VALIDATION/CALIBRATION

The existing conditions reflected in the base year VTA Model, which represent the year 2013, were reviewed and network geometry coding changes were made to reflect 2016 conditions. **Appendix I** contains a list of the roadway adjustments made. The model's 2013 land use was reviewed and updated to represent 2016 conditions within the jurisdictions of Palo Alto, East Palo Alto and Menlo Park, using available information on several developments that were not accurately represented in the 2013 model.

After the VTA Model roadway network and land use was updated to 2016 conditions, Stanford land use was refined at the trip table level to more accurately represent current Stanford University vehicular traffic, captured by cordon counts in 2015 (as described above in Section 5.2). A post-processing step was applied to the model-estimated trip generation for Stanford University TAZs, using a "Fratar" factoring process, which takes into account the inbound and outbound vehicle trip generation as an input and then factors the origins and destinations of trips generated by the model for Stanford University TAZs. This process allows for the relative distribution of trips generated by the model for Stanford University TAZs to be maintained, and also allows the model to assign Stanford vehicular traffic to the model roadway network using standard model impedance functions that take into account delay from Stanford trips as well as non-Stanford trips.

With these changes, the 2016 model's estimates of existing traffic volumes at study area intersections was compared to the fall 2016 traffic counts, to validate the model's accuracy and make necessary calibration adjustments to the input files to ensure that the model operates in accordance with industry standards, in particular the *Caltrans Travel Forecasting Guidelines* (1992). **Appendix I** describes this process. At the conclusion of this process, the 2016 model was considered validated and appropriate for use in preparing traffic forecasts for the study area.

5.4.2 BACKGROUND (2018) NO PROJECT AND CUMULATIVE (2035) NO PROJECT FORECASTS

5.4.2.1 Background (2018) No Project Model

Operations under the 2018 General Use Permit are anticipated to commence in 2018. In order to represent conditions on the date of Project commencement (Background (2018) Conditions), the VTA 2020 Model was used. The model land uses were developed with a straight-line interpolation between the 2016 and 2040 land uses because, while the 2020 model contains an official representation of transportation area-wide and regional transportation network improvements for that year, VTA does not maintain a 2020 land use data set. As part of this review, the land uses in particular TAZs were compared to approved and pending project lists submitted by the City of Menlo Park and East Palo Alto, and checked against development projects described on the City of Palo Alto's website. This was completed to ensure the TAZs contained at least as much new development as indicated by the cities (approved projects and pending projects with a completed traffic study were included). **Appendix I** contains the land uses and roadway and transit network assumptions in the 2020 model.

The Background (2018) No Project Stanford trip growth was modeled in a two-step process to estimate the completion of the 2000 General Use Permit. First, the VTA 2020 model land uses were adjusted to allow the model to approximate the trip generation expected with completion of the 2000 General Use Permit (with the exception of the Escondido Village Graduate Residences, which is not expected to be occupied by 2018). Then, a post-processing step was applied to the model-estimated trip generation for Stanford University TAZs using the same "Fratar" factoring process described above.

After the VTA modeling step, all Stanford University trips were removed from the model to determine the regional and local growth in the area aside from the Stanford University trips. This regional and local growth was then added to the existing 2016 turning movement counts. The trips associated with the Stanford No Project growth (2000 General Use Permit completion) were added to these turning movement volumes by manual-assignment within a TRAFFIX 8.0 manual assignment model. The TRAFFIX 8.0 model incorporates the estimated trip generation for the 2000 General Use Permit completion through 2018 (described in Section 5.2) and the residential locations of Stanford commuters and the known trip distribution patterns for campus residents (described in Section 5.3). The TRAFFIX 8.0 model contains commuter and residential TAZs, into which the appropriate numbers of new trips were loaded. The trips were then assigned to regional "gateways" using the trip distribution information from Section 5.3. **Appendix I** describes the TRAFFIX 8.0 model in more detail.

The Background (2018) No Project results were reviewed for reasonableness and adjustments were made to the model input files to ensure traffic growth at the various intersections and freeway segments in the study area reasonably reflect the land use growth in the model.

5.4.2.2 Cumulative (2035) No Project Model

The 2018 General Use Permit is estimated to be built out and occupied by the year 2035. The VTA 2040 model was used to represent Cumulative (2035) No Project Conditions. The model incorporates the official regional projections by the Association of Bay Area Governments (ABAG), MTC, and VTA of development growth under the *Plan Bay Area* regional transportation plan and Sustainable Communities Strategy. As it includes five additional years of growth beyond 2035, this is considered a conservative evaluation of cumulative buildout conditions. The list of approved and pending projects with a completed traffic study provided by the Cities of East Palo Alto and Menlo Park, and the projects listed on the City of Palo Alto's website were verified to be included within the model. After these adjustments, the model's citywide land use growth in these cities was also reviewed against ABAG *Projections 2013* forecasts, and the model land uses were found to be somewhat higher than ABAG projections for the three cities as a whole. The 2040 model network was also reviewed to ensure that the network improvements reflect roadway and transit projects expected to be complete by 2035. **Appendix I** describes the land uses and roadway and transit network assumptions in the 2040 model.

The Stanford University trip growth that would occur in the Cumulative (2035) No Project case is the completion of the 2000 General Use Permit, including completion and occupancy of the Escondido Village Graduate Residences project. Section 5.2 describes this trip growth. The Cumulative (2035) No Project Stanford trip growth was modeled in a two-step process. First, the land uses were adjusted to allow the model to approximate the trip generation expected with completion of the 2000 General Use Permit. Then, a post-processing step was applied to the model-estimated trip generation for Stanford University TAZs, using the same "Fratar" factoring as described above.

Regional and local growth from the model was added to existing 2016 turning movement counts following the same procedure identified above for the VTA 2020 Model. For the freeway forecasts, raw model volumes were used since a consistent set of traffic counts was not available within the freeway study area. Stanford No Project trips were added manually via the TRAFFIX 8.0 model.

The Cumulative (2035) No Project results were reviewed for reasonableness, and adjustments were made to the model input files to ensure traffic growth at the various intersections and freeway segments in the study area reasonably reflect the land use growth in the model.

5.4.3 2018 GENERAL USE PERMIT PROJECT TRAFFIC (2018 AND 2035)

The 2018 General Use Permit traffic forecasts were prepared by entering the 2018 General Use Permit Project trips, as defined in Section 5.2, into the TRAFFIX 8.0 model. The TRAFFIX 8.0 model contains commuter and residential TAZs, into which the appropriate number of new trips was loaded using the trip generation described in Section 5.2 and trip distribution described in Section 5.3. These trips were then added to the Background (2018) No Project and Cumulative (2035) No Project intersection and freeway

forecasts, to produce the Background (2018) With Project and Cumulative (2035) With Project forecasts, respectively.

The final intersection turn movements for the four future year cases – Background (2018) No Project, Background (2018) With Project, Cumulative (2035) No Project, and Cumulative (2035) With Project – are included in **Appendix E.**⁹

⁹ 2020 forecasts were used to estimate Background (2018) Conditions. 2040 forecasts were used to estimate Cumulative (2035) Conditions.



6. BACKGROUND (2018) CONDITIONS: NO PROJECT AND WITH PROJECT

This section presents the operations of the surrounding transportation system under Background (2018) No Project and Background (2018) With Project Conditions. Background (2018) No Project Conditions are defined as conditions without the 2018 General Use Permit. Traffic volumes for Background (2018) No Project Conditions are based on forecasts from the VTA traffic model, including ABAG 2020 land use projections, traffic generated by approved development projects, and the completion of the 2000 General Use Permit (except for the Escondido Village Graduate Residences project), as described in Chapter 5. A list of planned transportation improvements within the study area may be found in **Appendix I**.

Background (2018) With Project Conditions are defined as Background (2018) No Project Conditions plus traffic generated by build-out of the 2018 General Use Permit.

6.1 BACKGROUND (2018) INTERSECTION ANALYSIS

Level of service calculations were prepared using the TRAFFIX 8.0 software to evaluate signalized and unsignalized intersection operations under Background (2018) Conditions. The TRAFFIX 8.0 software uses the 2000 HCM methodology and is consistent with VTA TIA guidelines. The intersection volumes are shown in **Appendix E** and results of the LOS analysis are summarized in **Table 6-1**. The corresponding LOS calculation sheets are included in **Appendix F** and peak hour signal warrant calculations for unsignalized intersections that are significantly impacted are provided in **Appendix G**.

The results for Existing (2016) Conditions are included in **Table 6-1** for comparison purposes, along with the projected increases in critical delay and critical volume-to-capacity (V/C) ratios between the Background (2018) No Project and With Project Conditions. **Figure 6-1** and **Figure 6-2** show the LOS results graphically by intersection for the Background (2018) No Project and With Project Conditions, respectively. Critical delay represents the delay associated with the critical movements of the intersection, or the movements that require the most “green time” and have the greatest effect on overall intersection operations. Project impacts are identified by comparing Background (2018) No Project to Background (2018) With Project Conditions. Significant impacts are identified based on the impact criteria presented in Chapter 3, which include changes in the LOS from an acceptable to an unacceptable level or changes in critical delay and critical V/C ratios for intersections operating unacceptably.

In the Background (2018) With Project analysis, significant impacts are identified at six intersections:

- Intersection #2: I-280 NB Off-Ramp/Sand Hill Road (AM peak hour)
- Intersection #13: I-280 SB Off-Ramp/Page Mill Road (AM and PM peak hours)
- Intersection #17: Junipero Serra Blvd./Foothill Expwy./Page Mill Road (AM and PM peak hours)
- Intersection #30: Foothill Expressway/Arastradero Road (PM peak hour)
- Intersection #31: Foothill Expressway/San Antonio Road (PM peak hour)
- Intersection #58: Alma Street/Charleston Road (PM peak hour)

It is noted that only two of these intersections (Intersections #13 and #17) would be significantly impacted under an Existing With Project Conditions (2018 General Use Permit traffic added to 2016 existing traffic volumes). This was determined with a sensitivity test in which the 2018 General Use Permit intersection turning movements were added to existing counts. **Appendix F** contains the LOS calculations for this case.

At times, intersections may show a reduction in average delay with the addition of Project traffic, which is counter-intuitive. However, the average delay values in the table are weighted averages. Weighted average delays will be reduced when traffic is added to a movement that has a low delay under existing conditions.¹⁰ Conversely, relatively small volume increases to movements with high delays can substantially increase the weighted average delay.

Mitigation measures to address these impacts are presented in Chapter 8.

¹⁰ For example, if there is one movement with 10 vehicles and a delay of 100 seconds and another movement with 400 vehicles and 10 seconds of delay, the weighted average delay is calculated as (100 seconds X 10 vehicles + 10 seconds X 400 vehicles) / 410 vehicles = 12.2 seconds per vehicle. Now if 100 vehicles are added to the movement with 10 seconds of delay, the weighted average delay is calculated as (100 seconds X 10 vehicles + 10 seconds X 500 vehicles) / 510 vehicles = 11.8 seconds per vehicle. The weighted average delay improves, even though more vehicles are added.

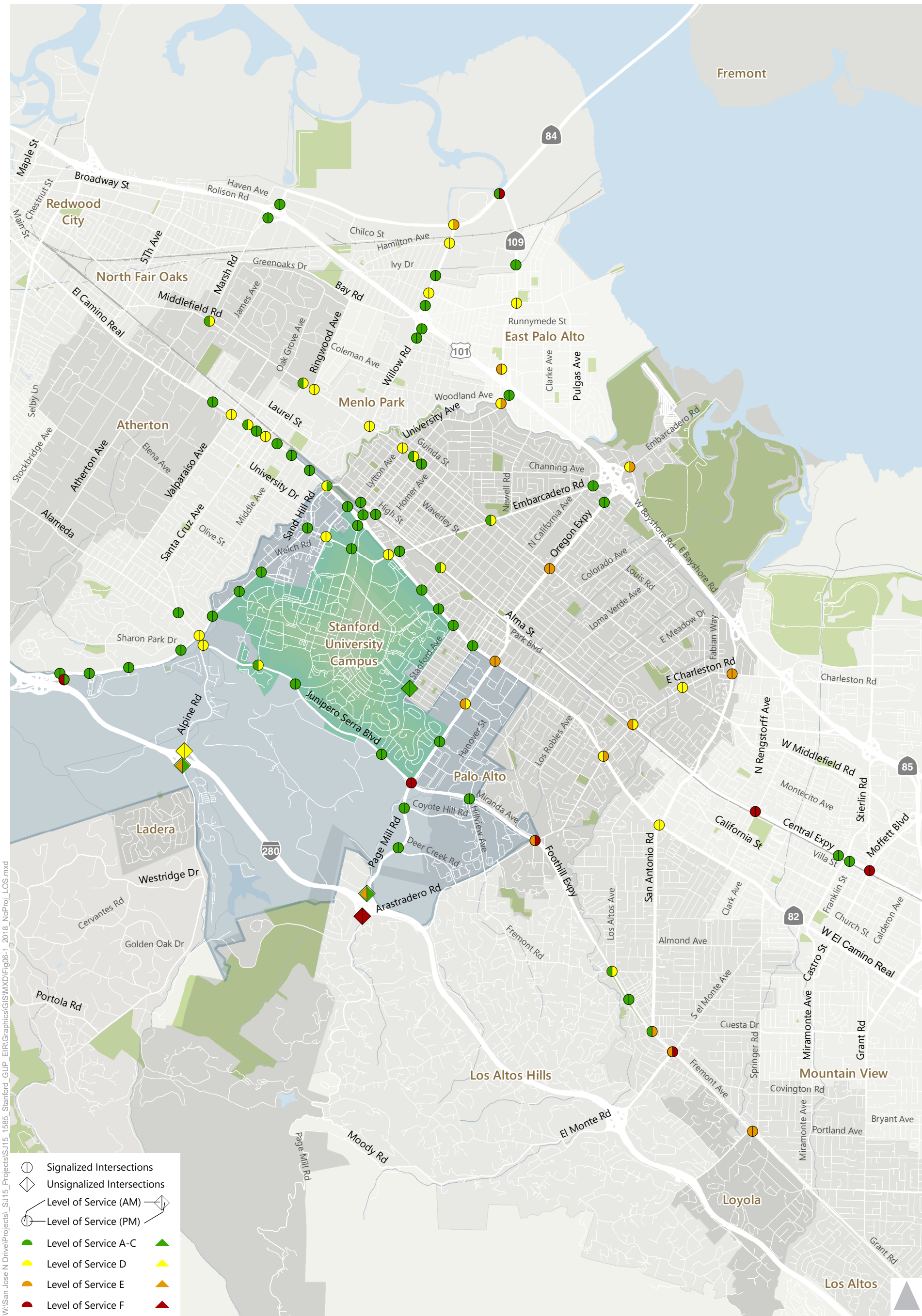
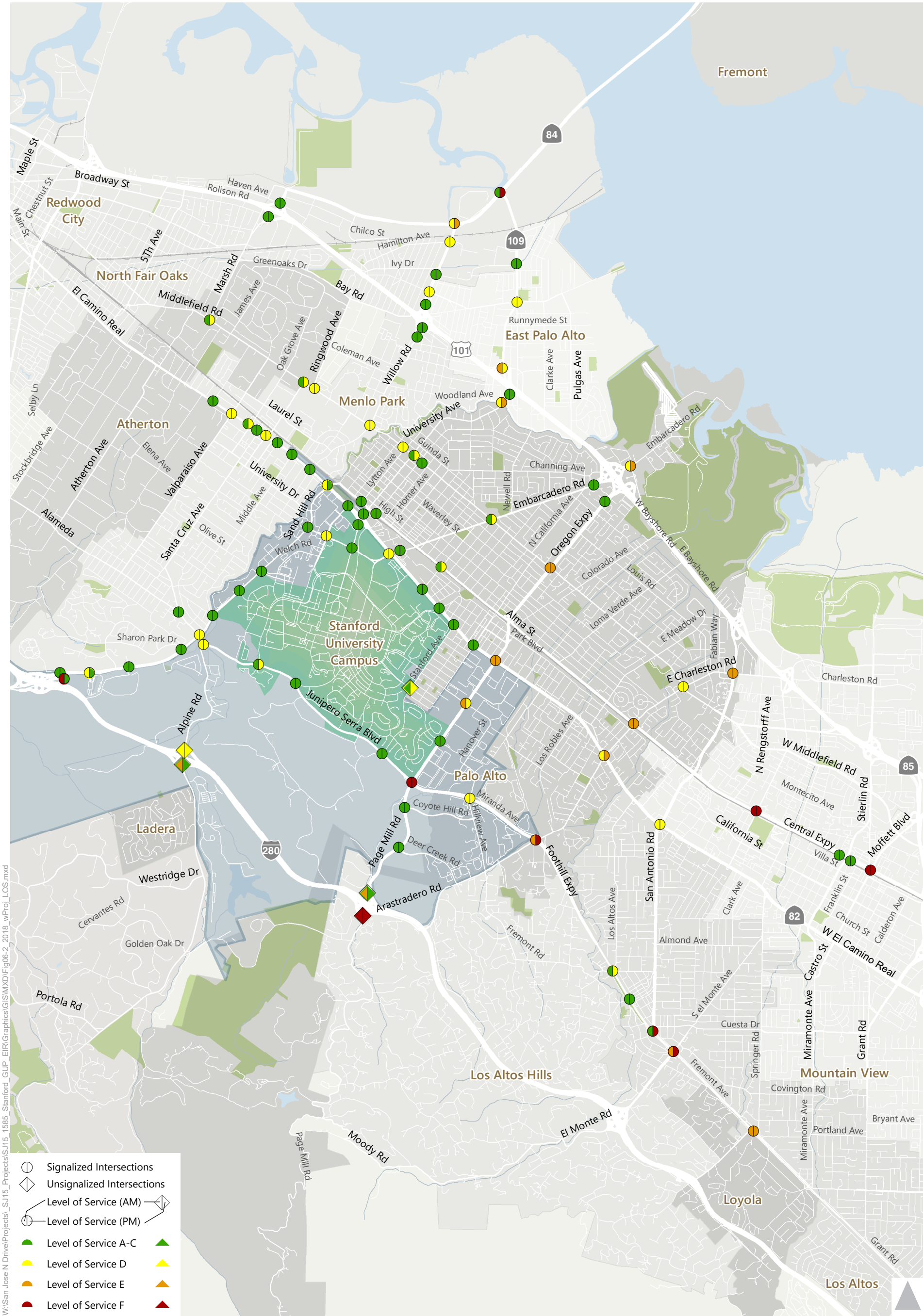


Figure 6-1

Stanford 2018 General Use Permit 2018 No Project Intersection Level of Service Results



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Figure 6-2
Stanford 2018 General Use Permit 2018 With Project Intersection Level of Service Results

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
1	I-280 NB On-Ramp / Sand Hill Rd	Menlo Park	LOS D	AM PM	10.6 10.2	B+ B+	10.4 12.5	B+ B	10.2 13.5	B+ B	0.015 0.032	-0.2 1.1
2	I-280 NB Off-Ramp / Sand Hill Rd	Menlo Park	LOS D	AM PM	39.1 17.2	D B	119.6 21.2	F C+	137.4 21.4	F C+	0.038 0.021	18.9 0.2
3	Addison Wesley / Sand Hill Rd	Menlo Park	LOS D	AM PM	18.8 19.4	B- B-	32.4 21.0	C- C+	42.4 21.7	D C+	0.037 0.032	15.7 1.3
4	Saga Ln / Sand Hill Rd	Menlo Park	LOS D	AM PM	13.6 19.0	B B-	15.0 21.7	B C+	15.3 21.2	B C+	0.036 0.031	0.6 -0.5
5	Sharon Park Dr / Sand Hill Rd	Menlo Park	LOS D	AM PM	16.5 15.8	B B	16.7 16.6	B B	16.8 16.3	B B	0.036 0.032	0.4 -0.1
6	Alameda de las Pulgas / Santa Cruz Ave	San Mateo County	LOS D	AM PM	13.9 13.8	B B	16.1 16.9	B B	16.0 16.8	B B	0.000 0.000	0.0 0.0
7	Santa Cruz Ave / Sand Hill Rd	Menlo Park	LOS D	AM PM	47.2 46.7	D D	48.9 48.1	D D	49.8 49.0	D D	0.031 0.038	1.4 1.7
8	Oak Ave / Sand Hill Rd	Menlo Park	LOS D	AM PM	10.5 3.8	B+ A	10.6 3.9	B+ A	10.5 3.9	B+ A	0.025 0.024	0.0 0.1
9	Stock Farm Rd / Sand Hill Rd	Palo Alto	LOS D	AM PM	20.0 25.9	C+ C	23.3 28.2	C C	24.3 29.2	C C	0.028 0.027	1.6 1.2
10	Pasteur Dr / Sand Hill Rd	Palo Alto	LOS D	AM PM	19.9 23.9	B- C	20.9 27.3	C+ C	20.9 27.7	C+ C	0.009 0.017	0.3 0.7
11	Arboretum Rd / Sand Hill Rd	Palo Alto	LOS D	AM PM	21.5 27.8	C+ C	18.5 27.3	B- C	19.3 27.8	B- C	0.013 0.017	1.3 0.9
12	El Camino Real / Sand Hill Rd	Palo Alto (SC CMP)	LOS E	AM PM	32.8 32.1	C- C-	39.0 34.1	D C-	38.9 34.3	D+ C-	0.012 0.016	-0.1 0.3

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
13	I-280 SB Ramps / Page Mill Rd*	Santa Clara County	LOS E (warrant)	AM PM	93.4 72.0	F F	151.7 85.9	F F	153.3 88.3	F F	N/A	N/A
14	I-280 NB Ramps / Page Mill Rd*	Santa Clara County	LOS E (warrant)	AM PM	34.0 14.1	D B	40.5 14.8	E B	41.5 14.9	E B	N/A	N/A
15	Deer Creek Rd / Page Mill Rd	Santa Clara County	LOS E	AM PM	14.2 13.4	B B	14.5 13.5	B B	15.4 13.7	B B	0.026 0.021	1.4 -0.3
16	Coyote Hill Rd / Page Mill Rd	Santa Clara County	LOS E	AM PM	7.5 8.6	A A	7.5 9.0	A A	8.0 9.4	A A	0.014 0.021	0.0 -0.2
17	Junipero Serra Blvd - Foothill Expy / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	AM PM	93.6 93.0	F F	97.2 97.0	F F	101.5 109.9	F F	0.029 0.063	7.2 19.3
18	Peter Coutts / Page Mill Rd	Santa Clara County	LOS E	AM PM	20.0 28.4	C+ C	20.9 29.7	C+ C	21.3 29.8	C+ C	0.020 0.015	0.6 0.0
19	Hanover St / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	AM PM	60.1 48.6	E D	63.0 47.6	E D	65.7 48.2	E D	0.013 0.017	0.6 -0.1
20	El Camino Real / Page Mill Rd - Oregon Expy	Santa Clara County (SC CMP)	LOS E	AM PM	57.9 62.2	E+ E	61.2 66.2	E E	66.1 68.8	E E	0.047 0.021	6.5 2.7
21	Middlefield Rd / Oregon Expy	Santa Clara County (SC CMP)	LOS E	AM PM	62.3 57.5	E E+	63.6 58.5	E E+	64.2 58.9	E E+	0.009 0.012	1.0 0.5
22	Oregon Expy / West Bayshore Rd	Santa Clara County	LOS E	AM PM	17.3 18.7	B B-	20.7 18.9	C+ B-	20.7 19.1	C+ B-	0.003 0.008	0.1 0.2
23	I-280 SB Ramps / Alpine Rd*	San Mateo County	LOS E (warrant)	AM PM	36.6 15.7	E C	40.5 16.1	E C	41.0 16.2	E C	N/A	N/A
24	I-280 NB Ramps / Alpine Rd*	San Mateo County	LOS E (warrant)	AM PM	25.1 24.2	D C	27.2 26.8	D D	28.5 29.9	D D	N/A	N/A

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
25	Junipero Serra Blvd / Alpine Rd	Menlo Park	LOS D	AM PM	41.9 47.4	D D	43.8 48.8	D D	46.2 50.9	D D	0.049 0.048	3.0 2.4
26	Junipero Serra Blvd / Campus Drive West	Santa Clara County	LOS E	AM PM	26.9 37.8	C D+	28.7 40.7	C D	30.5 45.4	C D	0.009 0.052	1.2 5.9
27	Junipero Serra Blvd / Campus Drive East	Santa Clara County	LOS E	AM PM	13.2 15.2	B B	14.1 16.3	B B	14.5 17.9	B B	0.020 0.036	0.8 2.8
28	Junipero Serra Blvd / Stanford Ave	Santa Clara County	LOS E	AM PM	18.8 19.9	B- B-	19.6 21.1	B- C+	21.0 25.1	C+ C	0.061 0.076	1.8 4.4
29	Foothill Expy / Hillview Ave	Santa Clara County	LOS E	AM PM	33.5 34.2	C- C-	35.0 34.9	C- C-	35.7 35.1	D+ D+	0.006 0.015	-0.3 0.2
30	Foothill Expy / Arastradero Rd	Santa Clara County (SC CMP)	LOS E	AM PM	66.9 83.6	E F	71.8 92.3	E F	74.7 95.8	E F	0.016 0.150	4.6 -1.0
31	Foothill Expy / San Antonio Rd	Santa Clara County (SC CMP)	LOS E	AM PM	17.9 67.2	B E	18.7 79.6	B- E-	19.2 82.7	B- F	0.016 0.022	0.6 4.7
32	Foothill Expy / El Monte Ave	Santa Clara County (SC CMP)	LOS E	AM PM	63.3 84.4	E F	74.6 88.9	E F	79.0 89.9	E- F	0.014 0.004	9.5 1.3
33	Foothill Expy / Springer Road-Magdalena Ave	Santa Clara County (SC CMP)	LOS E	AM PM	58.8 70.2	E+ E	62.6 71.9	E E	64.0 73.2	E E	0.015 0.010	1.9 2.3
34	Bowdoin St / Stanford Ave*	Palo Alto	LOS E (warrant)	AM PM	13.1 16.8	B C	14.4 18.5	B C	18.4 27.6	C D	N/A	N/A
35	Arboretum Rd / Quarry Rd	Palo Alto	LOS D	AM PM	44.9 42.2	D D	43.6 41.5	D D	44.1 42.1	D D	0.040 0.039	1.2 1.4
36	Arboretum Rd / Palm Dr	Palo Alto	LOS D	AM PM	30.0 29.7	C C	29.9 28.6	C C	31.9 29.4	C C	0.085 0.044	3.3 1.3

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
37	El Camino Real / Encinal Ave	Menlo Park	LOS D	AM PM	16.8 29.5	B C	17.2 29.9	B C	17.0 29.8	B C	0.011 0.015	-0.1 0.1
38	El Camino Real / Valparaiso Ave	Menlo Park	LOS D	AM PM	40.2 37.5	D D+	42.5 42.0	D D	42.4 42.2	D D	0.017 0.015	0.4 0.5
39	El Camino Real / Oak Grove Ave	Menlo Park	LOS D	AM PM	30.7 35.0	C D+	31.3 35.6	C D+	31.0 35.4	C D+	0.018 0.017	-0.3 -0.1
40	El Camino Real / Santa Cruz Ave	Menlo Park	LOS D	AM PM	13.6 19.7	B B-	14.0 23.0	B C	13.8 22.7	B C+	0.018 0.016	-0.3 -0.4
41	El Camino Real / Ravenswood Rd	Menlo Park	LOS D	AM PM	41.2 44.6	D D	43.7 47.0	D D	43.9 47.2	D D	0.022 0.020	0.6 0.7
42	El Camino Real / Roble Ave	Menlo Park	LOS D	AM PM	12.9 13.4	B B	14.4 14.7	B B	14.1 14.3	B B	0.014 0.013	-0.3 -0.3
43	El Camino Real / Middle Ave	Menlo Park	LOS D	AM PM	27.1 27.1	C C	27.2 27.5	C C	27.0 27.2	C C	0.014 0.009	-0.3 -0.2
44	El Camino Real / Cambridge Ave	Menlo Park	LOS D	AM PM	13.2 19.1	B B-	13.6 19.6	B B-	13.4 19.5	B B-	0.014 0.009	-0.3 -0.2
45	El Camino Real / Quarry Rd	Palo Alto	LOS D	AM PM	15.2 33.1	B C-	14.3 33.2	B C-	15.8 34.2	B C-	0.029 0.031	1.6 1.6
46	El Camino Real (SB) / University Ave	Palo Alto (SC CMP)	LOS E	AM PM	21.0 20.0	C+ C+	21.1 20.3	C+ C+	20.7 20.0	C+ C+	0.028 0.030	-0.2 -0.3
47	El Camino Real (NB) / University Ave	Palo Alto (SC CMP)	LOS E	AM PM	18.7 26.3	B- C	19.5 26.3	B- C	20.0 26.4	B- C	0.030 0.033	0.4 0.8
48	El Camino Real / Embarcadero Rd	Palo Alto (SC CMP)	LOS E	AM PM	44.9 49.1	D D	45.9 51.1	D D-	47.5 54.9	D D-	0.047 0.059	2.0 7.0

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
49	El Camino Real / Churchill Ave	Palo Alto	LOS D	AM PM	23.1 25.9	C C	24.7 26.6	C C	24.4 26.4	C C	0.017 0.018	-0.1 -0.1
50	El Camino Real / Serra St	Palo Alto	LOS D	AM PM	22.3 25.8	C+ C	24.5 28.0	C C	27.8 33.2	C C-	0.082 0.112	5.4 8.0
51	El Camino Real / Stanford Ave	Palo Alto	LOS D	AM PM	33.0 31.0	C- C	33.0 31.9	C- C	33.8 33.1	C- C-	0.060 0.054	11.5 2.0
52	El Camino Real / California Ave	Palo Alto	LOS D	AM PM	23.6 28.5	C C	24.0 28.8	C C	22.8 27.9	C+ C	0.029 0.031	-0.9 -0.7
53	El Camino Real / Arastradero Rd - Charleston Rd	Palo Alto (SC CMP)	LOS E	AM PM	47.2 53.0	D D-	47.8 55.6	D E+	48.3 56.3	D E+	0.020 0.007	0.9 0.4
54	El Camino Real / San Antonio Rd	Mountain View (SC CMP)	LOS E	AM PM	52.7 53.0	D- D-	53.4 53.6	D- D-	53.4 53.5	D- D-	0.008 0.007	0.0 -0.1
55	Alma St / Lytton Ave	Palo Alto	LOS D	AM PM	18.3 18.3	B- B-	20.8 18.0	C+ B	21.8 18.6	C+ B-	0.016 0.015	1.5 0.8
56	Alma St / Hamilton Ave	Palo Alto	LOS D	AM PM	6.7 13.3	A B	6.9 14.9	A B	7.1 15.3	A B	0.008 0.012	0.2 0.8
57	Alma St / Churchill Ave	Palo Alto	LOS D	AM PM	26.9 46.5	C D	28.2 48.3	C D	28.3 48.3	C D	0.005 0.005	0.1 0.0
58	Alma St / Charleston Rd	Palo Alto	LOS D	AM PM	53.5 50.9	D- D	55.2 55.0	E+ D-	55.7 55.9	E+ E+	0.010 0.017	0.5 1.1
59	Middlefield Rd / Marsh Rd	Atherton	LOS D	AM PM	24.0 40.2	C D	29.2 53.9	C D-	30.1 54.4	C D-	0.012 0.005	1.4 0.8
60	Middlefield Rd / Ravenswood Ave	Menlo Park	LOS D	AM PM	31.3 36.1	C D+	34.3 40.4	C- D	35.0 41.2	C- D	0.012 0.012	0.8 0.9

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
61	Middlefield Rd / Ringwood Ave	Menlo Park	LOS D	AM PM	37.1 50.0	D+ D	38.0 50.6	D+ D	38.1 50.7	D+ D	0.004 0.005	0.2 0.2
62	Middlefield Rd / Willow Rd	Menlo Park	LOS D	AM PM	47.3 46.6	D D	47.9 47.3	D D	48.0 47.5	D D	0.007 0.006	5.3 0.2
63	Middlefield Rd / Lytton Ave	Palo Alto	LOS D	AM PM	36.3 43.7	D+ D	38.0 45.9	D+ D	38.3 46.5	D+ D	0.018 0.016	0.4 0.6
64	Middlefield Rd / University Ave	Palo Alto	LOS D	AM PM	29.0 33.7	C C-	30.0 35.6	C D+	30.3 36.1	C D+	0.019 0.031	0.3 0.9
65	Middlefield Rd / Hamilton Ave	Palo Alto	LOS D	AM PM	11.4 11.6	B+ B+	11.5 11.6	B+ B+	11.5 11.6	B+ B+	0.009 0.007	0.0 0.0
66	Middlefield Rd / Embarcadero Rd	Palo Alto	LOS D	AM PM	33.2 36.6	C- D+	33.7 39.6	C- D	34.1 40.1	C- D	0.030 0.025	0.7 0.5
67	St. Francis Drive / Embarcadero Road	Palo Alto	LOS D	AM PM	23.6 17.5	C B	23.6 17.5	C B	23.4 17.3	C B	0.015 0.014	0.0 -0.1
68	E. Bayshore Rd / Embarcadero Rd	Palo Alto	LOS D	AM PM	44.1 53.6	D D-	51.3 57.6	D- E+	51.6 58.1	D- E+	0.007 0.005	0.4 0.6
69	Middlefield Rd / Charleston Rd	Palo Alto	LOS D	AM PM	49.8 52.4	D D-	50.5 52.6	D D-	50.6 52.7	D D-	0.004 0.006	0.0 0.2
70	US 101 SB Ramps / Marsh Rd	Menlo Park	LOS D	AM PM	21.0 24.7	C+ C	32.6 33.9	C- C-	32.6 33.9	C- C-	0.000 0.000	0.0 0.0
71	US 101 NB Ramps / Marsh Rd	Menlo Park	LOS D	AM PM	16.3 14.9	B B	18.2 20.7	B- C+	18.2 20.7	B- C+	0.000 0.000	0.0 0.0
72	Bay Rd / Willow Rd	Menlo Park	LOS D	AM PM	16.8 10.7	B B+	18.8 10.7	B- B+	18.8 10.7	B- B+	0.008 0.006	0.1 0.0

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
73	Newbridge St / Willow Rd	Menlo Park	LOS D	AM PM	42.7 40.6	D D	43.5 44.1	D D	43.4 44.1	D D	0.005 0.004	0.0 0.2
74	O'Brien Dr / Willow Rd	Menlo Park	LOS D	AM PM	11.0 11.8	B+ B+	12.0 14.5	B+ B	11.9 14.5	B+ B	0.003 0.005	0.0 0.0
75	Hamilton Ave / Willow Rd	Menlo Park	LOS D	AM PM	14.5 18.8	B B-	40.9 45.3	D D	41.5 45.5	D D	0.005 0.003	1.0 0.3
76	Bayfront Expy / Willow Rd	Menlo Park (SM CMP)	LOS F	AM PM	39.0 56.8	D+ E+	40.3 57.8	D E+	40.3 58.0	D E+	0.000 0.004	0.0 0.2
77	Woodland Ave / University Ave	East Palo Alto	LOS D	AM PM	48.1 58.9	D E+	54.5 60.1	D- E	54.8 60.3	D- E	0.000 0.000	0.0 0.0
78	US 101 SB Ramps / University Ave	East Palo Alto	LOS D	AM PM	26.7 25.0	C C	29.4 25.5	C C	29.4 25.5	C C	0.003 0.006	0.1 0.1
79	Donohoe St / University Ave	East Palo Alto	LOS D	AM PM	65.3 42.5	E D	72.4 44.3	E D	73.2 44.3	E D	0.005 0.004	1.3 0.1
80	University Ave / Bay Rd	East Palo Alto	LOS D	AM PM	38.0 47.1	D+ D	48.6 50.1	D D	48.7 50.6	D D	0.005 0.009	0.2 0.9
81	University Ave / Bayfront Expy	Menlo Park (SM CMP)	LOS F	AM PM	21.7 85.0	C+ F	23.6 94.4	C F	23.7 96.9	C F	0.008 0.007	0.2 3.1
82	Town & Country Driveway / Embarcadero Rd	Palo Alto	LOS D	AM PM	29.2 27.9	C C	28.9 28.4	C C	28.1 28.0	C C	0.031 0.021	-0.6 -0.3
83	Charleston Rd / San Antonio Rd	Mountain View (SC CMP)	LOS E	AM PM	54.5 51.6	D- D-	61.6 62.5	E E	61.8 62.7	E E	0.001 0.002	0.3 0.4
84	US 101 SB Ramps / Willow Rd	Menlo Park	LOS D	AM PM	N/A ⁶	N/A ⁶	11.4 13.0	B+ B	11.5 13.0	B+ B	0.002 0.000	0.2 0.0

TABLE 6-1: BACKGROUND (2018) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Background (2018) No Project		Background (2018) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
85	US 101 NB Ramps / Willow Rd	Menlo Park	LOS D	AM PM	N/A ⁶	N/A ⁶	21.1 23.5	C+ C	21.2 23.5	C+ C	0.000 0.002	0.0 0.1
86	Central Expy / Rengstorff Ave	Santa Clara County (SC CMP)	LOS E	AM PM	76.7 62.1	E- E	175.3 83.9	F F	177.4 86.1	F F	0.010 0.008	3.1 1.3
87	Central Expy / Shoreline Blvd (N)	Santa Clara County (SC CMP)	LOS E	AM PM	3.2 5.4	A A	3.6 7.0	A A	3.6 6.9	A A	0.003 0.007	0.0 -0.1
88	Central Expy / Shoreline Blvd (S)	Santa Clara County (SC CMP)	LOS E	AM PM	8.1 7.4	A A	12.0 7.6	B+ A	11.9 7.5	B+ A	0.003 0.005	-0.1 0.0
89	Central Expy / Castro St- Moffett Blvd	Santa Clara County (SC CMP)	LOS E	AM PM	62.6 63.4	E E	122.6 94.4	F F	125.1 97.1	F F	0.007 0.006	4.1 3.3
90	Foothill Expy / Edith Ave	Santa Clara County	LOS E	AM PM	28.8 27.6	C C	28.9 39.0	C D+	29.2 43.2	C D	0.016 0.288	0.6 22.9
91	Foothill Expy / Main St	Santa Clara County (SC CMP)	LOS E	AM PM	22.3 22.5	C+ C+	23.0 24.3	C+ C	23.2 24.4	C C	0.016 0.009	0.5 -0.4
92	University Ave / O'Brien Dr	Menlo Park	LOS D	AM PM	7.8 12.5	A B	9.2 12.7	A B	9.2 12.7	A B	0.005 0.006	0.0 0.0
Additional Intersections												
93	University Ave / Adams Dr*	Menlo Park	LOS E (warrant)	AM PM	62.4 21.4	F ¹⁰ C	76.3 30.7	F ¹⁰ D	79.8 31.9	F ¹⁰ D	N/A	N/A
94	University Ave / Runnymede St	East Palo Alto	LOS D	AM PM	14.9 19.8	B B-	15.3 19.9	B B-	15.3 19.8	B B-	0.005 0.005	0 0
95	University Avenue / Bell Street	East Palo Alto	LOS D	AM PM	14.5 17.7	B B	14.8 18.2	B B-	14.7 18.1	B B-	0.005 0.005	0 -0.1

Notes: **Bold text** indicates intersection operates at unacceptable level of service. **Bold and highlighted text** indicates a significant impact.

*Indicates unsignalized intersection.

1. Intersection jurisdiction and identification of CMP (Congestion Management Program) intersections.
(SC CMP) – CMP intersection in Santa Clara County
(SM CMP) – CMP intersection in San Mateo County
2. LOS Threshold is the threshold between acceptable and unacceptable level of service.
3. AM = morning peak hour, PM = evening peak hour.
4. Existing presents the delay and LOS for intersections using existing intersection geometry and existing traffic counts.
5. Whole intersection weighted average control delay expressed in seconds per vehicle calculated using methods described in the 2000 *Highway Capacity Manual*, with adjusted saturation flow rates to reflect Santa Clara County Conditions for signalized intersections. For side-street stop-controlled intersections, delay and LOS are reported for the worst-case approach.
6. LOS = Level of Service. LOS calculations conducted using the TRAFFIX 8.0 analysis software packages, which applies the methods described in the 2000 *Highway Capacity Manual*.
7. Change in critical volume to capacity ratio between Background (2018) and Background (2018) With Project Conditions. This ratio is not applicable for side-street stop controlled intersections and is denoted by "N/A".
8. Change in average critical movement delay between Background (2018) and Background (2018) With Project Conditions. This ratio is not applicable for side-street stop controlled intersections and is denoted by "N/A".
9. The US 101 / Willow Road interchange reconfiguration is estimated to be constructed by 2020, and is denoted by "N/A" under Existing and Background (2018) Conditions.
10. A signal warrant is not met for this intersection.

Source: Fehr & Peers, August 2017.

6.2 BACKGROUND (2018) FREEWAY SEGMENT ANALYSIS

The future operations of freeway mainline segments in Santa Clara County and San Mateo County are evaluated using V/C ratios, with the volume-to-capacity ratio greater than 1.0 indicating the vehicle demand exceeds capacity. Freeway volumes for the Background (2018) No Project and Background (2018) With Project cases were developed as described in Chapter 5. As described in Chapter 3, a Santa Clara County VTA freeway segment impact under Background (2018) with Project Conditions is determined to occur when:

- the addition of traffic causes a freeway segment volume-to-capacity ratio to exceed 1.0, or
- the Project increases traffic demand on a freeway segment already operating at a V/C greater than or equal to 1.0 by an amount equal to one percent or more of the segment capacity.

Freeway segments in San Mateo County also abide by this impact criteria. Plus, an impact may occur if the Project causes the freeway segment V/C ratio to increase by one (1.0) percent on a segment already operating at a V/C greater than or equal to 1.0.

Freeway segments with significant Project impacts under Background (2018) with Project Conditions are:

- Northbound State Route 85
 - South De Anza Boulevard to Stevens Creek Boulevard (AM peak hour);
 - Stevens Creek Boulevard to I-280 (AM peak hour);
- Southbound State Route 85
 - Stevens Creek Boulevard to South De Anza Boulevard (PM peak hour);
- Southbound Interstate 280
 - El Monte Road to Magdalena Avenue (PM peak hour).

Appendix J includes the freeway V/C ratio calculations, levels of service, and impact assessment. See Chapter 8: Transportation Impact Assessment, for further discussion on freeway segment impacts and mitigations.

6.2.1 BACKGROUND (2018) FREEWAY RAMP ANALYSIS

The freeway ramp analysis was conducted to assess increases in peak period ramp queue lengths with the addition of Project traffic and their effects of freeway and local street operations. Ramp queuing is not considered an environmental impact, but rather an operational consideration that is managed over time by Caltrans and local jurisdictions. Thus, the results are provided for information purposes only.

6.2.1.1 On-Ramp Analysis Results

The on-ramp queuing results for the AM and PM peak periods are presented in **Table 6-2** and the calculation sheets are provided in **Appendix H**.

On-ramp queues were evaluated for Background (2018) No Project and With Project conditions. The US 101 / Embarcadero Road and US 101 / Oregon Expressway ramps are the only metered on-ramps within the study area. Caltrans operates dynamic ramp metering rates based on the queues on the freeways and on the ramps. Therefore, the on-ramp queues were evaluated at the minimum and maximum ramp metering rates to show the potential range of queues at the given ramp. As shown in **Table 6-2**, the Embarcadero Road on-ramp queue will surpass the available storage when the ramp metering rate operates at the maximum, 900 vehicles per hour, rate during the PM peak period under No Project and With Project Conditions. All other queues are anticipated to remain within the available storage when operating at the maximum ramp metering rate. All queues are anticipated to exceed the available storage when using the minimum ramp metering rate (it is unlikely that the metering rate will remain at the minimum rate).

Volumes from all other on-ramps that provide access to Stanford University are shown in **Table 6-3**.

TABLE 6-2: BACKGROUND (2018) FREEWAY ON-RAMP QUEUING EVALUATION

On-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Background (2018) No Project		Background (2018) With Project	
			Ramp Volume	Queue (ft) ^{3, 4} “Min. / Max.”	Ramp Volume	Queue (ft) ^{3, 4} “Min. / Max.”
US 101 Southbound On-Ramps						
Oregon Expressway (diagonal)	1,400	AM	1,383	30 / 20,280	1,389	30 / 20,400
		PM	1,305	30 / 67,140	1,318	30 / 68,370
Embarcadero Road (diagonal)	1,150	AM	817	30 / 18,630	833	30 / 19,500
		PM	803	1,890 / 31,770	835	2,490 / 35,010

Notes: **Bold** text indicates conditions where the queue exceeds the available storage capacity.

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.
2. AM peak period – 6:00 AM to 9:00 AM. PM peak period – 3:00 PM to 7:00 PM.
3. Minimum queues estimated using the maximum metering rates as presented in **Table 4-4**. Maximum queues estimated using the minimum metering rates as presented in **Table 4-4**. The minimum queue is one vehicle, which is equal to 30 feet.
4. "N/A" = not applicable, ramp is not metered during that time period.

Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

TABLE 6-3: BACKGROUND (2018) FREEWAY NON-METERED ON-RAMP VOLUMES

On-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Background (2018) No Project Volume	Background (2018) With Project Volume
US 101 Northbound On-Ramps				
Willow Road (loop)	650	AM PM	372 243	374 249
University Avenue (loop)	880	AM PM	381 202	383 206
I-280 Northbound On-Ramps				
Sand Hill Road (diagonal)	1,460	AM PM	631 1,516	675 1,617
Alpine Road (diagonal)	1,000	AM PM	360 710	360 710
Page Mill Road (diagonal)	700	AM PM	740 430	756 459
I-280 Southbound On-Ramps				
Page Mill Road (loop)	1,500	AM PM	606 948	650 1,037
Alpine Road (loop)	650	AM PM	377 563	377 563
Sand Hill Road (loop)	800	AM PM	390 1,200	398 1,211

Notes: **Bold** text indicates conditions where the queue exceeds the available storage capacity.

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.

2. AM peak period – 6:00AM to 9:00AM. PM peak period – 3:00PM to 7:00PM.

Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

6.2.1.2 Off-Ramp Analysis Results

This section summarizes the queues calculated using the Poisson distribution method at the off-ramps with signalized terminal intersections for the AM and PM peak periods. **Table 6-4** presents the desired storage for the signalized turning movements that serve trips travelling toward Stanford. Off-ramp calculation sheets are provided in **Appendix H**. Data is used for either left-turning or right-turning movements/storage lengths, based on which turning movement serves the Project site. Queue lengths were calculated using a vehicle length of 30 feet.

As shown in **Table 6-4**, all off-ramps are expected to serve vehicle queues within the available ramp storage, with the exception of the I-280 / Sand Hill Road northbound diagonal off-ramp. Under Background (2018) No Project Conditions, the I-280 / Sand Hill Road northbound diagonal on-ramp is anticipated to experience a vehicle queue of 1,740 feet in the AM peak period, and with the Project, that queue will extend to 1,860

feet. This results in a queue spillback into the freeway mainline of 1,000 feet and 1,120 feet without and with the Project, respectively.

Additionally, the following queues are anticipated to exceed the available turn-pocket storage queue:

- US 101 / University Avenue southbound loop off-ramp – right-turn queue exceeds pocket storage length during the AM and PM peak periods, without and with the Project
- I-280 / Sand Hill Road northbound diagonal off-ramp – right-turn queue exceeds pocket storage length during the AM and PM peak periods, without and with the Project
- I-280 / Page Mill Road northbound diagonal off-ramp – left-turn queue exceeds pocket storage length during the AM peak period, without and with the Project
- I-280 / Page Mill Road southbound diagonal off-ramp – left-turn queue exceeds pocket storage length during the AM and PM peak periods, without and with the Project

While these turn queues are anticipated to exceed the available turn pocket storage, the queue would still be served within the total ramp storage, and would not spillback into the freeway mainline.

TABLE 6-4: BACKGROUND (2018) FREEWAY OFF-RAMP QUEUING EVALUATION - SIGNALIZED AND STOP-CONTROLLED TERMINAL INTERSECTIONS

Off-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Background (2018) No Project		Background (2018) With Project	
			Ramp Volume ³	Queue (ft) ⁴	Ramp Volume ³	Queue (ft) ⁴
US 101 Northbound Off-Ramps						
Embarcadero Road (loop) ⁵	See Table 6-5. ⁶					
US 101 Southbound Off-Ramps						
Willow Road (diagonal)	See Table 6-5. ⁶					
University Avenue (loop)	1,870 / 190	AM PM	262 / 360 191 / 560	480 / 630 300 / 660	265 / 360 194 / 560	480 / 630 300 / 690
I-280 Northbound Off-Ramps						
Sand Hill Road (diagonal)	740 / 300	AM PM	100 / 710 50 / 300	90 / 1,740 60 / 510	100 / 713 50 / 305	90 / 1,860 60 / 540
Alpine Road (diagonal) ⁸	1,360 / 280	AM PM	250 / 881 130 / 272	30 / ⁷ 30 / ⁷	250 / 911 130 / 293	30 / ⁷ 30 / ⁷
Page Mill Road (diagonal) ⁸	60 / 1,830	AM PM	140 / 1,839 50 / 341	90 / ⁷ 30 / ⁷	140 / 1,926 50 / 406	90 / ⁷ 30 / ⁷

**TABLE 6-4: BACKGROUND (2018) FREEWAY OFF-RAMP QUEUING EVALUATION -
SIGNALIZED AND STOP-CONTROLLED TERMINAL INTERSECTIONS**

Off-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Background (2018) No Project		Background (2018) With Project	
			Ramp Volume ³	Queue (ft) ⁴	Ramp Volume ³	Queue (ft) ⁴
I-280 Southbound Off-Ramps						
Sand Hill Road (loop)	See Table 6-5. ⁶					
Alpine Road (diagonal) ⁸	1,370 / 450	AM PM	390 / 520 160 / 270	240 / ⁷ 60 / ⁷	390 / 520 160 / 270	240 / ⁷ 60 / ⁷
Page Mill Road (diagonal) ⁸	150 / 1,940	AM PM	1,140 / 50 820 / 100	810 / ⁷ 330 / ⁷	1,143 / 50 827 / 100	810 / ⁷ 330 / ⁷

Notes: **Bold** text indicates conditions where the queue exceeds the turn pocket capacity.

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements (not necessarily the freeway/ramp gore point).

Storage Capacity for a Controlled Ramp - ##/## = left-turn and (or) through pocket / right-turn pocket

2. AM peak period – 6:00 AM to 9:00 AM. PM peak period – 3:00 PM to 7:00 PM.

3. Ramp volume by turning movement - ##/## = left-turn and (or) through movement / right-turn movement

4. The queue indicated represents the 95th Percentile Queue for signalized movements and the Average Queue for stop-controlled movements - ##/## = left-turn and (or) through queue / right-turn queue

5. Oregon Expressway off-ramp is not evaluated under this evaluation. The northbound Oregon Expressway off-ramp is the beginning of Oregon Expressway and enters directly onto the roadway without any conflicting movement.

6. Table 6-5 includes the uncontrolled off-ramps.

7. Only the left-turn movement is stop-controlled. Free right-turn queues are not provided.

8. For all-way stop-controlled ramp intersections, the average queue is reported due to the limitations of the 2000 HCM.

Source: Fehr & Peers, August 2017.

Table 6-5 summarizes the V/C ratios for the off-ramps with uncontrolled terminal intersections for the AM and PM peak periods. Most of the V/C ratios for Background (2018) Conditions without and with the Project are less than 1.00, indicating that the off-ramps have sufficient capacity to accommodate the exiting volumes at these locations, with the exception of the following off-ramps:

- I-280 / Page Mill Road northbound diagonal off-ramp (No Project V/C is 0.97, With Project V/C is 1.01, in the AM peak period);
- I-280 / Sand Hill Road southbound loop off-ramp (No Project V/C is 1.15, With Project V/C is 1.21, in the AM peak period).

TABLE 6-5: BACKGROUND (2018) FREEWAY OFF-RAMP QUEUING EVALUATION - UNCONTROLLED TERMINAL INTERSECTIONS

Off-Ramp	Maximum Vehicle Flow Rate - Capacity (vphpl) ¹	Peak Period ²	Background (2018) No Project		Background (2018) With Project	
			Ramp Volume	V/C ³	Ramp Volume	V/C ³
US 101 Northbound Off-Ramps						
Embarcadero Road (loop) ⁴	1,800	AM	644	0.36	681	0.38
		PM	510	0.28	530	0.29
US 101 Southbound Off-Ramps						
Willow Road (diagonal)	1,900	AM	433	0.23	440	0.23
		PM	402	0.21	405	0.21
University Avenue (loop)	See Table 6-4. ⁶					
I-280 Northbound Off-Ramps						
Sand Hill Road (diagonal)	See Table 6-4. ⁶					
Alpine Road (diagonal) ⁵	1,900	AM	881	0.46	911	0.48
		PM	272	0.14	294	0.15
Page Mill Road (diagonal) ⁵	1,900	AM	1,839	0.97	1,926	1.01
		PM	341	0.18	406	0.21
I-280 Southbound Off-Ramps						
Sand Hill Road (loop)	1,800	AM	2,065	1.15	2,179	1.21
		PM	722	0.40	782	0.43
Alpine Road (diagonal) ⁵	1,900	AM	520	0.27	520	0.27
		PM	270	0.14	270	0.14
Page Mill Road (diagonal) ⁵	1,900	AM	50	0.03	50	0.03
		PM	100	0.05	100	0.05

Notes: **Bold** text indicates the off-ramp does not have sufficient capacity to accommodate the exiting volumes.

1. Diagonal ramps were assumed to have a capacity of 1,900 vehicles per hour per lane (vphpl). Loop ramps were assumed to have a capacity of 1,800 vphpl.
2. AM peak period – 6:00 AM to 9:00 AM. PM peak period – 3:00 PM to 7:00 PM.
3. V/C = volume-to-capacity ratio.

4. Oregon Expressway off-ramp is not evaluated under this evaluation. The northbound Oregon Expressway off-ramp is the beginning of Oregon Expressway and enters directly onto the roadway without any conflicting movement.
 5. The right-turn movement is uncontrolled. Therefore, the right-turn volume and V/C is the only ramp movement reported in the table.
 6. Table 6-4 includes the signalized and stop-controlled off-ramps.
- Source: Fehr & Peers, August 2017.

6.3 BACKGROUND (2018) TRANSIT DELAY ANALYSIS

The Project will add traffic along major transit corridors throughout the Cities of Palo Alto and Menlo Park, which could affect operations of VTA and C/CAG's bus routes. The bus routes evaluated along with the methodology for estimating this delay is described in Chapter 3, Section 3.6. The additional delay to transit service in the area due to implementation of the Project is shown in **Table 6-6. Appendix K** contains the calculation summary for each transit route.

Based on the delay assessment, the Project does not add substantial delays relative to the total route travel time to any of the transit routes assessed. The additional delay is less than 15 seconds on all but two of the routes, and less than 25 seconds in all cases. The longest-delay result, 20.8 seconds on the Dumbarton Express 1 westbound in the AM, constitutes less than one percent of the total travel time on that route.

TABLE 6-6: BACKGROUND (2018) WITH PROJECT TRANSIT ROUTE DELAY

Route		Direction	Peak Hour	Additional Route Average Delay with Project (seconds) ¹
22	Palo Alto Transit Center to Eastridge Transit Center via El Camino	Eastbound	AM PM	< 5.0 14.3
		Westbound	AM PM	10.9 7.0
35	Downtown Mountain View to Stanford Shopping Center	Northbound	AM PM	< 5.0 < 5.0
		Southbound	AM PM	< 5.0 < 5.0
89	California Avenue Caltrain Station to Palo Alto Veterans Hospital	Northbound	AM PM	< 5.0 < 5.0
		Southbound	AM PM	< 5.0 < 5.0
102	South San Jose to Palo Alto	Northbound	AM	< 5.0
		Southbound	PM	7.1
104	Penitencia Creek Transit Center to Palo Alto	Eastbound	PM	< 5.0
		Westbound	AM	14.4

TABLE 6-6: BACKGROUND (2018) WITH PROJECT TRANSIT ROUTE DELAY

Route		Direction	Peak Hour	Additional Route Average Delay with Project (seconds) ¹
522	Palo Alto Transit Center to Eastridge Transit Center	Eastbound	AM PM	< 5.0 16.0
		Westbound	AM PM	10.9 7.0
281	Onetta Harris Center to Stanford Shopping Center	Eastbound	AM PM	5.1 < 5.0
		Westbound	AM PM	< 5.0 < 5.0
ECR	Daly City BART to Palo Alto Transit Center	Northbound	AM PM	< 5.0 < 5.0
		Southbound	AM PM	< 5.0 < 5.0
DB	Dumbarton Express - Union City BART to Stanford Oval	Eastbound	AM PM	< 5.0 < 5.0
		Westbound	AM PM	< 5.0 < 5.0
DB1	Dumbarton Express 1 - Union City BART to Stanford Research Park	Eastbound	AM PM	< 5.0 9.3
		Westbound	AM PM	20.8 13.3
U	Fremont BART to Stanford Oval	Eastbound	PM	12.3
		Westbound	AM	< 5.0
E	University Avenue Caltrain Station to Baylands Business Parks	Eastbound	AM PM	< 5.0 5.3
		Westbound	AM PM	< 5.0 < 5.0
C	University Avenue/Downtown to South Palo Alto at Charleston Road	Eastbound	AM PM	< 5.0 < 5.0
		Westbound	AM PM	< 5.0 < 5.0

Note:

1. The Project was not considered to have a measureable change in overall transit delay if the increase in travel time was less than five seconds or the travel time improved slightly (due to changes in signal timing, critical movement changes, etc.).

Source: Fehr & Peers, August 2017.

6.4 BACKGROUND (2018) BICYCLE AND PEDESTRIAN QUALITY OF SERVICE ANALYSIS

Pedestrian and bicycle QOS analysis is presented in Chapter 8, as the analysis depends on the traffic mitigation measures proposed.



7. CUMULATIVE (2035) CONDITIONS: NO PROJECT AND WITH PROJECT

This section presents the operations of the surrounding transportation system under Cumulative (2035) No Project and Cumulative (2035) With Project Conditions. Cumulative (2035) No Project Conditions are defined as conditions without the 2018 General Use Permit. Traffic volumes for Cumulative (2035) No Project Conditions are based on forecasts from the VTA traffic model, including ABAG 2040 land use projections, traffic generated by approved development projects, and the completion of the 2000 General Use Permit (including the Escondido Village Graduate Residences project), as described in Chapter 5. A list of planned transportation improvements within the study area may be found in **Appendix I**.

Cumulative (2035) With Project Conditions are defined as Cumulative (2035) No Project Conditions plus traffic generated by build-out of the 2018 General Use Permit.

7.1 CUMULATIVE (2035) INTERSECTION ANALYSIS

Level of service calculations were conducted using the TRAFFIX 8.0 software to evaluate signalized and unsignalized intersection operations under Cumulative (2035) No Project and Cumulative (2035) With Project Conditions. The TRAFFIX 8.0 software uses the *2000 HCM* methodology, per the VTA TIA Guidelines. The intersection volumes are shown in **Appendix E** and results of the LOS analysis are summarized in **Table 7-1**. The corresponding LOS calculation sheets are included in **Appendix F** and the peak hour signal warrants for intersections that are significantly impacted are provided in **Appendix G**.

The results for Existing Conditions are included in **Table 7-1** for comparison purposes, along with the projected increases in critical delay and critical volume-to-capacity (V/C) ratios between the Cumulative (2035) No Project and Cumulative (2035) With Project Conditions.

Figure 7-1 and **Figure 7-2** show the LOS results graphically by intersection for the Cumulative (2035) No Project and Cumulative (2035) With Project Conditions, respectively. Critical delay represents the delay associated with the critical movements of the intersection, or the movements that require the most “green time” and have the greatest effect on overall intersection operations. Project impacts are identified by comparing Cumulative (2035) No Project with Cumulative (2035) With Project Conditions. Significant impacts are identified based on the impact criteria stated earlier, which includes changes in the LOS from an acceptable to an unacceptable level or changes in critical delay and critical V/C ratio for intersection operating unacceptably. The Project has significant impacts on 21 intersections under Cumulative (2035) With Project Conditions.

As shown in **Table 7-1**, in the Cumulative (2035) With Project analysis, significant impacts are identified at 21 intersections:

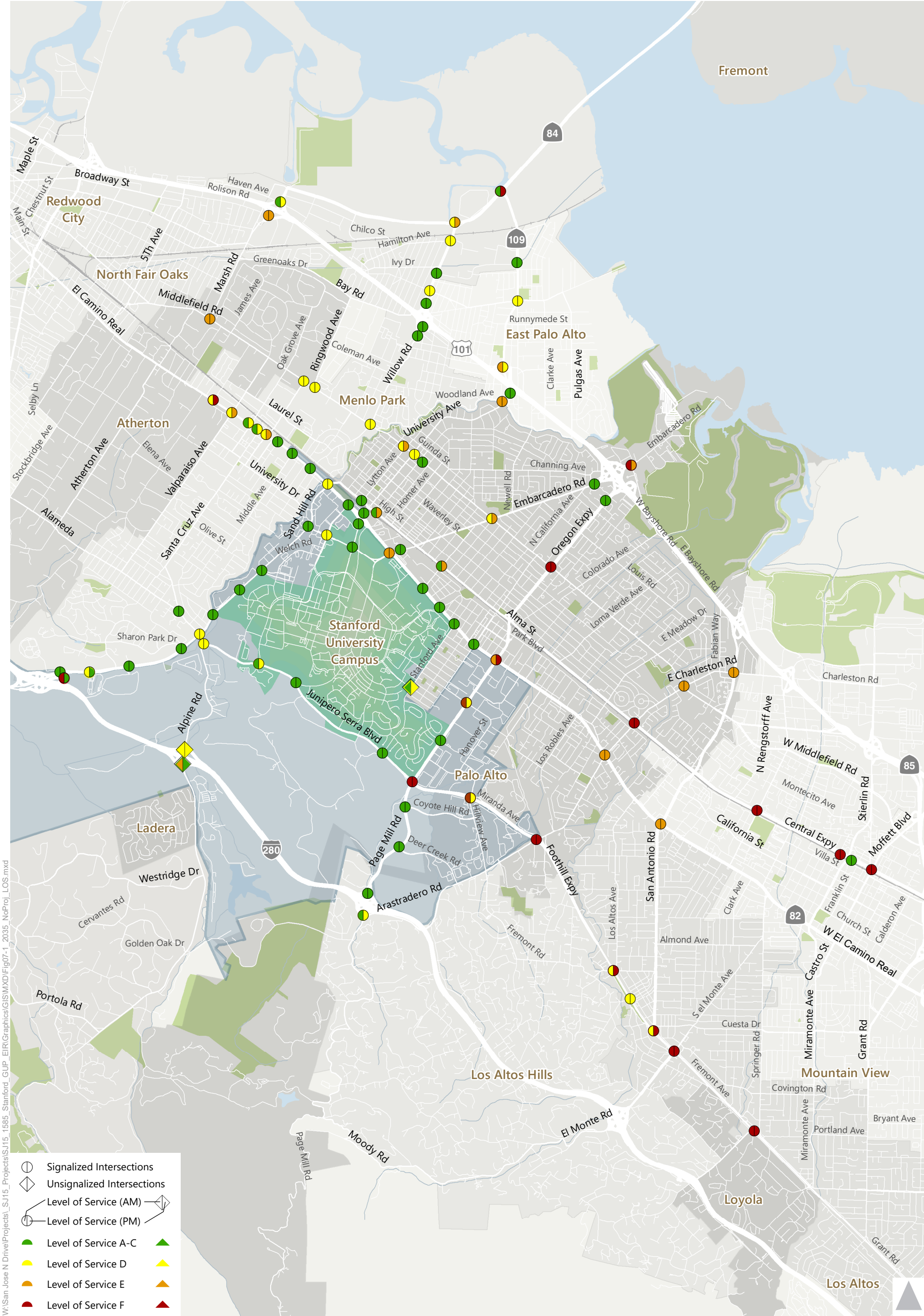
- Intersection #2: I-280 NB Off-Ramp/Sand Hill Road (AM peak hour)
- Intersection #17: Junipero Serra Blvd./Foothill Expressway/Page Mill Road (AM and PM peak hours)
- Intersection #19: Hanover Street/Page Mill Road (AM peak hour)
- Intersection #20: El Camino Real/Page Mill Road/Oregon Expressway (AM and PM peak hours)
- Intersection #21: Middlefield Road/Oregon Expressway (AM peak hour)
- Intersection #29: Foothill Expressway/Hillview Avenue (AM peak hour)
- Intersection #30: Foothill Expressway/Arastradero Road (AM and PM peak hours)
- Intersection #31: Foothill Expressway/San Antonio Road (PM peak hour)
- Intersection #32: Foothill Expressway/El Monte Avenue (AM peak hour)
- Intersection #33: Foothill Expressway/Springer Road-Magdalena Avenue (AM and PM peak hours)
- Intersection #37: El Camino Real/Encinal Avenue (PM peak hour)
- Intersection #38: El Camino Real/Valparaiso Avenue (PM peak hour)
- Intersection #41: El Camino Real/Ravenswood Road (PM peak hour)
- Intersection #48: El Camino Real/Embarcadero Road (PM peak hour)
- Intersection #56: Alma Street/Hamilton Avenue (PM peak hour)
- Intersection #58: Alma Street/Charleston Road (PM peak hour)
- Intersection #59: Middlefield Road/Marsh Road (AM peak hour)
- Intersection #63: Middlefield Road/Lytton Avenue (PM peak hour)

- Intersection #66: Middlefield Road/Embarcadero Road (AM and PM peak hours)
- Intersection #89: Central Expressway/Castro Street-Moffett Boulevard (AM peak hour)
- Intersection #90: Foothill Expressway/Edith Avenue (PM peak hour)

Mitigation measures to address these impacts are presented in Chapter 8.



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- Signalized Intersections
- Unsignalized Intersections
- Level of Service (AM)
- Level of Service (PM)
- Level of Service A-C
- Level of Service D
- Level of Service E
- Level of Service F

Stanford University Campus

Stanford Lands



Figure 7-1

Stanford 2018 General Use Permit 2035 No Project Intersection Level of Service Results

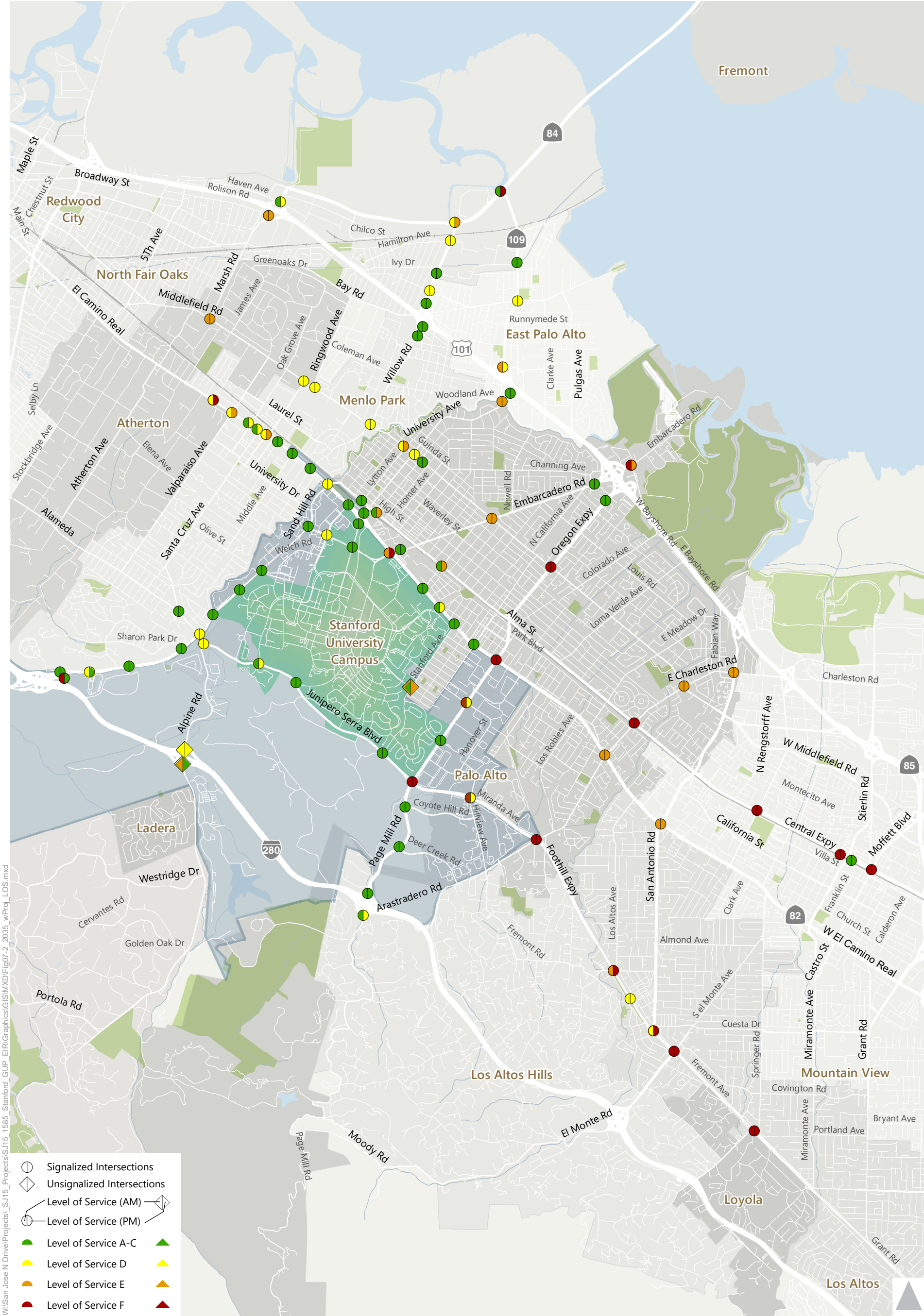


Figure 7-2

Stanford 2018 General Use Permit 2035 With Project Intersection Level of Service Results

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
1	I-280 NB On-Ramp / Sand Hill Rd	Menlo Park	LOS D	AM PM	10.6 10.2	B+ B+	10.3 12.6	B+ B	10.1 13.7	B+ B	0.015 0.032	-0.2 1.2
2	I-280 NB Off-Ramp / Sand Hill Rd	Menlo Park	LOS D	AM PM	39.1 17.2	D B	136.9 18.4	F B-	155.2 18.6	F B-	0.038 0.021	19.2 0.2
3	Addison Wesley / Sand Hill Rd	Menlo Park	LOS D	AM PM	18.8 19.4	B- B-	37.9 21.5	D+ C+	49.6 22.3	D C+	0.037 0.032	18.3 1.4
4	Saga Ln / Sand Hill Rd	Menlo Park	LOS D	AM PM	13.6 19.0	B B-	19.4 30.1	B- C	19.6 29.8	B- C	0.036 0.031	0.5 -0.2
5	Sharon Park Dr / Sand Hill Rd	Menlo Park	LOS D	AM PM	16.5 15.8	B B	17.4 18.9	B B-	17.4 18.6	B B-	0.036 0.032	0.3 0.0
6	Alameda de las Pulgas / Santa Cruz Ave	San Mateo County	LOS D	AM PM	13.9 13.8	B B	13.3 14.6	B B	13.3 14.5	B B	0.000 0.000	0.0 0.0
7	Santa Cruz Ave / Sand Hill Rd	Menlo Park	LOS D	AM PM	47.2 46.7	D D	50.6 45.9	D D	52.1 46.9	D- D	0.030 0.038	2.0 1.7
8	Oak Ave / Sand Hill Rd	Menlo Park	LOS D	AM PM	10.5 3.8	B+ A	10.5 3.9	B+ A	10.5 3.9	B+ A	0.025 0.024	0.1 0.1
9	Stock Farm Rd / Sand Hill Rd	Palo Alto	LOS D	AM PM	20.0 25.9	C+ C	24.3 29.4	C C	25.4 30.3	C C	0.028 0.022	1.7 0.9
10	Pasteur Dr / Sand Hill Rd	Palo Alto	LOS D	AM PM	19.9 23.9	B- C	20.8 26.9	C+ C	20.8 27.7	C+ C	0.009 0.021	0.4 1.4
11	Arboretum Rd / Sand Hill Rd	Palo Alto	LOS D	AM PM	21.5 27.8	C+ C	25.2 31.6	C C	25.9 32.3	C C-	0.013 0.012	1.2 0.9
12	El Camino Real / Sand Hill Rd	Palo Alto (SC CMP)	LOS E	AM PM	32.8 32.1	C- C-	43.7 39.8	D D	43.6 40.3	D D	0.016 0.013	-3.1 0.6

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
13	I-280 SB Ramps / Page Mill Rd**	Santa Clara County	LOS E (warrant)	AM PM	93.4 72.0	F F	32.5 47.1	C- D	32.7 47.8	C- D	0.002 0.005	0.1 0.2
14	I-280 NB Ramps / Page Mill Rd**	Santa Clara County	LOS E (warrant)	AM PM	14.2 13.4	D B	9.3 11.7	A B+	9.3 12.2	A B	0.004 0.007	0.1 1.8
15	Deer Creek Rd / Page Mill Rd	Santa Clara County	LOS E	AM PM	14.2 13.4	B B	15.9 13.8	B B	16.6 13.9	B B	0.021 0.016	1.2 -0.3
16	Coyote Hill Rd / Page Mill Rd	Santa Clara County	LOS E	AM PM	7.5 8.6	A A	8.0 8.7	A A	8.5 9.0	A A	0.011 0.016	0.0 -0.2
17	Junipero Serra Blvd - Foothill Expy / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	AM PM	93.6 93.0	F F	163.6 152.6	F F	169.5 166.9	F F	0.026 0.063	4.2 20.3
18	Peter Coutts / Page Mill Rd	Santa Clara County	LOS E	AM PM	20.0 28.4	C+ C	22.7 30.6	C+ C	23.3 30.9	C C	0.020 0.015	0.9 0.0
19	Hanover St / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	AM PM	60.1 48.6	E D	90.7 52.7	F D-	97.6 53.8	F D-	0.025 0.018	11.6 0.7
20	El Camino Real / Page Mill Rd - Oregon Expy	Santa Clara County (SC CMP)	LOS E	AM PM	57.9 62.2	E+ E	76.4 83.1	E- F	86.3 90.7	F F	0.047 0.035	13.4 10.8
21	Middlefield Rd / Oregon Expy	Santa Clara County (SC CMP)	LOS E	AM PM	62.3 57.5	E E+	122.6 101.6	F F	125.3 103.7	F F	0.014 0.012	4.4 3.1
22	Oregon Expy / West Bayshore Rd	Santa Clara County	LOS E	AM PM	17.3 18.7	B B-	23.6 20.9	C C+	23.6 21.0	C C+	0.003 0.008	0.0 0.1
23	I-280 SB Ramps / Alpine Rd*	San Mateo County	LOS E (warrant)	AM PM	36.6 15.7	E C	42.0 16.7	E C	42.7 16.9	E C	N/A	N/A
24	I-280 NB Ramps / Alpine Rd*	San Mateo County	LOS E (warrant)	AM PM	25.1 24.2	D C	26.3 26.7	D D	27.4 29.7	D D	N/A	N/A

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
25	Junipero Serra Blvd / Alpine Rd	Menlo Park	LOS D	AM PM	41.9 47.4	D D	47.3 50.4	D D	50.7 52.6	D D-	0.049 0.029	4.3 1.6
26	Junipero Serra Blvd / Campus Drive West	Santa Clara County	LOS E	AM PM	26.9 37.8	C D+	29.9 43.7	C D	32.2 49.9	C- D	0.009 0.043	1.4 8.2
27	Junipero Serra Blvd / Campus Drive East	Santa Clara County	LOS E	AM PM	13.2 15.2	B B	14.0 18.1	B B-	14.3 19.7	B B-	0.020 0.037	0.7 2.7
28	Junipero Serra Blvd / Stanford Ave	Santa Clara County	LOS E	AM PM	18.8 19.9	B- B-	20.6 25.9	C+ C	22.4 31.3	C+ C	0.061 0.084	2.5 7.3
29	Foothill Expy / Hillview Ave	Santa Clara County	LOS E	AM PM	33.5 34.2	C- C-	121.1 48.2	F D	131.6 52.4	F D-	0.024 0.015	16.1 6.7
30	Foothill Expy / Arastradero Rd	Santa Clara County (SC CMP)	LOS E	AM PM	66.9 83.6	E F	293.4 211.5	F F	298.6 217.3	F F	0.016 0.013	7.8 -2.0
31	Foothill Expy / San Antonio Rd	Santa Clara County (SC CMP)	LOS E	AM PM	17.9 67.2	B E	36.0 156.3	D+ F	40.1 161.2	D F	0.016 0.021	6.1 7.6
32	Foothill Expy / El Monte Ave	Santa Clara County (SC CMP)	LOS E	AM PM	63.3 84.4	E F	142.1 123.9	F F	148.9 128.4	F F	0.014 0.004	13.5 1.8
33	Foothill Expy / Springer Road-Magdalena Ave	Santa Clara County (SC CMP)	LOS E	AM PM	58.8 70.2	E+ E	128.7 148.3	F F	131.9 151.1	F F	0.014 0.010	4.8 5.1
34	Bowdoin St / Stanford Ave*	Palo Alto	LOS E (warrant)	AM PM	13.1 16.8	B C	16.7 25.8	C D	22.8 43.2	C E	N/A	N/A
35	Arboretum Rd / Quarry Rd	Palo Alto	LOS D	AM PM	44.9 42.2	D D	46.8 43.3	D D	47.5 44.2	D D	0.040 0.039	1.3 1.8
36	Arboretum Rd / Palm Dr	Palo Alto	LOS D	AM PM	30.0 29.7	C C	31.0 31.1	C C	32.4 32.5	C- C-	0.080 0.049	2.1 2.5

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
37	El Camino Real / Encinal Ave	Menlo Park	LOS D	AM PM	16.8 29.5	B C	44.9 89.9	D F	45.4 92.9	D F	0.007 0.015	1.4 5.5
38	El Camino Real / Valparaiso Ave	Menlo Park	LOS D	AM PM	40.2 37.5	D D+	53.5 56.0	D- E+	54.0 57.4	D- E+	0.017 0.015	1.9 2.7
39	El Camino Real / Oak Grove Ave	Menlo Park	LOS D	AM PM	30.7 35.0	C D+	34.4 39.0	C- D+	34.1 38.9	C- D+	0.018 0.017	-0.2 0.0
40	El Camino Real / Santa Cruz Ave	Menlo Park	LOS D	AM PM	13.6 19.7	B B-	26.8 35.5	C D+	26.5 35.5	C D+	0.018 0.010	-0.1 0.0
41	El Camino Real / Ravenswood Rd	Menlo Park	LOS D	AM PM	41.2 44.6	D D	48.0 63.8	D E	48.7 65.8	D E	0.008 0.020	1.0 3.8
42	El Camino Real / Roble Ave	Menlo Park	LOS D	AM PM	12.9 13.4	B B	12.8 15.3	B B	12.7 15.2	B B	0.006 0.009	-0.1 -0.1
43	El Camino Real / Middle Ave	Menlo Park	LOS D	AM PM	27.1 27.1	C C	25.1 28.5	C C	24.9 28.3	C C	0.014 0.009	-0.2 0.1
44	El Camino Real / Cambridge Ave	Menlo Park	LOS D	AM PM	13.2 19.1	B B-	15.2 24.8	B C	15.0 24.8	B C	0.014 0.009	-0.2 0.2
45	El Camino Real / Quarry Rd	Palo Alto	LOS D	AM PM	15.2 33.1	B C-	12.0 33.0	B+ C-	13.3 34.8	B C-	0.029 0.032	1.6 2.7
46	El Camino Real (SB) / University Ave	Palo Alto (SC CMP)	LOS E	AM PM	21.0 20.0	C+ C+	21.0 22.7	C+ C+	20.7 22.5	C+ C+	0.016 0.031	-0.1 0.0
47	El Camino Real (NB) / University Ave	Palo Alto (SC CMP)	LOS E	AM PM	18.7 26.3	B- C	27.3 25.2	C C	28.6 26.1	C C	0.008 0.016	0.5 0.7
48	El Camino Real / Embarcadero Rd	Palo Alto (SC CMP)	LOS E	AM PM	44.9 49.1	D D	56.9 72.1	E+ E	60.4 82.2	E F	0.032 0.059	5.2 20.0

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
49	El Camino Real / Churchill Ave	Palo Alto	LOS D	AM PM	23.1 25.9	C C	25.4 27.1	C C	25.3 27.1	C C	0.017 0.018	0.1 0.1
50	El Camino Real / Serra St	Palo Alto	LOS D	AM PM	22.3 25.8	C+ C	25.2 29.0	C C	28.8 35.8	C D+	0.082 0.111	6.0 10.8
51	El Camino Real / Stanford Ave	Palo Alto	LOS D	AM PM	33.0 31.0	C- C	31.0 32.3	C C-	31.7 34.8	C C-	0.033 0.054	1.0 4.0
52	El Camino Real / California Ave	Palo Alto	LOS D	AM PM	23.6 28.5	C C	22.7 27.7	C+ C	22.1 27.5	C+ C	0.029 0.031	-0.4 0.0
53	El Camino Real / Arastradero Rd - Charleston Rd	Palo Alto (SC CMP)	LOS E	AM PM	47.2 53.0	D D-	68.5 71.6	E E	71.7 74.0	E E	0.020 0.010	5.5 2.0
54	El Camino Real / San Antonio Rd	Mountain View (SC CMP)	LOS E	AM PM	52.7 53.0	D- D-	60.9 55.7	E E+	61.4 55.8	E E+	0.008 0.005	0.8 0.1
55	Alma St / Lytton Ave	Palo Alto	LOS D	AM PM	18.3 18.3	B- B-	28.2 25.9	C C	30.9 27.1	C C	0.017 0.015	4.1 1.9
56	Alma St / Hamilton Ave	Palo Alto	LOS D	AM PM	6.7 13.3	A B	10.2 57.7	B+ E+	10.4 60.0	B+ E	0.007 0.012	0.3 5.0
57	Alma St / Churchill Ave	Palo Alto	LOS D	AM PM	26.9 46.5	C D	32.4 59.2	C- E+	32.5 59.8	C- E+	0.005 0.006	0.2 1.0
58	Alma St / Charleston Rd	Palo Alto	LOS D	AM PM	53.5 50.9	D- D	123.7 117.4	F F	127.5 122.5	F F	0.009 0.017	3.9 6.6
59	Middlefield Rd / Marsh Rd	Atherton	LOS D	AM PM	24.0 40.2	C D	76.9 76.0	E- E-	79.7 77.4	E- E-	0.012 0.000	4.6 0.0
60	Middlefield Rd / Ravenswood Ave	Menlo Park	LOS D	AM PM	31.3 36.1	C D+	49.3 45.3	D D	51.0 46.7	D D	0.011 0.012	2.1 1.9

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
61	Middlefield Rd / Ringwood Ave	Menlo Park	LOS D	AM PM	37.1 50.0	D+ D	43.2 52.6	D D-	43.4 52.9	D D-	0.004 0.006	0.2 0.4
62	Middlefield Rd / Willow Rd	Menlo Park	LOS D	AM PM	47.3 46.6	D D	50.0 53.0	D D-	50.2 53.4	D D-	0.000 0.006	0.0 0.5
63	Middlefield Rd / Lytton Ave	Palo Alto	LOS D	AM PM	36.3 43.7	D+ D	49.2 66.1	D E	51.1 70.1	D- E	0.018 0.017	2.1 4.4
64	Middlefield Rd / University Ave	Palo Alto	LOS D	AM PM	29.0 33.7	C C-	35.1 39.4	D+ D	35.6 40.8	D+ D	0.019 0.031	0.5 2.0
65	Middlefield Rd / Hamilton Ave	Palo Alto	LOS D	AM PM	11.4 11.6	B+ B+	10.5 10.8	B+ B+	10.6 10.9	B+ B+	0.005 0.007	0.1 0.1
66	Middlefield Rd / Embarcadero Rd	Palo Alto	LOS D	AM PM	33.2 36.6	C- D+	55.0 68.1	D- E	59.4 72.9	E+ E	0.030 0.025	5.8 6.4
67	Saint Francis Dr / Embarcadero Rd	Palo Alto	LOS D	AM PM	23.6 17.5	C B	23.0 19.3	C+ B-	23.0 19.1	C+ B-	0.015 0.014	0.2 -0.1
68	E. Bayshore Rd / Embarcadero Rd	Palo Alto	LOS D	AM PM	44.1 53.6	D D-	98.5 77.7	F E-	99.0 78.7	F E-	0.006 0.004	0.5 0.9
69	Middlefield Rd / Charleston Rd	Palo Alto	LOS D	AM PM	49.8 52.4	D D-	56.9 66.5	E+ E	57.2 67.2	E+ E	0.004 0.007	0.3 1.4
70	US 101 SB Ramps / Marsh Rd	Menlo Park	LOS D	AM PM	21.0 24.7	C+ C	77.3 78.0	E- E-	77.2 77.9	E- E-	0.000 0.000	0.0 0.0
71	US 101 NB Ramps / Marsh Rd	Menlo Park	LOS D	AM PM	16.3 14.9	B B	23.2 41.1	C D	23.2 41.1	C D	0.000 0.000	0.0 0.0
72	Bay Rd / Willow Rd	Menlo Park	LOS D	AM PM	16.8 10.7	B B+	19.7 11.3	B- B+	19.7 11.3	B- B+	0.008 0.006	0.1 0.1

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
73	Newbridge St / Willow Rd	Menlo Park	LOS D	AM PM	42.7 40.6	D D	42.7 53.6	D D-	42.7 53.9	D D-	0.005 0.004	0.1 0.6
74	O'Brien Dr / Willow Rd	Menlo Park	LOS D	AM PM	11.0 11.8	B+ B+	19.4 20.1	B- C+	19.4 20.0	B- C+	0.003 0.004	0.0 0.0
75	Hamilton Ave / Willow Rd	Menlo Park	LOS D	AM PM	14.5 18.8	B B-	41.3 40.9	D D	42.0 41.1	D D	0.005 0.004	1.2 0.3
76	Bayfront Expy / Willow Rd	Menlo Park (SM CMP)	LOS F	AM PM	39.0 56.8	D+ E+	51.1 64.9	D- E	51.1 65.3	D- E	0.000 0.004	0.0 0.6
77	Woodland Ave / University Ave	East Palo Alto	LOS D	AM PM	48.1 58.9	D E+	71.7 66.1	E E	72.7 66.4	E E	0.000 0.006	0.0 0.9
78	US 101 SB Ramps / University Ave	East Palo Alto	LOS D	AM PM	26.7 25.0	C C	27.9 25.8	C C	28.0 25.8	C C	0.004 0.006	0.2 0.1
79	Donohoe St / University Ave	East Palo Alto	LOS D	AM PM	65.3 42.5	E D	76.3 43.4	E- D	77.1 43.5	E- D	0.005 0.004	1.3 0.1
80	University Ave / Bay Rd	East Palo Alto	LOS D	AM PM	38.0 47.1	D+ D	54.1 51.8	D- D-	54.4 52.4	D- D-	0.005 0.009	0.5 1.1
81	University Ave / Bayfront Expy	Menlo Park (SM CMP)	LOS F	AM PM	21.7 85.0	C+ F	26.4 137.3	C F	26.6 140	C F	0.008 0.007	0.5 3.3
82	Town & Country Driveway / Embarcadero Rd	Palo Alto	LOS D	AM PM	29.2 27.9	C C	27.8 28.3	C C	27.2 27.9	C C	0.031 0.021	-0.4 -0.3
83	Charleston Rd / San Antonio Rd	Mountain View (SC CMP)	LOS E	AM PM	54.5 51.6	D- D-	79.2 66.8	E- E	79.4 67.0	E- E	0.001 0.002	0.4 0.5
84	US 101 SB Ramps / Willow Rd	Menlo Park	LOS D	AM PM	N/A ⁶	N/A ⁶	11.1 12.8	B+ B	11.2 12.8	B+ B	0.003 0.000	0.2 0.0

TABLE 7-1: CUMULATIVE (2035) NO PROJECT AND WITH PROJECT INTERSECTION LEVELS OF SERVICE

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Peak Hour ³	Existing ⁴		Cumulative (2035) No Project		Cumulative (2035) With Project			
					Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Delay ⁵	LOS ⁶	Δ in Crit. V/C ⁷	Δ in Crit. Delay ⁸
85	US 101 NB Ramps / Willow Rd	Menlo Park	LOS D	AM PM	N/A ⁶	N/A ⁶	25.0 24.2	C C	25.1 24.2	C C	0.000 0.003	0.0 0.1
86	Central Expy / Rengstorff Ave	Santa Clara County (SC CMP)	LOS E	AM PM	76.7 62.1	E- E	449.7 247.6	F F	452.3 250.0	F F	0.010 0.008	2.3 2.5
87	Central Expy / Shoreline Blvd (N)	Santa Clara County (SC CMP)	LOS E	AM PM	3.2 5.4	A A	227.3 97.6	F F	226.4 97.4	F F	0.004 0.006	0.2 -0.1
88	Central Expy / Shoreline Blvd (S)	Santa Clara County (SC CMP)	LOS E	AM PM	8.1 7.4	A A	11.2 7.5	B+ A	11.2 7.5	B+ A	0.003 0.005	-0.1 0.0
89	Central Expy / Castro St- Moffett Blvd	Santa Clara County (SC CMP)	LOS E	AM PM	62.6 63.4	E E	241.9 221.4	F F	245.4 225.0	F F	0.010 0.009	5.2 4.5
90	Foothill Expy / Edith Ave	Santa Clara County	LOS E	AM PM	28.8 27.6	C C	52.2 92.8	D- F	57.5 99.7	E+ F	0.016 0.015	9.6 11.6
91	Foothill Expy / Main St	Santa Clara County (SC CMP)	LOS E	AM PM	22.3 22.5	C+ C+	41.1 53.8	D D-	46.0 54.2	D D-	0.016 0.009	7.7 -1.3
92	University Ave / O'Brien Dr	Menlo Park	LOS D	AM PM	7.8 12.5	A B	9.1 13.4	A B	9.1 13.3	A B	0.005 0.006	0.0 0.0
Additional Intersections												
93	University Ave / Adams Dr*	Menlo Park	LOS E (warrant)	AM PM	62.4 21.4	F ¹⁰ C	425.5 39.6	F ¹⁰ E	456.2 41.4	F ¹⁰ E	N/A	N/A
94	University Ave / Runnymede St	East Palo Alto	LOS D	AM PM	14.9 19.8	B B-	15.3 19.1	B B-	15.3 19.1	B B-	0.005 0.005	0.0 0.0
95	University Avenue / Bell Street	East Palo Alto	LOS D	AM PM	14.5 17.7	B B	14.8 17.3	B B	14.7 17.2	B B	0.005 0.005	0.0 0.0

Notes: **Bold text** indicates intersection operates at unacceptable level of service **Bold and highlighted text** indicates a significant impact.

*Indicates unsignalized intersection.

**Indicates intersection is unsignalized under Existing and Background (2018) Conditions and signalized under Cumulative (2035) Conditions.

1. Intersection jurisdiction and identification of CMP (Congestion Management Program) intersections.
(SC CMP) – CMP intersection in Santa Clara County
(SM CMP) – CMP intersection in San Mateo County
2. LOS Threshold is the threshold between acceptable and unacceptable level of service.
3. AM = morning peak hour, PM = evening peak hour.
4. Existing presents the delay and LOS for intersections using existing intersection geometry and existing traffic counts.
5. Whole intersection weighted average control delay expressed in seconds per vehicle calculated using methods described in the 2000 *Highway Capacity Manual*, with adjusted saturation flow rates to reflect Santa Clara County Conditions for signalized intersections. For side-street stop-controlled intersections, delay and LOS are reported for the worst-case approach.
6. LOS = Level of Service. LOS calculations conducted using the TRAFFIX 8.0 analysis software packages, which applies the methods described in the 2000 *Highway Capacity Manual*.
7. Change in critical volume to capacity ratio between Cumulative (2035) and Cumulative (2035) With Project Conditions. This ratio is not applicable for side-street stop controlled intersections and is denoted by "N/A".
8. Change in average critical movement delay between Cumulative (2035) and Cumulative (2035) With Project Conditions. This ratio is not applicable for side-street stop controlled intersections and is denoted by "N/A".
9. The US 101 / Willow Road interchange reconfiguration is estimated to be constructed by 2020, and is denoted by "N/A" under Existing Conditions.
10. A signal warrant is not met for this intersection.

Source: Fehr & Peers, August 2017.

7.2 CUMULATIVE (2035) FREEWAY SEGMENT ANALYSIS

The future operations of freeway mainline segments in Santa Clara County and San Mateo County are evaluated using V/C ratios, with the volume-to-capacity ratio greater than 1.0 indicating the vehicle demand exceeds capacity. Freeway volumes for the Cumulative (2035) No Project and Cumulative (2035) With Project cases were developed as described in Chapter 5. As described in Chapter 3, a Santa Clara County VTA freeway segment impact under Cumulative (2035) with Project Conditions is determined to occur when:

- the addition of traffic causes a freeway segment volume-to-capacity ratio to exceed 1.0, or
- the Project increases traffic demand on a freeway segment already operating at a V/C greater than or equal to 1.0 by an amount equal to one percent or more of the segment capacity.

Freeway segments in San Mateo County also abide by this impact criteria. Plus, an impact may occur if the Project causes the freeway segment V/C ratio to increase by one (1.0) percent on a segment already operating at a V/C greater than or equal to 1.0.

Freeway segments with significant Project impacts under Cumulative (2035) With Project Conditions are:

- Northbound State Route 85
 - South De Anza Boulevard to Stevens Creek Boulevard (AM peak hour);
 - Stevens Creek Boulevard to I-280 (AM Peak hour);
- Southbound State Route 85
 - Stevens Creek Boulevard to South De Anza Boulevard (PM peak hour);
- Northbound Interstate 280
 - Wolfe Road to De Anza Boulevard (AM peak hour);
 - State Route 85 to Foothill Expressway (AM and PM peak hours);
 - Foothill Expressway to Magdalena Avenue (AM peak hour);
 - Sand Hill Road to Woodside Road (PM peak hour);
- Southbound Interstate 280
 - Sheep Camp Trail to Edgewood Road (AM peak hour);
 - Magdalena Avenue to Foothill Expressway (PM peak hour);
 - Foothill Expressway to State Route 85 (PM peak hour);
 - De Anza Boulevard to Wolfe Road (PM peak hour).

Appendix J includes the freeway V/C ratio calculations, levels of service, and impact assessment. See Chapter 8: Transportation Impact Assessment, for further discussion on freeway segment impacts and mitigations.

7.2.1 CUMULATIVE (2035) FREEWAY RAMP ANALYSIS

The freeway ramp analysis was conducted to assess increases in peak period ramp queue lengths with the addition of Project traffic and their effects of freeway and local street operations. Ramp queueing is not considered an environmental impact, but rather an operational consideration that is managed over time by Caltrans and local jurisdictions. Thus, the results are provided for information purposes only.

7.2.1.1 On-Ramp Analysis Results

On-ramp queues were evaluated for Cumulative (2035) No Project and Cumulative (2035) With Project conditions. The on-ramp queueing results for the AM and PM peak periods are presented in **Table 6-2** and the calculation sheets are provided in **Appendix H**. The US 101 / Embarcadero Road and US 101 / Oregon Expressway ramps are the only metered on-ramps within the study area. Caltrans operates dynamic ramp metering rates based on the queues on the freeways and on the ramps. Therefore, the on-ramp queues were evaluated at the minimum and maximum ramp metering rates to show the potential range of queues at the given ramp. As shown in **Table 7-2**, all queues will remain within the available storage when the ramp metering rate operates at the maximum, 900 vehicles per hour. All other queues are anticipated to remain within the available storage when operating at the maximum ramp metering rate. All queues are anticipated to exceed the available storage when using the minimum ramp metering rate (it is unlikely that the metering rate will remain at the minimum rate).

Volumes from all other on-ramps that provide access to Stanford University are shown in **Table 7-3**.

TABLE 7-2: CUMULATIVE (2035) FREEWAY ON-RAMP QUEUEING EVALUATION

On-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Cumulative (2035) No Project		Cumulative (2035) With Project	
			Ramp Volume	Queue (ft) ^{3, 4} “Min. / Max.”	Ramp Volume	Queue (ft) ^{3, 4} “Min. / Max.”
US 101 Southbound On-Ramps						
Oregon Expressway (diagonal)	1,400	AM PM	1,304 1,416	30 / 18,300 30 / 77,610	1,310 1,429	30 / 18,390 30 / 78,870
Embarcadero Road (diagonal)	1,150	AM PM	813 726	30 / 18,450 750 / 24,120	829 758	30 / 19,290 1,080 / 27,270

Notes: **Bold** text indicates conditions where the queue exceeds the available storage capacity.

- Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queueing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.
- AM peak period – 6:00 AM to 9:00 AM. PM peak period – 3:00 PM to 7:00 PM.
- Minimum queues estimated using the maximum metering rates as presented in **Table 4-4**. Maximum queues estimated using the minimum metering rates as presented in **Table 4-4**. The minimum queue is one vehicle, which is equal to 30 feet.
- "N/A" = not applicable, ramp is not metered during that time period.

Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

TABLE 7-3: CUMULATIVE (2035) FREEWAY NON-METERED ON-RAMP VOLUMES

On-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Cumulative (2035) No Project	Cumulative (2035) With Project
US 101 Northbound On-Ramps				
Willow Road (loop) ³	650	AM PM	411 352	413 358
University Avenue (loop)	880	AM PM	391 121	393 125
I-280 Northbound On-Ramps				
Sand Hill Road (diagonal)	1,460	AM PM	648 1,526	692 1,627
Alpine Road (diagonal)	1,000	AM PM	360 710	360 710
Page Mill Road (diagonal)	700	AM PM	923 1,445	939 1,474
I-280 Southbound On-Ramps				
Page Mill Road (loop)	1,500	AM PM	706 1,189	750 1,278
Alpine Road (loop)	650	AM PM	376 561	376 561
Sand Hill Road (loop)	800	AM PM	330 1,130	338 1,141

Notes: **Bold** text indicates conditions where the queue exceeds the available storage capacity.

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements.

2. AM peak period – 6:00AM to 9:00AM. PM peak period – 3:00PM to 7:00PM.

3. The Willow Road interchange is reconstructed by Year 2035 to include a signal for the US 101 northbound ramps and a signal for the US 101 southbound ramps.

Source: Caltrans, April 2017; and Fehr & Peers, August 2017.

7.2.1.2 Off-Ramp Analysis Results

This section summarizes the queues calculated using the Poisson distribution method at the off-ramps with signalized terminal intersections for the AM and PM peak periods. **Table 6-4** presents the desired storage for the signalized turning movements that provide access to the Project site. Off-ramp calculation sheets are provided in **Appendix H**. Data for left-turning and right-turning vehicles are presented separately based on which turning movement serves the Project site. Queue lengths were calculated using a vehicle length of 30 feet.

As shown in **Table 7-4**, all off-ramps are expected to serve vehicle queues within the available ramp storage, with the exception of the I-280 / Sand Hill Road northbound diagonal off-ramp. Under Cumulative (2035) Conditions, the I-280 / Sand Hill Road northbound diagonal on-ramp is anticipated to experience a vehicle queue of 1,680 feet in the AM peak period, and with the Project, that queue will extend to 1,770 feet. This

results in a queue spillback into the freeway mainline of 940 feet and 1,030 feet without and with the Project, respectively.

Additionally, the following turn queues are anticipated to exceed the available turn-pocket storage length:

- US 101 / University Avenue southbound loop off-ramp – right-turn queue exceeds pocket storage length during the AM and PM peak periods, without and with the Project
- I-280 / Sand Hill Road northbound diagonal off-ramp – right-turn queue exceeds pocket storage length during the AM and PM peak periods, without and with the Project
- I-280 / Page Mill Road northbound diagonal off-ramp – left-turn queue exceeds pocket storage length during the AM and PM peak periods, without and with the Project
- I-280 / Page Mill Road southbound diagonal off-ramp – left-turn queue exceeds pocket storage length during the AM and PM peak periods, without and with the Project

While these turn queues are anticipated to exceed the available turn pocket storage, the queue would still be served within the total ramp storage, and would not spillback into the freeway mainline.

**TABLE 7-4: CUMULATIVE (2035) FREEWAY OFF-RAMP QUEUING EVALUATION -
SIGNALIZED AND STOP-CONTROLLED TERMINAL INTERSECTIONS**

Off-Ramp	Storage Capacity (ft) ¹	Peak Period ²	Cumulative (2035) No Project		Cumulative (2035) With Project	
			Ramp Volume ³	Queue (ft) ⁴	Ramp Volume ³	Queue (ft) ⁴
US 101 Northbound Off-Ramps						
Embarcadero Road (loop) ⁵	See Table 7-5. ⁶					
US 101 Southbound Off-Ramps						
Willow Road (diagonal) ⁷	1,025 / 1,025	AM PM	160 / 432 470 / 401	150 / 510 480 / 420	160 / 440 470 / 404	150 / 510 480 / 420
University Avenue (loop)	1,870 / 190	AM PM	262 / 250 190 / 590	540 / 510 300 / 690	267 / 250 193 / 590	540 / 510 300 / 720
I-280 Northbound Off-Ramps						
Sand Hill Road (diagonal)	740 / 300	AM PM	100 / 630 50 / 230	90 / 1,680 90 / 450	100 / 633 50 / 235	120 / 1,770 90 / 450
Alpine Road (diagonal) ⁹	1,360 / 280	AM PM	250 / 821 130 / 269	30 / ⁸ 30 / ⁸	250 / 850 130 / 291	30 / ⁸ 30 / ⁸
Page Mill Road (diagonal)	60 / 1,830	AM PM	240 / 1,839 50 / 312	840 / ⁸ 150 / ⁸	240 / 1,926 50 / 377	840 / ⁸ 210 / ⁸
I-280 Southbound Off-Ramps						
Sand Hill Road (loop)	See Table 7-5. ⁶					
Alpine Road (diagonal)	1,370 / 450	AM PM	390 / 550 160 / 320	240 / ⁸ 60 / ⁸	390 / 550 160 / 320	240 / ⁸ 60 / ⁸
Page Mill Road (diagonal)	150 / 1,940	AM PM	1,612 / 50 1,256 / 50	1,710 / ⁸ 1,140 / ⁸	1,615 / 50 1,263 / 50	1,740 / ⁸ 1,170 / ⁸

Notes: **Bold** text indicates conditions where the queue exceeds the turn pocket capacity.

1. Vehicle storage capacity is defined as the length of the longest mixed-flow lane available for vehicle queuing. Length is measured from gore point to gore point or where any queue spillback has the potential to block other movements (not necessarily the freeway/ramp gore point).

Storage Capacity for a Controlled Ramp - ##/## = left-turn and (or) through pocket / right-turn pocket

2. AM peak period – 6:00 AM to 9:00 AM. PM peak period – 3:00 PM to 7:00 PM.

3. Ramp volume by turning movement - ##/## = left-turn and (or) through movement / right-turn movement

4. The queue indicated represents the 95th Percentile Queue for signalized movements and the Average Queue for stop-controlled movements - ##/## = left-turn and (or) through queue / right-turn queue

5. Oregon Expressway off-ramp is not evaluated under this evaluation. The northbound Oregon Expressway off-ramp is the beginning of Oregon Expressway and enters directly onto the roadway without any conflicting movement.

6. Table 7-5 includes the uncontrolled off-ramps.

7. The Willow Road interchange is reconstructed by Year 2035 to include a signal for the US 101 northbound ramps and a signal for the US 101 southbound ramps.

8. Only the left-turn movement is stop-controlled. Free right-turn queues are not provided.

9. For all-way stop-controlled ramp intersections, the average queue is reported due to the limitations of 2000 HCM.

Source: Fehr & Peers, August 2017.

Table 7-5 summarizes the V/C ratios for the off-ramps with uncontrolled terminal intersections for the AM and PM peak periods. Most of the V/C ratios for Cumulative (2035) Conditions without and with the Project are less than 1.00, indicating that the off-ramps have sufficient capacity to accommodate the exiting volumes at these locations, with the exception of the following off-ramps:

- I-280 / Page Mill Road northbound diagonal off-ramp (No Project V/C is 0.97, With Project V/C is 1.01, in the AM peak period);
- I-280 / Sand Hill Road southbound diagonal off-ramp (No Project V/C 1.03, With Project V/C is 1.10, in the AM peak period).

TABLE 7-5: CUMULATIVE (2035) FREEWAY OFF-RAMP QUEUING EVALUATION - UNCONTROLLED TERMINAL INTERSECTIONS

Off-Ramp	Maximum Vehicle Flow Rate - Capacity (vphpl) ¹	Peak Period ²	Cumulative (2035) No Project		Cumulative (2035) With Project	
			Ramp Volume	V/C ³	Ramp Volume	V/C ³
US 101 Northbound Off-Ramps						
Embarcadero Road (loop) ⁴	1,800	AM	741	0.41	778	0.43
		PM	601	0.33	621	0.35
US 101 Southbound Off-Ramps						
Willow Road (diagonal) ⁷	See Table 7-4. ⁶					
University Avenue (loop)	See Table 7-4. ⁶					
I-280 Northbound Off-Ramps						
Sand Hill Road (diagonal)	See Table 7-4. ⁶					
Alpine Road (diagonal) ⁵	1,900	AM	821	0.43	850	0.45
		PM	269	0.14	291	0.15
Page Mill Road (diagonal) ⁵	1,900	AM	1,839	0.97	1,926	1.01
		PM	312	0.16	377	0.20
I-280 Southbound Off-Ramps						
Sand Hill Road (loop)	1,800	AM	1,860	1.03	1,974	1.10
		PM	720	0.40	780	0.43
Alpine Road (diagonal) ⁵	1,900	AM	550	0.29	550	0.29
		PM	320	0.17	320	0.17
Page Mill Road (diagonal) ⁵	1,900	AM	50	0.03	50	0.03
		PM	50	0.03	50	0.03

Notes: **Bold** text indicates the off-ramp does not have sufficient capacity to accommodate the exiting volumes.

1. Diagonal ramps were assumed to have a capacity of 1,900 vehicles per hour per lane (vphpl). Loop ramps were assumed to have a capacity of 1,800 vphpl.

2. AM peak period – 6:00 AM to 9:00 AM. PM peak period – 3:00 PM to 7:00 PM.

3. V/C = volume-to-capacity ratio.

4. Oregon Expressway off-ramp is not evaluated under this evaluation. The northbound Oregon Expressway off-ramp is the beginning of Oregon Expressway and enters directly onto the roadway without any conflicting movement.

5. The right-turn movement is uncontrolled. Therefore, the right-turn volume and V/C is the only ramp movement reported in the table.
6. Table 7-4 includes the signalized and stop-controlled off-ramps.
7. The Willow Road interchange is reconstructed by Year 2035 to include a signal for the US 101 northbound ramps and a signal for the US 101 southbound ramps.

Source: Fehr & Peers, August 2017.

7.3 CUMULATIVE (2035) TRANSIT DELAY ANALYSIS

The Project will add traffic along major transit corridors throughout the Cities of Palo Alto and Menlo Park, which could affect operations of VTA and C/CAG's bus routes. The bus routes evaluated along with the methodology for estimating this delay are described in Chapter 3, Section 3.6. The additional delay to transit service in the area due to implementation of the Project can be found in **Table 7-6**. **Appendix K** contains the calculation summary for each transit route.

The Project does not substantially increase transit delay relative to the total route travel times, for the transit routes identified in Transit Service Analysis Methods. As shown in **Table 7-6**, the traffic created by the Project in 2035 will increase the travel times by less than 30 seconds on all but two routes. VTA Route 22 experiences a longer delay change, at 36.5 seconds (eastbound direction in the PM peak hour only) and VTA Route 522 experiences a longer delay change, at 34.8 seconds (eastbound direction in the PM peak hour only).

VTA is studying the implementation of a Bus Rapid Transit (BRT) system on El Camino Real that would extend into the study area with a terminus at the Palo Alto Downtown Transit Center. The BRT system would be an update of the existing 522 service. Therefore, delays for the future BRT service would be similar to the delay for the existing 522 service. Of the seven alternatives presented in the El Camino Real Bus Rapid Transit Draft Environmental Impact Report/Environmental Assessment (October 2014), only one would provide a dedicated BRT lane in Palo Alto extending from City of Mountain View city limits to Embarcadero Road. All other alternatives require buses to operate within mixed-flow lanes or HOV lanes without signal modifications. Therefore, under the majority of the alternatives being considered, the delays to the future BRT service would be similar to the delays experienced by the existing 522 service.

TABLE 7-6: CUMULATIVE (2035) WITH PROJECT TRANSIT ROUTE DELAY

Route		Direction	Peak Hour	Additional Route Average Delay with Project (seconds) ¹
22	Palo Alto Transit Center to Eastridge Transit Center via El Camino	Eastbound	AM PM	12.3 36.5
		Westbound	AM PM	21.4 18.6
35	Downtown Mountain View to Stanford Shopping Center	Northbound	AM PM	16.6 13.4
		Southbound	AM PM	11.7 22.1
89	California Avenue Caltrain Station to Palo Alto Veterans Hospital	Northbound	AM PM	< 5.0 < 5.0
		Southbound	AM PM	< 5.0 < 5.0
102	South San Jose to Palo Alto	Northbound	AM	< 5.0
		Southbound	PM	29.7
104	Penitencia Creek Transit Center to Palo Alto	Eastbound	PM	< 5.0
		Westbound	AM	26.6
522	Palo Alto Transit Center to Eastridge Transit Center	Eastbound	AM PM	9.2 34.8
		Westbound	AM PM	21.4 18.6
281	Onetta Harris Center to Stanford Shopping Center	Eastbound	AM PM	6.4 9.7
		Westbound	AM PM	< 5.0 < 5.0
ECR	Daly City BART to Palo Alto Transit Center	Northbound	AM PM	< 5.0 9.8
		Southbound	AM PM	< 5.0 < 5.0
DB	Dumbarton Express - Union City BART to Stanford Oval	Eastbound	AM PM	< 5.0 7.4
		Westbound	AM PM	22.6 9.2
DB1	Dumbarton Express 1 - Union City BART to Stanford Research Park	Eastbound	AM PM	< 5.0 13.1
		Westbound	AM PM	28.4 26.0
U	Fremont BART to Stanford Oval	Eastbound	PM	29.4
		Westbound	AM	17.0

TABLE 7-6: CUMULATIVE (2035) WITH PROJECT TRANSIT ROUTE DELAY

Route		Direction	Peak Hour	Additional Route Average Delay with Project (seconds) ¹
E	University Avenue Caltrain Station to Baylands Business Parks	Eastbound	AM PM	5.9 13.9
		Westbound	AM PM	11.8 < 5.0
C	University Avenue/Downtown to South Palo Alto at Charleston Road	Eastbound	AM PM	< 5.0 8.7
		Westbound	AM PM	29.1 6.1

Note:

1. The Project was not considered to have a measureable change in overall transit delay if the increase in travel time was less than five seconds or the travel time improved slightly (due to changes in signal timing, critical movement changes, etc.).

Source: Fehr & Peers, August 2017.

7.4 CUMULATIVE (2035) BICYCLE AND PEDESTRIAN QUALITY OF SERVICE ANALYSIS

Pedestrian and bicycle QOS analysis is presented in Chapter 8, as the analysis depends on the traffic mitigation measures proposed.



8. TRANSPORTATION IMPACT ASSESSMENT

This chapter discusses Project impacts to the study intersections, freeway segments, neighborhood streets, transit, bicycle and pedestrian facilities, and safety and emergency access.

8.1 INTERSECTION IMPACTS AND MITIGATION MEASURES

Stanford intends to prevent significant impacts to intersection and freeway congestion by achieving the Stanford Community Plan's No Net New Commute Trips goal through the use of trip reduction efforts (both for Stanford and non-Stanford trips), infrastructure improvements that will serve and promote the use of non-auto modes, and funding contributions to programs that will reduce auto trips. It is Stanford's intent to avoid the need for intersection capacity improvements.

This Traffic Impact Assessment conservatively assumes that Stanford does not achieve the No Net New Commute Trips goal, and does not expand its existing TDM programs. Under this assumption, intersection impacts were evaluated under Background (2018) with Project and Cumulative (2035) with Project Conditions. For each scenario (2018 and 2035), the evaluation is organized as follows:

- Intersections with significant impacts are listed, and impact statements for each intersection, along with proposed mitigation measures, are presented, grouped by jurisdiction.
- Where possible, feasible physical and/or operational mitigation measures have been identified and are presented. The acronym "LTS" is used if the mitigation measure reduces the impact to a

less-than-significant level. Impacts that would remain significant and unavoidable after mitigation are designated “SU”.

- For intersection impacts, the effect of the proposed mitigation measure on bicycle and pedestrian quality of service (QOS) is also described using StreetScore+.

8.1.1 TRAFFIC MITIGATION APPROACH

Sections 8.1.2 and 8.1.3 describe physical and operational improvements to address the 2018 General Use Permit’s significant impacts on intersections in the traffic study area. These impacts are projected to occur if Stanford generates peak hour vehicle trips at the same rates as those of the current campus. However, Stanford intends to limit the trip growth under the 2018 General Use Permit as it has successfully done under the 2000 General Use Permit. Since 2001, Stanford has met its No Net New Commute Trips target every year, even as the campus facilities and populations grew. This is documented in the annual traffic monitoring reports prepared to implement the 2000 General Use Permit Conditions of Approval. The monitoring process considers both trips entering the campus cordon in the morning peak hour and exiting in the afternoon peak hour (as adjusted per the approved monitoring methodology), along with Stanford-provided trip reductions outside of campus. In the 2018 General Use Permit Application, Section 7.1, Stanford proposes a continuation of the No Net New Commute Trips goal. Stanford intends to enhance the mechanisms by which the University would contribute to vehicle trip reductions within the traffic impact area. The proposed program is summarized below.

8.1.1.1 No Net New Commute Trips Goal

Stanford has stated in its application that it intends to continue to take all necessary steps to meet the No Net New Commute Trips goal established in the Stanford Community Plan. The goal is defined to mean no additional trips above a base level during the peak commute hour in the campus commute direction.

8.1.1.2 Travel Demand Management Program

Stanford plans to continue to mitigate the transportation impacts of its additional development by implementing a TDM program designed to achieve the No Net New Commute Trips goal. Stanford’s TDM program has contributed to a decrease in Stanford’s commuter drive-alone rate from 72 percent in 2002 to 50 percent today. Stanford will continue to monitor program effectiveness and adjust the specific services, incentives and disincentives over time to optimize the effectiveness of the programs.

8.1.1.3 Off-Campus Trip Reductions: Stanford-Provided Programs and Services, and Funding for Infrastructure Projects

Stanford proposes in its application to continue to recognize off-campus trip reductions efforts as specified by Stanford Community Plan policy C-8 and 2000 General Use Permit Condition G.8 with two minor modifications. First, Stanford proposes a clarification to the existing policy that reduction of an off-campus

trips can be recognized as long as one terminus for the trip is within the local impact boundary. For example, if Stanford runs a shuttle to East Palo Alto and an East Palo Alto resident rides that shuttle to a business in Palo Alto, a vehicle trip will have been removed within the targeted geographic boundary.

Second, Stanford proposes that funding off-campus circulation infrastructure improvements may qualify for trip credits as long as the improvements would enhance safety or increase mobility for pedestrians, bicyclists or transit users within the local impact area. For example,

- funding roadway modifications to add transit vehicle lanes or bicycle lanes;
- adding signals to improve pedestrian or bicycle safety;
- providing transit signal pre-emption along major corridors;
- connecting gaps in the bicycle network;
- reducing non-local traffic in neighborhood areas through traffic calming measures; and
- other pedestrian, bicycle and transit-supportive projects envisioned in the Palo Alto Comprehensive Plan and ConnectMenlo, could qualify for trip credits under this approach if approved by the County.

Any proposal for such credits would be accompanied by evidence demonstrating how the project or program would remove vehicular trips from the local impact area.

8.1.1.4 Funding for Others' Off-Campus Trip Reduction Programs

For the 2018 General Use Permit, Stanford proposes in its application that its first priority would be to take steps within its own control to reduce trips through trip reduction measures and trip credits, as described above. However, if Stanford cannot achieve the No Net New Commute Trips goal using those two means, Stanford would be given the option of achieving No Net New Commute Trips by funding other entities' trip reduction programs or infrastructure projects before applying such funds to its proportionate share of intersection improvements.

Payment would be made to an account managed by the County Planning Office that would be used to fund off-campus projects that encourage and improve use of alternative transportation modes or otherwise reduce peak period traffic. These projects include but are not limited to transit improvements that directly or indirectly benefit the local impact area and community education and outreach regarding non-auto mode transportation options. This fund also could be used for transportation improvements that increase safety and mobility for pedestrians, bicyclists and transit users.

8.1.1.5 Funding Calculation

In its application, Stanford proposes that the amount of the payment for each exceeded trip be based upon the dollar amount that otherwise would be expended for intersection improvements required to mitigate

the effects of development under the 2018 General Use Permit. Such a payment program is consistent with Stanford Community Plan implementation measure SCP-C (i)(9).

To calculate the annual payment on a per-trip basis, the total amount of Stanford's fair-share contribution to all intersection improvements would be divided by 17, to reflect the number of years that the 2018 General Use Permit is expected to be in effect. The resulting quotient would then be divided by the number of peak hour, peak direction vehicle trips anticipated to occur absent the No Net New Commute Trips goal. That per-trip dollar amount times the number of trips exceeding the goal would constitute the payment necessary. In no event would Stanford be required to pay cumulatively over the time period of the 2018 General Use Permit more than the total amount of its fair-share contribution toward feasible improvements at impacted intersections and roadways.

8.1.2 BACKGROUND (2018) WITH PROJECT CONDITIONS

Table 6-1 shows the delays, LOS results, and changes in critical volume-to-capacity ratio and delay used to identify significant intersection impacts under Background (2018) with Project Conditions. Based on the impact criteria listed in Chapter 3: Significance Criteria & Analysis Methodology, the Project has significant impacts at the following six intersections:

- Intersection #2: I-280 NB Off-Ramp/Sand Hill Road (AM peak hour)
- Intersection #13: I-280 SB Off-Ramp/Page Mill Road (AM and PM peak hours)
- Intersection #17: Junipero Serra Blvd./Foothill Expwy./Page Mill Road (AM and PM peak hours)
- Intersection #30: Foothill Expressway/Arastradero Road (PM peak hour)
- Intersection #31: Foothill Expressway/San Antonio Road (PM peak hour)
- Intersection #58: Alma Street/Charleston Road (PM peak hour)

It is noted that only two of these intersections (Intersections #13 and #17) would be significantly impacted under an Existing With Project case, as described in Section 6.1.

Where feasible physical capacity improvements or other operational improvements are possible, they have been identified, and are described below, along with the post-mitigation level of service and resulting impact level of significance. A bicycle and pedestrian QOS evaluation was performed for each mitigation location, to assess the impacts on bicycle and pedestrian conditions of the proposed mitigation, using the methodology described in Chapter 3, Section 3.7.2. These impacts are also described below. **Table 8-1** summarizes all of this information, for the six impacted locations. **Appendix L** contains the mitigation LOS calculations. **Appendix M** shows the bicycle and pedestrian StreetScore+ QOS results for each location.

8.1.2.1 Santa Clara County

I-280 Southbound Off-Ramp/Page Mill Road (Intersection #13) – The addition of Project traffic under Background (2018) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County unsignalized intersection during the AM and PM peak hours. Under Existing Conditions, it functions at an unacceptable LOS F during the AM and PM peak hours. It would continue to function at LOS F under Background (2018) No Project Conditions and Background (2018) With Project conditions while also meeting the criteria for a peak hour signal warrant. This intersection serves two major corridors, I-280 and Page Mill Road, which traverse the City of Palo Alto and connects to El Camino Real and US 101. As such, it serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested intersection in 2018.

The following physical improvements are capable of reducing this impact:

- Int. #13 Mitigation: Contribute fair-share funding toward the installation of a traffic signal.

Installation of a traffic signal would not require the acquisition of additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement requires additional funding that has not yet been identified, and depends on actions taken by Caltrans, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle QOS; the bicycle StreetScore+ QOS would remain at QOS 3.7. Aside from large eastbound/westbound shoulders for bicyclists, there are no other bicycle or pedestrian facilities at this intersection. Depending on the ultimate design, additional bicycle facilities may be implemented at this intersection. However, as the intersection is currently striped, the mitigation measure would not adversely affect the existing bicycle facilities.

There is no pedestrian access at this intersection; therefore the proposed mitigation measure would have no effect on pedestrian quality of service as pedestrians are not allowed at the intersection.

It is noted that Santa Clara County's *Page Mill Expressway Corridor Study Report* describes improvements along the length of Page Mill Road from the I-280 Southbound Ramps to El Camino Real. The improvement concept at the I-280 Southbound Ramps intersection is a roundabout with a traffic signal at the I-280 Northbound 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 County will determine the ultimate improvement design and phasing for the corridor improvements. The Project's fair-share funding contribution identified above may be applied toward a roundabout at the I-280 Southbound Ramps intersection if the County chooses, and the timing of this improvement will also be determined by the County.

Junipero Serra Boulevard-Foothill Expressway/Page Mill Road (Intersection #17) – The addition of Project traffic under Background (2018) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM and PM peak hours. Under Existing Conditions, it functions at an unacceptable LOS F during the AM and PM peak hours. It would continue to function at LOS F under Background (2018) No Project Conditions and Background (2018) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. This intersection serves two major corridors that connect to I-280 and also provides a parallel route to I-280. As such, it serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested intersection in 2018.

The following physical improvements are capable of reducing this impact:

- Int. #17 Mitigation: Contribute fair-share funding toward installation of an overlap phase for northbound and southbound right-turning vehicles and widening of the southbound approach to two lanes between Page Mill Road and Stanford Avenue to align with the existing designated right-turn lane.

Installation of an overlap phase for northbound and southbound right-turning vehicles would be accommodated through the modification of the existing traffic signal, which requires no additional right-of-way. Widening the southbound approach to two lanes between Page Mill Road and Stanford Avenue will likely require the acquisition of additional right-of-way. This improvement would allow southbound right-turning vehicles additional queuing space so southbound through vehicles do not block the right-turn lane. With this mitigation, the LOS and delay would improve under AM and PM peak hours, as shown in **Table 8-1**, but it would not be mitigated to a less-than-significant level. The impact would remain **significant and unavoidable**. This mitigation measure would bring the Project's impact to a less-than-significant level under Cumulative (2035) With Project Conditions due to shift in travel patterns at this intersection with the widening of Page Mill Road between I-280 and Junipero Serra Boulevard-Page Mill Road.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; bicycle and pedestrian StreetScore+ QOS would remain unchanged at QOS 3.5 and QOS 4, respectively. With the proposed mitigation, a second lane would be added in the southbound direction between Stanford Avenue and Page Mill Road aligning with the existing designated right-turn lane at Page Mill Road, and would not impact the existing intersection configuration. The pedestrian crossing distances would be unchanged in all directions, maintaining but not exacerbating the relatively uncomfortable crossing conditions at the intersection.

It is noted that there are improvements identified for this intersection in the draft *Santa Clara County Expressway Plan 2040*. The first improvement, which is a Tier 1 improvement, would widen Page Mill Road from just east of Junipero Serra Boulevard-Foothill Expressway to the I-280 ramps. The Tier 1 improvement is fully funded through Measure B and is anticipated to be in place by 2035.

The second improvement, which is a Tier 3 improvement in the *County Expressway Plan 2040*, is to grade separate Page Mill Road. The grade separation improvements were not identified as mitigation because the identified mitigation, which is a smaller project and would have fewer secondary environmental effects, mitigates the Project's impact to a less-than-significant level by 2035. In addition, the grade separation project has not undergone CEQA review, may not be approved, and may not receive funding.

Foothill Expressway/Arastradero Road (Intersection #30) – The addition of Project traffic under Background (2018) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an unacceptable LOS F during the PM peak hour. It would continue to function at LOS F under Background (2018) No Project Conditions and Background (2018) With Project Conditions. Project-generated traffic would decrease the average critical delay and would increase the critical volume-to-capacity ratio by 0.01 or more. Foothill Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including I-280. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2018.

The following physical improvements are capable of reducing this impact:

- Int. #30 Mitigation: If such grade separation is approved and implemented, contribute fair-share funding toward a grade separation project as identified in the draft *Santa Clara County Expressway Plan 2040*. The grade separation assumed for purposes of analysis includes a separated through-way for vehicles on Foothill Expressway.

Although the configuration of this proposed interchange has yet to be determined, additional right-of-way would be required to construction this improvement. Due to the close proximity of the Miranda Avenue/Arastradero Road intersection, additional modifications to roadway alignment and turning movements would need to be evaluated along with adequate access for bicyclists and pedestrians. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement has not undergone CEQA review, may not be approved, and would require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

With the exception of construction-related impacts, the mitigation would not have a substantial adverse effect on bicycle QOS, which would remain at QOS 3.5. Right-turn lanes and high vehicle speeds would

continue to cause uncomfortable situations for bicyclists at the intersection. However, the mitigation would cause pedestrian QOS to improve from QOS 4 to QOS 2.5. With the proposed mitigation, the pedestrian crossing distances at the northbound and southbound approaches would be reduced from the existing 6+ lanes to an estimated 2 to 3 lanes, providing more comfortable pedestrian crossing conditions at the intersection.

It is noted that this impact would not be significant under a 2016 Existing With Project case (see **Appendix F**).

Foothill Expressway/San Antonio Road (Intersection #31) – The addition of Project traffic under Background (2018) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS E in the PM peak hour. It would continue to function at LOS E in the PM peak hour under Background (2018) No Project Conditions, but would function at unacceptable LOS F in the PM peak hour under Background (2018) With Project Conditions. Foothill Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including I-280. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2018.

The following physical improvements are capable of reducing this impact:

- Int. #31 Mitigation: Contribute fair-share funding toward the construction of a third southbound through lane on Foothill Expressway between San Antonio Road and El Monte Avenue as identified in the draft *Santa Clara County Expressway Plan 2040*.

A third receiving lane would be added on the south leg of Foothill Expressway as identified as a Tier 1 improvement in the *Santa Clara County Expressway Plan 2040* to extend the southbound right-turn lane from El Monte Avenue to San Antonio Road, which will likely require additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement would require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle QOS; the bicycle QOS would remain unchanged at QOS 4. With the proposed mitigation, right-turn slip lanes and high vehicle turning speeds would remain, maintaining the current uncomfortable environments for bicyclists at the intersection.

There is no pedestrian access at this intersection; therefore, the proposed mitigation measure would have no effect on pedestrian quality of service.

It is noted that the full Tier 1 intersection improvement identified for this intersection in the draft *Santa Clara County Expressway Plan 2040* includes widening Foothill Expressway from four to six lanes between San Antonio Road and El Monte Avenue. The proposed mitigation implements the southbound widening.

It is noted that this impact would not be significant under a 2016 Existing With Project case (see **Appendix F**).

8.1.2.2 City of Palo Alto

Alma Street/Charleston Road (Intersection #58) – The addition of Project traffic under Background (2018) With Project Conditions would cause a significant impact based on the significance criteria for a City of Palo Alto signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS D. It would continue to function at LOS D in the PM peak hour under Background (2018) No Project Conditions, but would function at unacceptable LOS E in the PM peak hour under Background (2018) With Project Conditions. This intersection serves two major corridors serving the Cities of Palo Alto and Mountain View, including connections to US 101, El Camino Real and I-280. As such, it is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2018.

The following physical improvements are capable of reducing this impact:

- Int. #58 Mitigation: Contribute fair-share funding toward the addition of designated northbound right-turn lane and installation of an overlap phase for the northbound and southbound right-turn movements.

To accommodate the construction of a designated northbound right-turn lane, the northbound approach would need to be widened and will likely require the acquisition of additional right-of-way. Installation of an overlap phase for northbound and southbound right-turning vehicles would be accommodated through the modification of the existing traffic signal. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement depends on the actions of the City of Palo Alto, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; bicycle and pedestrian StreetScore+ QOS would remain unchanged at QOS 3.3 and QOS 3.5, respectively. With the proposed mitigation, pedestrian crossing distances would increase slightly on the south leg of the intersection and remain unchanged on all other approaches while maintaining the current quality of service score at the intersection. Bicycle lanes on the eastbound and westbound approaches, and low right-turn speeds would remain, resulting in slightly better conditions compared to what bicyclists experience on the northbound and southbound approaches. The proposed mitigation measure would not conflict with the

City of Palo Alto's proposed Class III facility along Alma Street as identified in the City of Palo Alto Bicycle & Pedestrian Transportation Plan. With a Class III facility, bicyclists travel in the vehicle lane and do not require a separated space as with a bicycle lane.

It is noted that this impact would not be significant under a 2016 Existing With Project case (see **Appendix F**).

8.1.2.3 City of Menlo Park

I-280 Northbound Off-Ramp/Sand Hill Road (Intersection #2) – The addition of Project traffic under Background (2018) With Project Conditions would cause a significant impact based on the significance criteria for a City of Menlo Park signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS D in the AM peak hour. It would function at an unacceptable LOS F in the AM peak hour under Background (2018) No Project Conditions and under Background (2018) With Project Conditions. Project-generated traffic would increase the average delay on the eastbound through (local) approach by more than 0.8 seconds. The unacceptable LOS conditions in the AM peak hour are the result of a substantial increase in non-Project traffic growth at the Sand Hill Road interchange, along with Project traffic primarily entering the northbound ramps intersection from the west (i.e. from the southbound off-ramp).

The following physical improvements are capable of reducing this impact:

- Int. #2 Mitigation: Contribute fair-share funding toward the addition of a second northbound right-turn lane as identified in the *ConnectMenlo Final Environmental Impact Report*.

To accommodate the construction of a second northbound right-turn lane, the northbound approach would be widened from two to three lanes and may require the acquisition of additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement depends on the actions of Caltrans and the City of Menlo Park, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle QOS; the bicycle StreetScore+ QOS would remain at QOS 4. Aside from an eastbound bicycle lane, there are no other bicycle or pedestrian facilities at this intersection. The northbound right-turn lane from the off-ramp to Sand Hill Road is currently protected, meaning vehicles are not permitted to turn right on red. The addition of a second northbound right-turn lane would not conflict with eastbound bicyclists if the right-turn lanes were to remain protected. Therefore, the mitigation measure would not adversely affect the existing bicycle lanes on Sand Hill Road. The San Mateo County *Comprehensive Bicycle and Pedestrian Plan* identifies interchange improvements at I-280 and Sand Hill Road.

Pedestrians interested in walking across the interchange must do so on the northern bridge that carries westbound traffic. The proposed mitigation measure would have no effect on pedestrian quality of service as pedestrians are not allowed at the intersection.

It is noted that this impact would not be significant under a 2016 Existing With Project case (see **Appendix F**).

8.1.2.4 City of East Palo Alto

No significant intersection impacts were identified in the City of East Palo Alto, under the Background (2018) With Project scenario.

8.1.2.5 Town of Atherton

No significant intersection impacts were identified in the Town of Atherton, under the Background (2018) With Project scenario.



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TABLE 8-1: BACKGROUND (2018) WITH PROJECT MITIGATION INTERSECTION LEVEL OF SERVICE, BICYCLE AND PEDESTRIAN QUALITY OF SERVICE RESULTS

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Mitigation Description	Peak Hour ³	Background (2018) No Project Conditions		Background (2018) With Project Conditions				Background (2018) With Project and Mitigation Conditions				Impact Significance With Mitigation ⁸
						Delay ⁴	LOS ⁵	Delay ⁴	LOS ⁵	Ped QOS ⁶	Bike QOS ⁷	Delay ⁴	LOS ⁵	Ped QOS ⁶	Bike QOS ⁷	
2	I-280 NB Off-Ramp / Sand Hill Rd	Menlo Park	LOS D	Contribute fair-share funding toward the addition of a second northbound right-turn lane (ConnectMenlo Final EIR).	AM PM	119.6 21.2	F C+	137.4 21.4	F C+	N/A	4	46.5 18.3	D B-	N/A	4	LTS/SU
13	I-280 SB Off-Ramp / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	Contribute a fair-share toward the installation of a signal.	AM PM	151.7 85.9	F F	153.3 88.3	F F	N/A	3.7	37.2 42.3	D+ D	N/A	3.7	LTS/SU
17	Junipero Serra Blvd - Foothill Expy / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward installation of an overlap phase for northbound and southbound right-turning vehicles and widening of the southbound approach to two lanes between Page Mill Road and Stanford Avenue to align with the existing designated right-turn lane.	AM PM	97.2 97.0	F F	101.5 109.9	F F	4	3.5	98.6 103.8	F F	4	3.5	SU
30	Foothill Expy / Arastradero Rd	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward a grade separation project (County Expressway Plan 2040).	AM PM	71.8 92.3	E F	74.7 95.8	E F	4	3.5	60.2 67.9	E E	2.5	3.5	LTS/SU
31	Foothill Expy / San Antonio Rd	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding to the construction of a third southbound through lane on Foothill Expressway between San Antonio Road and El Monte Avenue (County Expressway Plan 2040).	AM PM	18.7 79.6	B- E-	19.2 82.7	B- F	N/A	4	19.2 21.1	B- C+	N/A	4	LTS/SU
58	Alma St / Charleston Rd	Palo Alto	LOS D	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.	AM PM	55.2 55.0	E+ D-	55.7 55.9	E+ E+	3.3	3.5	54.7 54.8	D- D-	3.3	3.5	LTS/SU

Notes: **Bold text** indicates intersection operates at unacceptable level of service. **Bold and highlighted text** indicates a significant impact.

1. Intersection jurisdiction and identification of CMP (Congestion Management Program) intersections.
LOS Threshold is the threshold between acceptable and unacceptable level of service.
AM = morning peak hour, PM = evening peak hour.
Whole intersection weighted average control delay expressed in seconds per vehicle calculated using methods described in the 2000 *Highway Capacity Manual*, with adjusted saturation flow rates to reflect Santa Clara County Conditions for signalized intersections. For side-street stop-controlled intersections, delay and LOS are reported for the worst-case approach.
LOS = Level of Service. LOS calculations conducted using the TRAFFIX 8.0 analysis software packages, which applies the methods described in the 2000 *Highway Capacity Manual*.
Based on average pedestrian StreetScore+ Quality of Service of all intersection legs. See **Appendix M** for calculations.
Based on average bicycle StreetScore+ Quality of Service of all intersection legs. See **Appendix M** for calculations.
LTS = less-than-significant with mitigation; SU = significant and unavoidable; LTS/SU = less-than-significant with mitigation, but is either (1) located outside Santa Clara County where mitigation measures depend on funding and actions by other jurisdictions, or (2) located in Santa Clara County but depends on other funding for the mitigation to be constructed and thus the mitigation measure may not be implemented in a timely manner to avoid the impact. Significance determination is based on draft mitigation and responsible jurisdiction of the intersection.

Source: Fehr & Peers, August 2017.

8.1.3 CUMULATIVE (2035) WITH PROJECT CONDITIONS

Table 7-1 shows the delays, LOS results, and changes in critical volume-to-capacity ratio and delay used to identify significant intersection impacts under Cumulative (2035) with Project Conditions. Based on the impact criteria listed in Chapter 3: Significance Criteria & Analysis Methodology, the Project would have significant impacts at the following 21 intersections (asterisks indicate that the intersection is also significantly impacted under Background (2018) With Project Conditions):

- Intersection #2: I-280 NB Off-Ramp/Sand Hill Road (AM peak hour) *
- Intersection #17: Junipero Serra Blvd./Foothill Expressway/Page Mill Road (AM and PM peak hours) *
- Intersection #19: Hanover Street/Page Mill Road (AM peak hour)
- Intersection #20: El Camino Real/Page Mill Road-Oregon Expressway (AM and PM peak hours)
- Intersection #21: Middlefield Road/Oregon Expressway (AM peak hour)
- Intersection #29: Foothill Expressway/Hillview Avenue (AM peak hour)
- Intersection #30: Foothill Expressway/Arastradero Road (AM and PM peak hours) *
- Intersection #31: Foothill Expressway/San Antonio Road (PM peak hour) *
- Intersection #32: Foothill Expressway/El Monte Avenue (AM peak hour)
- Intersection #33: Foothill Expressway/Springer Road-Magdalena Avenue (AM and PM peak hours)
- Intersection #37: El Camino Real/Encinal Avenue (PM peak hour)
- Intersection #38: El Camino Real/Valparaiso Avenue (PM peak hour)
- Intersection #41: El Camino Real/Ravenswood Road (PM peak hour)
- Intersection #48: El Camino Real/Embarcadero Road (PM peak hour)
- Intersection #56: Alma Street/Hamilton Avenue (PM peak hour)
- Intersection #58: Alma Street/Charleston Road (PM peak hour) *
- Intersection #59: Middlefield Road/Marsh Road (AM peak hour)
- Intersection #63: Middlefield Road/Lytton Avenue (PM peak hour)
- Intersection #66: Middlefield Road/Embarcadero Road (AM and PM peak hours)
- Intersection #89: Central Expressway/Castro Street-Moffett Boulevard (AM peak hour)
- Intersection #90: Foothill Expressway/Edith Avenue (PM peak hour)

Where feasible physical capacity improvements or other operational improvements are possible, they have been identified, and are described below, along with the post-mitigation level of service and resulting impact level of significance. A bicycle and pedestrian QOS evaluation was performed for each mitigation location, to assess the impacts on bicycle and pedestrian conditions of the proposed mitigation, using the methodology described in Chapter 3, Section 3.6.2. These impacts are also described below. Table 8-2

summarizes all of this information, for the 21 impact locations. **Appendix L** contains the mitigation LOS calculations. **Appendix M** shows the bicycle and pedestrian StreetScore+ QOS results for each location.

8.1.3.1 Santa Clara County

Junipero Serra Boulevard-Foothill Expressway/Page Mill Road (Intersection #17) – The addition of Project traffic under Cumulative (2035) With Project Conditions causes a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM and PM peak hours. Under Existing Conditions, it functions at an unacceptable LOS F during the AM and PM peak hours. It would continue to function at LOS F under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. This intersection serves two major corridors that connect to I-280, and provides a parallel route to I-280. As such, it serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested intersection in 2035.

The following improvements would be capable of reducing this impact:

- Int. #17 Mitigation: Contribute fair-share funding toward the installation of an overlap phase for northbound and southbound right-turning vehicles, and widening of the southbound approach to two lanes between Page Mill Road and Stanford Avenue to align with the existing designated right-turn lane.

Installation of an overlap phase for northbound and southbound right-turning vehicles would be accommodated through the modification of the existing traffic signal, which requires no additional right-of-way. Widening the southbound approach to two lanes between Page Mill Road and Stanford Avenue will likely require the acquisition of additional right-of-way. This improvement would allow southbound right-turning vehicles additional queuing space so southbound through vehicles do not block the right-turn lane. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because the provision of these improvements may require additional funding that has not yet been identified, Santa Clara County may find that the improvements would not be implemented in a timely manner such that the Project's impact is mitigated. Therefore, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; bicycle and pedestrian StreetScore+ QOS would remain unchanged at QOS 3.5 and QOS 4, respectively. With the proposed mitigation, a second lane would be added traveling southbound between Stanford Avenue and Page Mill Road, aligning with the existing designated southbound right-turn lane at Page Mill Road, and would not impact the existing intersection configuration. The pedestrian crossing distances would be unchanged in all directions, maintaining but not exacerbating the current uncomfortable crossing conditions at the intersection.

It is noted that the Tier 1 improvement in the draft *Santa Clara County Expressway Plan 2040* to widen Page Mill Road from just east of Junipero Serra Boulevard-Foothill Expressway to the I-280 ramps is fully funded through Measure B and is assumed to be completed by Year 2035. The second improvement at this intersection, a Tier 3 improvement, is to grade separate Page Mill Road. This improvement was not identified as mitigation because the identified mitigation, which is a smaller project and would have fewer secondary environmental effects, mitigates the Project's impact to a less-than-significant level. In addition, the grade separation project has not undergone CEQA review, may not be approved, and may not receive funding.

Hanover Street/Page Mill Road (Intersection #19) – The addition of Project traffic under Cumulative (2035) With Project Conditions causes a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS E in the AM peak hour. It would function at unacceptable LOS F in the AM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Page Mill Road serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on the local roadway network. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of mitigating this impact:

- Int. #19 Mitigation: Contribute fair-share funding toward installation of a second westbound left-turn lane, identified as an option in the *Page Mill Expressway Corridor Study Report*.

To accommodate the construction of a second westbound left-turn lane, the westbound approach would be widened from three to four lanes and may require the removal of the center median, reduction in lane width, and/or reduction in bicycle lane width at the intersection. The City of Palo Alto has adequate right-of-way to accommodate the dual westbound left-turn lanes and associated receiving lanes on Hanover Street. With this mitigation, the impact would be reduced to a **less-than-significant** level. However, because the provision of this improvement may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian StreetScore+ QOS would remain QOS 4 and QOS 3, respectively. With the proposed mitigation, limited bicycle infrastructure on the north/south approaches would remain as well as the intersection crossing distance, maintaining but not exacerbating the current uncomfortable conditions for bicyclists at the intersection. Pedestrian crossing distances would be unchanged (curb-to-curb) on all approaches. The proposed mitigation measure would not create additional conflicts for the City of Palo Alto's proposed Class I facility on the south side of Page Mill Road as identified in their *Bicycle and Pedestrian Transportation Plan*.

It is noted that there is a Tier 1 intersection improvement identified for this intersection in the draft *Santa Clara County Expressway Plan 2040*. The improvement is to convert the signal phasing to an eight-phase signal. This improvement is not anticipated to reduce the Project's impact to a less-than-significant level. Therefore, it was not identified as a potential mitigation measure. The proposed mitigation measure does not conflict with the County's Tier 1 intersection improvement.

El Camino Real/Page Mill Road-Oregon Expressway (Intersection #20) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM and PM peak hours. Under Existing Conditions, it functions at an acceptable LOS E in the AM and PM peak hours. It would continue to function at LOS E in the AM peak hour under Cumulative (2035) No Project Conditions, but it would function at unacceptable LOS F in the AM peak hour under Cumulative (2035) With Project Conditions. In addition, it would function at unacceptable LOS F in the PM hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions where Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. This intersection serves two major corridors, one connecting to I-280 and US 101 and the other traversing the peninsula and south bay. As such, it serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested intersection in 2035.

The following physical improvements are capable of mitigating this impact:

- Int. #20 Mitigation: Contribute fair-share funding toward the reconfiguration of the east leg of the intersection to include one right-turn lane, two through lanes, two extended left-turn lanes, two receiving lanes, and no on-street parking; and to the extension of the double left-turn lanes as identified in the *Page Mill Expressway Corridor Study Report*.

To accommodate the reconfiguration of the east leg of the intersection, parking would need to be removed along the south side of Page Mill Road and the median island would need to be shifted further to the south to accommodate the additional westbound lane. Little to no right-of-way would be needed to accommodate this improvement; however, an easement on the north side of the roadway to preserve the sidewalk width would be needed, and the existing bus stop located on the southeast corner of the intersection on Oregon Expressway may need to be relocated or further addressed during design. These improvements are identified in Santa Clara County's *Page Mill Corridor Expressway Plan*, and the extension of the double westbound left-turn lanes is identified as a Tier 1 improvement in the draft *Santa Clara County Expressway Plan 2040* along with enhanced pedestrian facilities on the southwest and southeast corners of the intersection. With this mitigation, the impact would be reduced to a **less-than-significant** level. The Tier 1 improvements are fully funded through Measure B. However, because the provision of the remaining improvements may require additional funding that has not yet been identified and all improvements at this intersection would require approval from Caltrans, Santa Clara County may find that this improvement

would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian StreetScore+ QOS would remain at QOS 4. With the proposed mitigation, bicycle and pedestrian crossing distances would remain unchanged (curb-to-curb) in all directions assuming the parking is removed next to the eastbound receiving lanes, with right-turn slip lanes and/or high vehicle turning speeds preserving uncomfortable environments at the intersection. The proposed mitigation measure would not conflict with the City of Palo Alto's *Bicycle and Pedestrian Transportation Plan* to implement a Class III facility on Oregon Expressway east of the intersection.

Middlefield Road/Oregon Expressway (Intersection #21) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS E in the AM peak hour. It would function at unacceptable LOS F in the AM peak hour under Cumulative (2035) No Project Conditions and under Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more in the AM peak hour. This intersection serves two major corridors, one connecting to I-280, El Camino Real, and US 101, and the other traversing the City of Palo Alto and adjacent communities. As such, it serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested intersection in 2035.

Due to the close proximity of the Oregon Avenue frontage road and the County's desire to preserve the shoulder striping along Oregon Expressway for use by bicyclists, no feasible mitigation measures have been identified. Therefore, the impact would remain **significant and unavoidable**. Since no mitigation is proposed, the pedestrian and bicycle QOS would not be affected.

Foothill Expressway/Hillview Avenue (Intersection #29) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS C in the AM peak hour. It would function at unacceptable LOS F in the AM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Foothill Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including I-280. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

Due to the close proximity of the Miranda Avenue/Hillview Avenue intersection and lack of improvement identified in the *Santa Clara County Expressway Plan 2040* at this intersection, no feasible mitigation measures have been identified. Therefore, the impact would remain **significant and unavoidable**. Since no mitigation is proposed, the pedestrian and bicycle StreetScore+ QOS would not be affected.

Foothill Expressway/Arastradero Road (Intersection #30) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM and PM peak hours. Under Existing Conditions, it functions at an acceptable LOS E in the AM peak hour and LOS F in the PM peak hour. It would function at unacceptable LOS F in the AM and PM peak hours under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would decrease the average critical delay in the PM peak hour and increase the average critical delay by more than four seconds in the AM peak hour and would increase the critical volume-to-capacity ratio by 0.01 or more. This intersection serves two major corridors, one connecting to I-280, El Camino Real, and US 101, and the other connecting the Cities of Menlo Park, Palo Alto, Los Alto and Mountain View. As such, the intersection serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested intersection in 2035.

The following physical improvements are capable of mitigating this impact:

- Int. #30 Mitigation: If such grade separation is approved and implemented, contribute fair-share funding toward grade separation as identified in the draft *Santa Clara County Expressway Plan 2040*. The grade separation assumed for purposes of analysis includes a separated throughway for vehicles on Foothill Expressway.

Although the configuration of this proposed interchange has yet to be determined, additional right-of-way would be required to construct this improvement. Due to the close proximity of the Miranda Avenue/Arastradero Road intersection, additional modifications to roadway alignment and turning movements would need to be evaluated along with adequate access for bicyclists and pedestrians. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this Tier 3 improvement has not undergone CEQA review, may not be approved, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

With the exception of construction related impacts, the mitigation would not have a substantial adverse effect on bicycle QOS, which would remain at QOS 3.5. Right-turn lanes and high vehicle speeds would continue to cause uncomfortable conditions for bicyclists at the intersection. However, the mitigation would cause pedestrian QOS to improve from QOS 4 to QOS 2.5. With the proposed mitigation, the pedestrian

crossing distances at the northbound and southbound approaches would be reduced from the existing 6+ lanes to an estimated three lanes, providing more favorable pedestrian crossing conditions at the intersection.

Foothill Expressway/San Antonio Road (Intersection #31) – The addition of Project traffic under Cumulative (2035) With Project Conditions causes a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS E in the PM peak hour. It would function at LOS F under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Foothill Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including I-280. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #31 Mitigation: Contribute fair-share funding toward the construction of a third southbound through lane on Foothill Expressway between San Antonio Road and El Monte Avenue as identified in the draft *Santa Clara County Expressway Plan 2040*.

A third receiving lane would be added on the south leg of Foothill Expressway as identified as a Tier 1 improvement in the *Santa Clara County Expressway Plan 2040* to extend the southbound right-turn lane from El Monte Avenue to San Antonio Road, which will likely require additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement would require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle QOS; the bicycle QOS would remain unchanged at QOS 4. With the proposed mitigation, right-turn slip lanes and high vehicle turning speeds would remain preserving uncomfortable environments for bicyclists at the intersection.

There is no pedestrian access at this intersection; therefore, the proposed mitigation measure would have no effect on pedestrian quality of service.

It is noted that the full Tier 1 intersection improvement identified for this intersection in the draft *Santa Clara County Expressway Plan 2040* includes widening Foothill Expressway from four to six lanes between San Antonio Road and El Monte Avenue. The proposed mitigation implements the southbound widening.

Foothill Expressway/El Monte Avenue (Intersection #32) – The addition of Project traffic under Cumulative (2035) With Project Conditions causes a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS E in the AM peak hour. It would function at LOS F under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more in the AM peak hour. Foothill Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including I-280. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #32 Mitigation: Contribute fair-share funding toward the construction of a third northbound through lane at the intersection and associated receiving lane as identified in the draft *Santa Clara County Expressway Plan 2040*.

To accommodate the construction of a third northbound through lane, the northbound approach would be widened from two to three lanes and may require the acquisition of additional right-of-way. The receiving lanes on the north side of the intersection would also need to be widened as identified as a Tier 1 improvement in the *Santa Clara County Expressway Plan 2040* to extend the northbound right-turn lane from San Antonio Road to El Monte Avenue, which will likely require additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. The Tier 1 improvements are fully funded through Measure B. Because the remainder of these improvements would require additional funding that has not yet been identified, Santa Clara County may find that this improvement will not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian QOS would remain unchanged, at QOS 4 (for both). The east/west bicycle and pedestrian crossing distances would increase slightly due to the additional through lane and continue to have right-turn slip lanes and high vehicle turning speeds, while maintaining the current quality of service score.

It is noted that the full Tier 1 intersection improvement identified for this intersection in the draft *Santa Clara County Expressway Plan 2040* Includes widening Foothill Expressway from four to six lanes between San Antonio Road and El Monte Avenue. The proposed mitigation implements the northbound widening, but the southbound widening, although would increase the available storage capacity, would not reduce the Project's AM peak hour impact to a less-than-significant level. Therefore, the southbound widening was not identified as a potential mitigation measure at this intersection.

Foothill Expressway/Springer Road–Magdalena Avenue (Intersection #33) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM and PM peak hours. Under Existing Conditions, it functions at an acceptable LOS E in the AM and PM peak hours. It would function at unacceptable LOS F in the AM and PM peak hours under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Foothill Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including I-280. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #33 Mitigation: Contribute fair-share funding toward the following improvements:
 - Convert to an eight-phase signal as identified in the draft *Santa Clara County Expressway Plan 2040*
 - Change the lane configuration for the east leg to have two left-turn lanes, one through lane, and one right-turn lane
 - Change the lane configuration for the west leg to have one left-turn lane, two through lanes, and one right-turn lane

Converting the existing phasing to an eight-phase signal with the associated lane configuration changes above is identified as a Tier 2 improvement in the Santa Clara County *Expressway Plan 2040*. In order to accommodate an eight-phase signal, the eastbound and westbound left-turn movements would require designated left-turn lanes and may require the acquisition of additional right-of-way. The above mitigation measure would reduce the Project's impact to a less-than-significant level while also incorporating the Tier 2 improvement. In order to accommodate this improvement, the center median on the west leg of the intersection would need to be shifted to incorporate a designated left-turn lane and remove one receiving lane from the west leg. The eastbound approach would require re-striping to change the shared left-turn/through lane to a designated left-turn lane. With this mitigation, the impact would be reduced to a **less-than-significant** level. However, because the provision of this improvement may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian StreetScore+ QOS would remain at QOS 3.5 and QOS 4, respectively. With the proposed mitigation, bicycle and pedestrian crossing distances would remain unchanged (curb-to-curb) in all directions, with right-turn slip lanes and high vehicle turning speeds maintaining the current uncomfortable

environment at the intersection. To construct the designated eastbound left-turn lane, the eastbound lanes will be narrowed and the center median may be reduced resulting in the same curb-to-curb width, but increasing the number of travel lanes. The proposed mitigation would not adversely affect the City of Los Alto's existing Class II bicycle facilities at the Foothill Expressway/Springer Road-Magdalena Avenue intersection.

It is noted that the full Tier 2 intersection improvement identified for this intersection in the draft Santa Clara County Expressway Plan 2040 includes converting to an eight-phase signal, operational/safety improvements at the County Club Drive intersection, and potentially adding a signal at the adjacent Berry Avenue intersection. The proposed mitigation implements the eight-phase signal and associated lane configuration changes at the intersection.

Central Expressway/Castro Street-Moffett Boulevard (Intersection #89) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County CMP signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS E in the AM peak hour. It would function at LOS F under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Central Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including US 101. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #89 Mitigation: Close Castro Street at the train tracks to form a T-intersection of Central Expressway and Moffett Boulevard, consistent with recommendations in the *Mountain View Transit Center Master Plan (May 2017)*.

It is noted that there is a Tier 1 intersection improvement identified for this intersection in the draft *Santa Clara County Expressway Plan 2040*. The improvement is to grade separate the train tracks from the intersection. Although this improvement would increase the available capacity at the intersection and would reduce the Project's impact to a less-than-significant level, the City of Mountain View has approved plans to close Castro Street (the west leg) at the train tracks, which would change the current four-leg intersection to a T-intersection of Central Expressway and Moffett Boulevard. This improvement will not require any additional right-of-way if implemented by the City of Mountain View. Given that this is the City's preferred improvement and would reduce the Project's impact to a **less-than-significant** level, the closure of Castro Street is the identified mitigation measure at this intersection; if Castro Street is closed, Stanford would not need to contribute to any improvements at this intersection. Because this improvement would require approval from the City of Mountain View, Santa Clara County may find that this improvement would not be

implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation is anticipated to improve bicycle and pedestrian QOS; the bicycle QOS would shift from 3.3 to 1.7 and the pedestrian QOS would shift from 4 to 2. With the closure of Castro Street, pedestrian and bicycle crossings will be moved to a separated underground facility to cross Central Expressway and the Caltrain tracks with the exception of the east leg of the intersection where pedestrian crossings would still occur at grade. Northbound and southbound bicyclists would continue to travel on Central Expressway, but bicyclists traveling from Moffett Boulevard to Castro Street would use the underground crossing.

If the closure of Castro Street is not implemented in a timely manner and/or the City of Mountain View does not pursue the improvement, a second back-up mitigation measure is proposed. The following secondary physical improvements are capable of reducing this impact to a less than significant level:

- Int. #89 Mitigation Alternative: If the City of Mountain View does not close Castro Street, contribute fair-share funding toward the construction of a second southbound left-turn lane from Central Expressway to Moffett Boulevard.

To accommodate the construction of a second southbound left-turn lane, the Central Expressway center median would need to be reduced and/or removed, and the improvement would not require any additional right-of-way. Given the existing and proposed geometry, signal timings may also need to be adjusted to lead-lag lefts to account for potential truck turn conflicts. With this mitigation, the impact would be reduced to a less-than-significant level. Because this improvement would require approval from the City of Mountain View, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain significant and unavoidable.

Foothill Expressway/Edith Avenue (Intersection #90) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Santa Clara County signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS C in the PM peak hour. It would function at unacceptable LOS F in the PM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Foothill Expressway serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators, due to the limited available capacity on parallel routes including I-280. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

Due to the close proximity of the residential units and retail space near the intersection, no feasible mitigation measures have been identified. Therefore, the impact would remain **significant and unavoidable**. Since no mitigation is proposed, the pedestrian and bicycle QOS would not be affected.

8.1.3.2 City of Palo Alto

El Camino Real/Embarcadero Road (Intersection #48) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a City of Palo Alto / Santa Clara County CMP signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS D in the PM peak hour. It would function at acceptable LOS E in the PM peak hour under Cumulative (2035) No Project Conditions, but would function at unacceptable LOS F in the PM peak hour under Cumulative (2035) With Project Conditions. This intersection serves two major corridors, one connecting to US 101 and the other traversing the peninsula and south bay. The intersection serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested intersection in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #48 Mitigation: Contribute fair-share funding toward the addition of a second northbound left-turn lane.

To accommodate the construction of a second northbound left-turn lane, the northbound approach would be widened from four to five lanes by potentially reducing the lane widths, reducing the width of the center median, and/or removing on-street parking for the length of the additional left-turn pocket and taper. Right-of-way may be required to accommodate the second northbound left-turn lane. With this mitigation, the impact would be reduced to a **less-than-significant** level. However, because the provision of this improvement may require additional funding that has not yet been identified as well action by the City of Palo Alto and Caltrans, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is avoided or mitigated. In such case, the impact would remain **significant and unavoidable**.

The VTA El Camino Real Bus Rapid Transit (BRT) Project would upgrade the 522 Rapid Bus Route to have Bus Rapid Transit status. The geometric alternatives included in the draft Environmental Impact Report for the BRT Project do not include a separate bus lane through this intersection. Some alternatives studied include the creation of outboard bus lanes through the removal of parking on the south side of El Camino Real. Since there is no final design for this intersection and the BRT project completion data is uncertain, it is not possible to determine what, if any, effect of the mitigation would have on the BRT Project. However, the existing bus stop on the northeast corner on El Camino Real may block through traffic when boarding and alighting passengers if the proposed mitigation measure is built. This is typical for bus stops on El Camino Real and other major arterials.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian StreetScore+ QOS would remain QOS 3.8 and QOS 4, respectively. With the proposed mitigation, bicycle and pedestrian crossing distances would remain unchanged (curb-to-curb) in all directions, but

would add an additional travel lane on the south leg of the intersection, with right-turn slip lanes and high vehicle turning speeds maintaining the current uncomfortable environment at the intersection. This proposed mitigation would not adversely affect the City of Palo Alto's proposed Class III facilities as identified in their *Bicycle and Pedestrian Transportation Plan*. It should be noted that the City is currently designing bicycle improvements at this intersection.

Alma Street/Hamilton Avenue (Intersection #56) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a City of Palo Alto signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS B in the PM peak hour. It would function at unacceptable LOS E in the PM peak hours under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Alma Street provides a key north-south connection in Palo Alto and communities to the south, and given the limited capacity on parallel routes such as El Camino Real, it is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #56 Mitigation: Contribute fair-share funding toward the reconfiguration of the westbound approach to have one left-turn lane and one right-turn lane, by removing on-street parking.

By removing on-street parking, the reconfiguration of the westbound approach to have one left-turn lane and one right-turn lane would not require the acquisition of additional right-of-way, but would require the removal of potentially four on-street parking spaces on the north side of Hamilton Avenue. With this mitigation, the impact would be reduced to a **less-than-significant** level. However, because the provision of this improvement may require additional funding that has not yet been identified as well action by the City of Palo Alto, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is avoided or mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian StreetScore+ QOS would remain QOS 2.5 and QOS 2, respectively. With the proposed mitigation, bicycle and pedestrian crossing distances would remain unchanged (curb-to-curb) in all directions, with a single right-turn lane in the westbound direction and low vehicle turning speeds, preserving a generally comfortable environment at the intersection. This proposed mitigation would not adversely affect the City of Palo Alto's proposed Class III facilities as identified in their *Bicycle and Pedestrian Transportation Plan*.

Alma Street/Charleston Road (Intersection #58) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a City of Palo Alto signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an

acceptable LOS D in the PM peak hour. It would function at unacceptable LOS F in the PM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. This intersection serves two major corridors serving Palo Alto and Mountain View, including connections to US 101, El Camino Real and I-280. As such, it is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #58 Mitigation: Contribute fair-share funding toward add a designated right-turn lane and install an overlap phase for the northbound and southbound right-turn movements.

To accommodate the construction of a designated northbound right-turn lane, the northbound approach would need to be widened and will likely require the acquisition of additional right-of-way. Installation of an overlap phase for northbound and southbound right-turning vehicles would be accommodated through the modification of the existing traffic signal. With this mitigation, the level of service would be improved and the impact would be reduced, but not to a less than significant level. Therefore, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; bicycle and pedestrian StreetScore+ QOS would remain unchanged at QOS 3.3 and QOS 3.5, respectively. With the proposed mitigation, pedestrian crossing distances would increase slightly on the south leg of the intersection and remain unchanged on all other approaches while maintaining the current quality of service score at the intersection. Bicycle lanes on the eastbound and westbound approaches, and low right-turn speeds would remain, resulting in slightly better conditions compared to what bicyclists experience on the northbound and southbound approaches. The proposed mitigation measure would not conflict with the City of Palo Alto's proposed Class III facility along Alma Street as identified in the City of Palo Alto Bicycle & Pedestrian Transportation Plan. With a Class III facility, bicyclists travel in the vehicle lane and do not require a separated space as with a bicycle lane.

Middlefield Road/Lytton Avenue (Intersection #63) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a City of Palo Alto signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS D in the PM peak hour. It would function at unacceptable LOS E in the PM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. Middlefield Road provides a key north-south connection in Palo Alto and communities to the north and south, and given the limited capacity on parallel routes such as El

Camino Real, it is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

Due to the close proximity of the residential units near the intersection, no feasible mitigation measures have been identified. Therefore, the impact would remain **significant and unavoidable**. Since no mitigation is proposed, the pedestrian and bicycle QOS would not be affected.

It is noted that a mitigation was identified for this intersection in the *Menlo Park Facebook Campus Expansion Project FEIR (November 2016)*. The mitigation was to add a second eastbound left-turn lane. However, because of the inability to widen the roadway due to the close proximity of the residential units, it is considered infeasible.

Middlefield Road/Embarcadero Road (Intersection #66) – The addition of Project traffic under Cumulative (2035) With Project Conditions causes a significant impact based on the significance criteria for a City of Palo Alto signalized intersection during the AM and PM peak hours. Under Existing Conditions, it functions at an acceptable LOS C and D in the AM and PM peak hours, respectively. It would function at unacceptable LOS E in the AM and PM peak hours under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project conditions. Project-generated traffic would increase the average critical delay by more than four seconds and would increase the critical volume-to-capacity ratio by 0.01 or more. This intersection serves two key transportation corridors connecting to US 101 and El Camino Real, and connecting Palo Alto to communities to the north and south. As such, it is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

Based on the close proximity of the residential units near the intersection, no feasible mitigation measures have been identified. Therefore, the impact would remain **significant and unavoidable**. Since no mitigation is proposed, the pedestrian and bicycle QOS would not be affected.

8.1.3.3 City of Menlo Park

I-280 Northbound Off-Ramp/Sand Hill Road (Intersection #2) – The addition of Project traffic under Cumulative (2035) With Project Conditions causes a significant impact based on the significance criteria for a City of Menlo Park signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS D in the AM peak hour. It would function at unacceptable LOS F in the AM peak hour under Cumulative (2035) No Project Conditions and under Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average delay on the eastbound through (local) approach by more than 0.8 seconds. The poor AM peak hour conditions in 2035 are the result of a substantial increase in non-Project traffic growth at the Sand Hill Road interchange, along with Project traffic primarily entering the northbound ramps intersection from the west (i.e. from the southbound off-ramp).

The following physical improvements are capable of reducing this impact:

- Int. #2 Mitigation: Contribute fair-share funding toward the addition of a second northbound right-turn lane as identified in the *ConnectMenlo Final Environmental Impact Report*.

To accommodate the construction of a second northbound right-turn lane, the northbound approach would be widened from two to three lanes and may require the acquisition of additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement depends on the actions of Caltrans and the City of Menlo Park, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and QOS; the bicycle StreetScore+ QOS would remain at QOS 4. With the proposed mitigation, limited infrastructure to accommodate bicycle and pedestrian crossings, coupled with high vehicle speeds along Sand Hill Road, create an uncomfortable condition for bicyclists and pedestrians at the intersection. Aside from an eastbound bicycle lane, there are no other bicycle or pedestrian facilities at this intersection. The northbound right-turn lane from the off-ramp to Sand Hill Road is currently protected; meaning vehicles are not permitted to turn right on red. The addition of a second northbound right-turn lane would not conflict with eastbound bicyclists if the right-turn lanes were to remain protected.

Pedestrians interested in walking across the interchange must do so on the northern bridge that carries westbound traffic. The proposed mitigation measure would have no effect on pedestrian quality of service as pedestrians are not allowed at the intersection.

El Camino Real/Encinal Avenue (Intersection #37) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a City of Menlo Park signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS C in the PM peak hour. It would function at unacceptable LOS F in the PM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average delay on the westbound right-turn (critical) movements by more than 0.8 seconds. El Camino Real is a major north-south corridor serving the peninsula and south bay, which serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #37 Mitigation: Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane by removing on-street parking.

By removing on-street parking on the east side of El Camino Real, the conversion of the northbound right-turn lane to a shared through/right-turn lane would not require the acquisition of additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement depends on the actions of the City of Menlo Park and Caltrans, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian StreetScore+ QOS would remain at QOS 2.8 and QOS 2.7, respectively. With the proposed mitigation, pedestrian crossing distances would remain unchanged (curb-to-curb) on all approaches. Low right-turn speeds and short right-turn lanes would remain, maintaining better conditions for bicyclists traveling along the eastbound and westbound approaches, compared to what bicyclists experience on El Camino Real. While the bicycle StreetScore+ QOS at the northbound approach will not improve, bicyclists will no longer move left across the right-turn conflict area and RTOR will be reduced, because vehicles will no longer have a designated turn lane. The San Mateo County *Comprehensive Bicycle and Pedestrian Plan* (2011) proposes Class II facilities on El Camino Real between Valparaiso Avenue and Alejandra Avenue while the City of Menlo Park *Comprehensive Bicycle Development Plan* (2005) proposed Class III facilities on El Camino Real at Encinal Avenue. The proposed mitigation measure could conflict with a Class II facility (bicycle lane) if only on-street parking is removed in order to add a third through lane. However, if the center median were narrowed, space for a bicycle lane could be provided. The proposed mitigation measure would not conflict with a Class III facility. The existing bus stop on the northeast corner on El Camino Real may block through traffic when boarding and alighting passengers if the proposed mitigation measure is constructed. However, this is typical for bus stops on El Camino Real and other major arterials.

El Camino Real/Valparaiso Avenue (Intersection #38) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a City of Menlo Park signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS D in the PM peak hour. It would function at unacceptable LOS E in the PM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average delay on the eastbound left-turn and westbound through (critical) movements by more than 0.8 seconds. El Camino Real is a major north-south corridor serving the peninsula and south bay, which serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #38 Mitigation: Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane by removing on-street parking.

By removing on-street parking on the east side of El Camino Real, the conversion of the northbound right-turn lane to a shared through/right-turn lane would not require the acquisition of additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement depends on the actions of the City of Menlo Park and Caltrans, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; with the proposed mitigation, the bicycle and pedestrian StreetScore+ QOS would remain at QOS 3.3 and QOS 4, respectively. With the proposed mitigation, pedestrian crossing distances would remain unchanged (curb-to-curb) across all legs of the intersection, maintaining the current uncomfortable crossing conditions. Bicycle lanes and low right-turn speeds would remain along Valparaiso Avenue, maintaining better conditions for bicyclists traveling along the eastbound and westbound approaches, compared to what bicyclists experience on El Camino Real. While the bicycle StreetScore+ QOS at the northbound approach would not improve, bicyclists would no longer move left across the right-turn conflict area and RTOR will be reduced because vehicles would no longer have a designated turn lane. The *San Mateo County Comprehensive Bicycle and Pedestrian Plan* (2011) and the *City of Menlo Park Comprehensive Bicycle Development Plan* (2005) propose Class III facilities on El Camino Real at Valparaiso Avenue. The proposed mitigation measure would not conflict with a Class III facility.

El Camino Real/Ravenswood Road (Intersection #41) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a City of Menlo Park signalized intersection during the PM peak hour. Under Existing Conditions, it functions at an acceptable LOS D in the PM peak hour. It would function at unacceptable LOS E in the PM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase the average delay on the eastbound and westbound left-turn (critical movements by more than 0.8 seconds. El Camino Real is a major north-south corridor serving the peninsula and south bay, which serves a large existing traffic volume and is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #41 Mitigation: Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane by removing on-street parking.

The conversion of the northbound right-turn lane to a shared through/right-turn lane would not require the acquisition of additional right-of-way. With this mitigation, the impact would be reduced to a **less-than-significant** level. Because this improvement depends on the actions of the City of Menlo Park and

Caltrans, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The mitigation would not have a substantial adverse effect on bicycle and pedestrian QOS; the bicycle and pedestrian StreetScore+ QOS would remain unchanged at QOS 3.5 (for both). With the proposed mitigation, pedestrian crossing distances would remain unchanged (curb-to-curb) across all legs of the intersection, maintaining the current crossing conditions. Bicycle routes and low right-turn speeds would remain along Ravenswood Road, maintaining better conditions for bicyclists traveling in the eastbound and westbound directions, compared to what bicyclists experience on El Camino Real. While the bicycle StreetScore+ QOS at the northbound approach will not improve, bicyclists would no longer move left across the right-turn conflict area and RTOR would be reduced because vehicles would no longer have a designated turn lane. The *San Mateo County Comprehensive Bicycle and Pedestrian Plan* (2011) and the *City of Menlo Park Comprehensive Bicycle Development Plan* (2005) propose Class III facilities on El Camino Real at Valparaiso Avenue. The proposed mitigation measure would not conflict with a Class III facility.

8.1.3.4 City of East Palo Alto

No significant impacts are identified for East Palo Alto intersections.

8.1.3.5 Town of Atherton

Middlefield Road/Marsh Road (Intersection #59) – The addition of Project traffic under Cumulative (2035) With Project Conditions would cause a significant impact based on the significance criteria for a Town of Atherton signalized intersection during the AM peak hour. Under Existing Conditions, it functions at an acceptable LOS C in the AM peak hour. It would function at unacceptable LOS E in the AM peak hour under Cumulative (2035) No Project Conditions and Cumulative (2035) With Project Conditions. Project-generated traffic would increase average critical delay by more than four seconds and increase the volume to capacity ratio by 0.01 or more. This intersection serves a key north-south connector roadway in the region, and a key connecting roadway which provides access to US 101. As such, it is projected to serve substantial traffic growth from other non-Project regional generators. The significant impact is thus the result of adding Project traffic to an already-congested corridor in 2035.

The following physical improvements are capable of reducing this impact:

- Int. #59 Mitigation: Contribute fair-share funding toward the addition of a second westbound left-turn lane and add a second receiving lane on the south leg, consistent with the recommendations in the *ConnectMenlo Final EIR* (November 2016) and the *Middle Plaza at 500 El Camino Real Draft EIR* (March 2017).

Right-of-way acquisition would be required to accommodate the construction of a second westbound left-turn lane and a second receiving lane on the south leg. This mitigation measure may also be found in the Facebook Campus Expansion FEIR and the Menlo Gateway FEIR. The Town of Atherton has preliminary plans to redesign the intersection. With this mitigation, the impact would be reduced to a ***less-than-significant*** level. Because this improvement depends on the actions of the City of Menlo Park and Town of Atherton, and may require additional funding that has not yet been identified, Santa Clara County may find that this improvement would not be implemented in a timely manner such that the Project's impact is mitigated. In such case, the impact would remain **significant and unavoidable**.

The proposed mitigation would cause the bicycle StreetScore+ QOS to fall from QOS 2.7 to QOS 3; the pedestrian StreetScore+ QOS would remain at QOS 3. With the proposed mitigation, a second receiving lane would be added on the southbound approach, causing an uncomfortable situation where bicyclists travel along a four-lane roadway compared to a three-lane roadway existing today. Missing sidewalks and curb ramps cause uncomfortable situations for pedestrians at all intersection crossings.

TABLE 8-2: CUMULATIVE (2035) WITH PROJECT MITIGATION INTERSECTION LEVEL OF SERVICE, BICYCLE AND PEDESTRIAN QUALITY OF SERVICE RESULTS

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Mitigation Description	Peak Hour ³	Cumulative (2035) No Project Conditions		Cumulative (2035) With Project Conditions				2035 With Project and Mitigation Conditions				Impact Significance With Mitigation ⁸
						Delay ⁴	LOS ⁵	Delay ⁴	LOS ⁵	Ped QOS ⁶	Bike QOS ⁷	Delay ⁴	LOS ⁵	Ped QOS ⁶	Bike QOS ⁷	
2	I-280 NB Off-Ramp / Sand Hill Rd	Menlo Park	LOS D	Contribute fair-share funding toward the addition of a second northbound right-turn lane (ConnectMenlo Final EIR).	AM PM	136.9 18.4	F B-	155.2 18.6	F B-	4	4	68.1 15.7	E B	4	4	LTS/SU
17	Junipero Serra Blvd - Foothill Expy / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward the installation of an overlap phase for northbound and southbound right-turning vehicles and the widening of the southbound approach to two lanes between Page Mill Road and Stanford Avenue to align with the existing designated right-turn lane.	AM PM	163.6 152.6	F F	167.7 163.7	F F	4	3.5	130.1 150.4	F F	4	3.5	LTS/SU
19	Hanover St / Page Mill Rd	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward the addition of a second westbound left-turn lane (Page Mill Expressway Corridor Study Report).	AM PM	90.7 52.7	F D-	97.6 53.8	F D-	3	4	76.6 50.9	E- D	3	4	LTS/SU
20	El Camino Real / Page Mill Rd - Oregon Expy	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward the reconfiguration of the east leg of the intersection to include one right-turn lane, two through lanes, two left-turn lanes, two receiving lanes, and no on-street parking, as well as the extension of the double left-turn lanes (Page Mill Expressway Corridor Study Report).	AM PM	76.4 83.1	E- F	86.3 90.8	F F	4	4	70.7 83.0	E F	4	4	LTS/SU
21	Middlefield Rd / Oregon Expy	Santa Clara County (SC CMP)	LOS E	No feasible mitigation measure.	AM PM	122.6 101.6	F F	125.5 103.7	F F	3	3.7	N/A	N/A	N/A	N/A	SU
29	Foothill Expy / Hillview Ave	Santa Clara County	LOS E	No feasible mitigation measure.	AM PM	121.1 48.2	F D	131.6 52.4	F D-	4	3.7	N/A	N/A	N/A	N/A	SU
30	Foothill Expy / Arastradero Rd	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward grade separation (County Expressway Plan 2040).	AM PM	293.4 211.5	F F	298.6 217.3	F F	4	3.5	41.4 74.0	D E	2.5	3.5	LTS/SU
31	Foothill Expy / San Antonio Rd	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding to the construction of a third southbound through lane on Foothill Expressway between San Antonio Road and El Monte Avenue (County Expressway Plan 2040).	AM PM	36.0 156.3	D+ F	40.1 161.2	D F	N/A	4	40.1 45.4	D D	N/A	4	LTS/SU
32	Foothill Expy / El Monte Ave	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward the addition of a third northbound through lane and associated receiving lane (County Expressway Plan 2040).	AM PM	142.1 123.9	F F	148.9 128.4	F F	4	4	74.1 110.3	E F	4	4	LTS/SU
33	Foothill Expy / Springer Road-Magdalena Ave	Santa Clara County (SC CMP)	LOS E	Contribute fair-share funding toward converting to an eight-phase signal; changing the lane configuration for the east leg to have two left-turn lanes, one through lane, and one right-turn lane, and changing the west leg to have one left-turn lane, two through lanes, and one right-turn lane (County Expressway Plan 2040).	AM PM	128.7 148.3	F F	131.9 151.1	F F	4	3.5	123.0 144.9	F F	4	3.5	LTS/SU
37	El Camino Real / Encinal Ave	Menlo Park	LOS D	Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane.	AM PM	44.9 89.9	D F	45.4 92.9	D F	2.7	2.8	35.5 67.2	D+ E	2.7	2.8	LTS/SU
38	El Camino Real / Valparaiso Ave	Menlo Park	LOS D	Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane.	AM PM	53.5 56.0	D- E+	54.0 57.4	D- E+	4	3.3	52.5 52.3	D- D-	4	3.3	LTS/SU
41	El Camino Real / Ravenswood Rd	Menlo Park	LOS D	Contribute fair-share funding toward the conversion of the northbound right-turn lane to a shared through/right-turn lane.	AM PM	48.0 63.8	D E	48.7 65.8	D E	3.5	3.5	47.6 63.7	D E	3.5	3.5	LTS/SU
48	El Camino Real / Embarcadero Rd	Palo Alto (SC CMP)	LOS E	Contribute fair-share funding toward the addition of a second northbound left-turn lane.	AM PM	56.9 72.1	E+ E	60.4 82.2	E F	4	3.8	53.1 71.1	D- E	4	3.8	LTS/SU
56	Alma St / Hamilton Ave	Palo Alto	LOS D	Contribute fair-share funding toward the reconfiguration of the westbound approach to have one left-turn lane and one right-turn lane, by removing a portion of the parking.	AM PM	10.2 57.7	B+ E+	10.4 60.0	B+ E	2	2.5	10.0 39.3	B+ D	2	2.5	LTS/SU

TABLE 8-2: CUMULATIVE (2035) WITH PROJECT MITIGATION INTERSECTION LEVEL OF SERVICE, BICYCLE AND PEDESTRIAN QUALITY OF SERVICE RESULTS

ID	Intersection	Jurisdiction/ CMP ¹	LOS Threshold ²	Mitigation Description	Peak Hour ³	Cumulative (2035) No Project Conditions		Cumulative (2035) With Project Conditions				2035 With Project and Mitigation Conditions				Impact Significance With Mitigation ⁸
						Delay ⁴	LOS ⁵	Delay ⁴	LOS ⁵	Ped QOS ⁶	Bike QOS ⁷	Delay ⁴	LOS ⁵	Ped QOS ⁶	Bike QOS ⁷	
58	Alma St / Charleston Rd	Palo Alto	LOS D	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.	AM PM	123.7 117.4	F F	127.5 122.5	F F	3.3	3.5	121.7 119.9	F F	3.3	3.5	SU
59	Middlefield Rd / Marsh Rd	Atherton	LOS D	Contribute fair-share funding toward the addition of a second westbound left-turn lane and the addition of a second receiving lane on the south leg.	AM PM	76.9 76.0	E- E-	79.7 77.4	E- E-	3	2.7	41.7 68.6	D E	3	3	LTS/SU
63	Middlefield Rd / Lytton Ave	Palo Alto	LOS D	No feasible mitigation measure.	AM PM	49.2 66.1	D E	51.1 70.1	D- E	2	2.5	N/A	N/A	N/A	N/A	SU
66	Middlefield Rd / Embarcadero Rd	Palo Alto	LOS D	No feasible mitigation measure.	AM PM	55.0 68.1	E+ E	60.2 73.7	E E	2	3	N/A	N/A	N/A	N/A	SU
89	Central Expy / Castro St-Moffett Blvd	Santa Clara County (SC CMP)	LOS E	The City of Mountain View's planned closure of Castro Street at the train tracks to form a T-intersection of Central Expressway and Moffett Boulevard would mitigate the Project impact (Mountain View Transit Center Master Plan). The effects of this project are shown in the mitigation columns to the right. If the Castro Street closure project is not implemented, the secondary, back-up mitigation is to contribute fair-share funding toward the construction of a second southbound left turn lane from Central Expressway to Moffett Boulevard.	AM PM	241.9 221.4	F F	245.4 225.0	F F	4	3.3	85.9 93.0	F F	2	1.7	LTS/SU
90	Foothill Expy / Edith Ave	Santa Clara County (SC CMP)	LOS E	No feasible mitigation measure.	AM PM	52.2 92.8	D- F	57.5 99.7	E+ F	4	3.5	N/A	N/A	N/A	N/A	SU

Notes: **Bold text** indicates intersection operates at unacceptable level of service. **Bold and highlighted text** indicates a significant impact.

1. Intersection jurisdiction and identification of CMP (Congestion Management Program) intersections.
2. LOS Threshold is the threshold between acceptable and unacceptable level of service.
3. AM = morning peak hour, PM = evening peak hour.
4. Whole intersection weighted average control delay expressed in seconds per vehicle calculated using methods described in the 2000 *Highway Capacity Manual*, with adjusted saturation flow rates to reflect Santa Clara County Conditions for signalized intersections. For side-street stop-controlled intersections, delay and LOS are reported for the worst-case approach.
5. LOS = Level of Service. LOS calculations conducted using the TRAFFIX 8.0 analysis software packages, which applies the methods described in the 2000 *Highway Capacity Manual*.
6. Based on average pedestrian StreetScore+ Quality of Service of all intersection legs. See **Appendix M** for calculations.
7. Based on average bicycle StreetScore+ Quality of Service of all intersection legs. See **Appendix M** for calculations.
8. LTS = less-than-significant with mitigation, SU = significant and unavoidable. LTS/SU = less-than-significant with mitigation, but is either (1) located outside Santa Clara County where mitigation measures depend on funding and actions by other jurisdictions, or (2) located in Santa Clara County but depends on other funding for the mitigation to be constructed and thus the mitigation measure may not be implemented in a timely manner to avoid the impact. Significance determination is based on draft mitigation and responsible jurisdiction of the intersection.

Source: Fehr & Peers, August 2017.

8.2 FREEWAY SEGMENT IMPACTS AND MITIGATION MEASURES

Freeway impacts and the associated mitigation measures were evaluated under Background (2018) with Project and Cumulative (2035) with Project Conditions.

The Project is determined to cause a significant impact to freeway facilities based on the criteria described in **Chapter 3: Significance Criteria & Analysis Methodology**. Implementation of the Project would increase vehicle traffic and congestion, resulting in either unacceptable freeway segment LOS or increases in traffic volumes that would exceed the allowable percent increase threshold. This would be considered a significant impact on the following number of segments under each with Project Condition:

- Background (2018) with Project Conditions– four segments; and
- Cumulative (2035) with Project Conditions – eleven segments.

There are limited options to widen the impacted freeway segments due to right-of-way constraints. Additionally, the widening of roadways can lead to other effects, such as induced travel demand (e.g., more vehicles on the roadway due to increased capacity on a particular route), air quality degradation, increases in noise associated with motor vehicles, and reductions in transit use (less congestion or reduced driving time may make driving more attractive than transit travel).

Mitigation of freeway impacts is considered beyond the scope of an individual development project, due to the inability of any individual project or local agency to:

1. Acquire right-of-way for freeway widening, Freeway improvements would require approval by VTA and Caltrans, and as such the local agency cannot guarantee implementation of any improvement in the freeway right-of-way.
2. Fully fund a major freeway mainline improvement. To provide adequate funding, additional sources would be needed, which may include State Transportation Improvement Program funds for projects identified in the VTP, local agency impact fees, and/or a future regional impact fee. The County of Santa Clara could potentially participate in development of a regional fee should it be proposed by regional agencies, such as VTA.

For these reasons, the Project's freeway impacts would remain **significant and unavoidable**.

8.3 NEIGHBORHOOD STREET IMPACTS

Stanford University is surrounded by several residential neighborhoods located in the cities of Palo Alto and Menlo Park that currently experience some level of neighborhood traffic congestion, and are shown in **Figure 8-1**. These neighborhoods include five in the City of Palo Alto:

- College Terrace
- Southgate
- Evergreen Park
- Downtown North
- Crescent Park

There are three neighborhoods in the City of Menlo Park:

- University Heights
- Central Menlo Park
- Allied Arts

In addition to these nearby neighborhoods in Menlo Park and Palo Alto, there are three neighborhoods in the City of East Palo Alto that currently experience cut-through traffic due to the volume of regional traffic using the Dumbarton Bridge. Due to the existing congestion on University Avenue and Willow Road, these neighborhoods are potential cut-through traffic locations. The East Palo Alto neighborhoods reviewed included:

- Palo Alto Parks
- Weeks – Gateway 101
- Pulgas Gardens

Since the approval of the 2000 General Use Permit, there have been a number of efforts to reduce and/or eliminate travel through these neighborhoods generated by Stanford University. These efforts include the following actions:

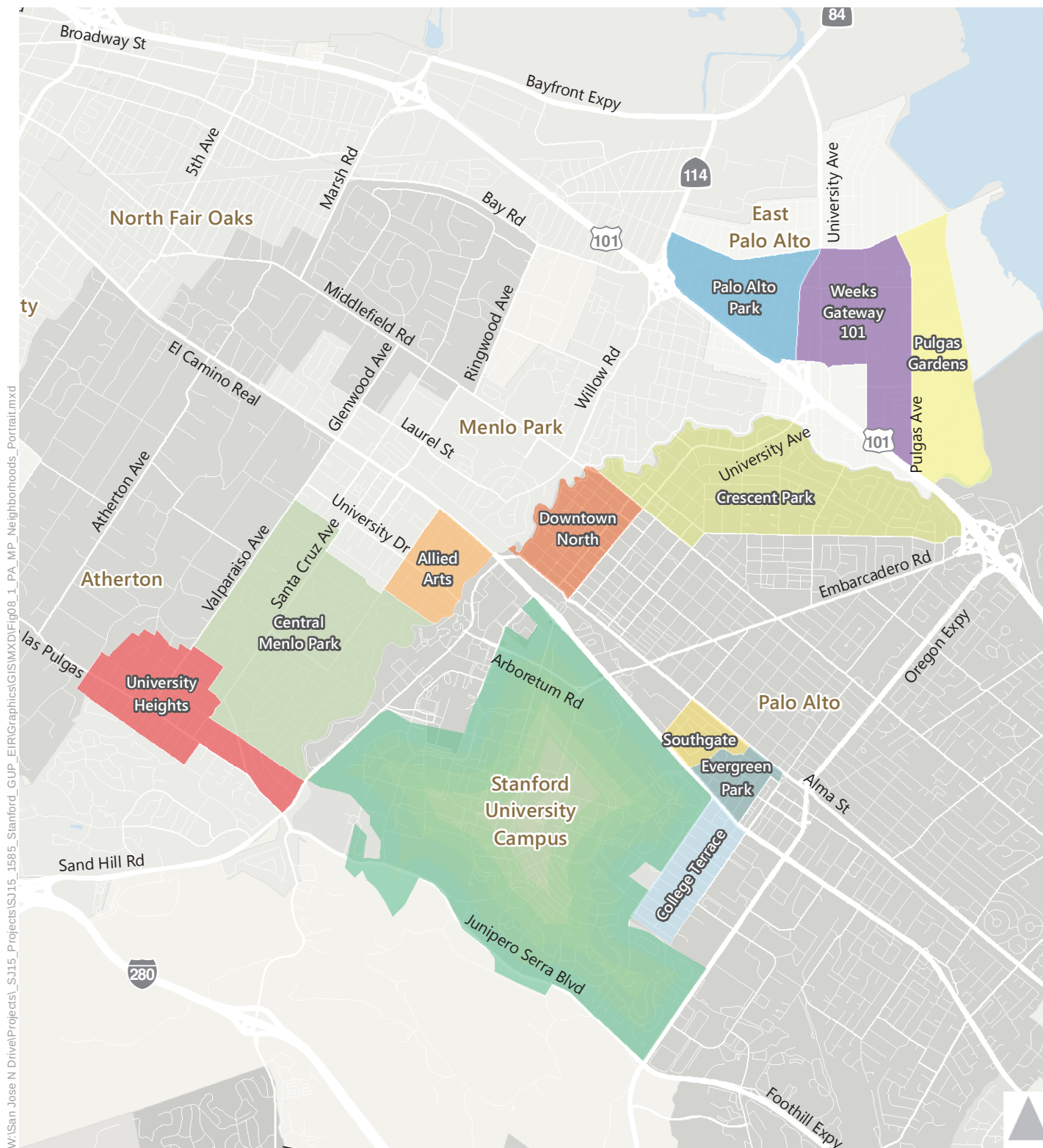
- Sand Hill Road Corridor Project (2003) – The Sand Hill Road Corridor Project resulted in widening and realignment of Sand Hill Road to four lanes between Santa Cruz Avenue and Arboretum Road, and a two-lane extension from Arboretum Road to El Camino Real. This widening and extension occurred after the approval of the 2000 General Use Permit. Widening and realignment of Santa Cruz Avenue from Sand Hill Road to Alpine Road occurred in 2006, which also included a realignment of the Alpine Road/Junipero Serra Boulevard intersection.

Prior to the construction of the Sand Hill Road Corridor Project, there was a two-lane bridge over San Francisquito Creek that created a bottleneck on Sand Hill Road during both the morning and evening peak travel periods. In addition, Sand Hill Road did not extend to El Camino Real. These two conditions limited both the accessibility and capacity of Sand Hill Road for trips between Santa Cruz Avenue and El Camino Real. Therefore, drivers chose alternative routes that passed through downtown Menlo Park including Santa Cruz Avenue, Oak Avenue, and Middle Avenue. The combination of improvements including the widening of Sand Hill Road, extension to El Camino Real, and turning movement restrictions at the intersection of Oak Avenue and Sand Hill Road

reduced the need for drivers to seek alternative routes through the University Heights, Central Menlo Park, and Allied Arts neighborhoods. Because drivers from outside University Heights, Central Menlo Park, and Allied Arts neighborhoods are no longer likely to cut through these neighborhoods to reach the Stanford campus, these neighborhoods are not included in the Neighborhood Streets assessment.

- Downtown North Traffic Calming Study (2004) – This was an effort to restrict through movements and turning movements during peak traffic periods to reduce or eliminate neighborhood traffic impacts in downtown Palo Alto between Middlefield Road and Alma Street. The study included an initial test of seven road closures using temporary barriers to restrict pass-through trips in the neighborhood. Based on input from the neighborhood, a modified plan was implemented that included the following traffic calming elements:
 - Street closure at Middlefield Road/Palo Alto Avenue
 - Traffic circles at the intersections of Everett Avenue/Emerson Street, Hawthorne Avenue/Cowper Street, and Everett Avenue/Webster Street
 - Speed tables on Palo Alto Avenue and Hawthorne Avenue between Alma Street and Emerson Street
 - Time limited left-turn restrictions during the morning and evening peak periods from Alma Street to Hawthorne Avenue and Everett Avenue
 - Time limited right-turn restrictions during the morning peak period from Middlefield Road to Hawthorne Avenue and Everett Avenue

These improvements have been effective at reducing through traffic in Downtown North while allowing access and mobility to the residents. Because drivers from outside Downtown North are no longer likely to pass through the Downtown North neighborhood to travel to and from Stanford University, this neighborhood has not been included in the Neighborhood Streets assessment.



Neighborhood Boundaries

Menlo Park

- Allied Arts
- Central Menlo Park
- University Heights

East Palo Alto

- Weeks Gateway 101
- Pulgas Gardens
- Palo Alto Park

Palo Alto

- College Terrace
- Crescent Park
- Downtown North
- Evergreen Park
- Southgate
- Stanford University Campus



Figure 8-1

Location of Neighborhoods Considered for Street Assessment

- College Terrace Traffic Calming Project (2004) – A traffic calming study was conducted for the neighborhood to develop additional traffic calming measures to reduce the potential for neighborhood traffic impacts from through traffic. College Terrace had a number of street closures that were designed to reduce through traffic in the neighborhood prior to the 2004 study. A new traffic calming plan was tested that included the installation of five traffic circles and five speed tables within the neighborhood. Four traffic circles were constructed on College Avenue at Yale Street, Oberlin Street, Hanover Street, and Columbia Street. A fifth traffic circle was constructed at Yale Street and Cambridge Avenue. Four speed humps were constructed on Stanford Avenue and three speed humps on California Avenue. Following a test period, the traffic calming plan was refined to include the following improvements:
 - Traffic circles on Yale Street at College Avenue and Cambridge Avenue
 - Four speed humps on Stanford Avenue at Wellesley Street, Oberlin Street, Dartmouth Street, and Amherst Street
 - Three speed humps on California Avenue at Wellesley Street, Oberlin Street, and Dartmouth Street
 - Four speed humps on College Avenue at Wellesley Street, Princeton Street, Harvard Street and Dartmouth Street
 - Center median islands were added at Oberlin Street/College Avenue, Hanover Street/College Avenue and Columbia Street/College Avenue

The before and after studies of the neighborhood indicated that the traffic calming program has reduced the number and speed of vehicles in the neighborhood.

While there have not been any new traffic calming studies in the Southgate and Evergreen Park neighborhoods since the preparation of the 2000 General Use Permit, these neighborhoods do have some existing traffic calming features that reduce the potential for vehicle trips through the neighborhood. Even without the existing traffic calming, the location and design of the roadway network eliminates any advantage in traveling through the neighborhood to access the Stanford Campus. In addition, there are existing barriers within the Southgate and Evergreen neighborhoods that make it difficult to use the roadways to pass through the neighborhood. Three critical barriers are:

- The vehicle barrier at the intersection of Castilleja Way and Park Boulevard that prevents vehicles from cutting through the neighborhood using Serra Street, Park Boulevard, Castilleja Way, and Mariposa Avenue to access Churchill Avenue.
- A partial barrier on Park Boulevard east of Oxford Avenue that prevents westbound cut through traffic.
- A road closure on Ash Avenue east of Stanford Avenue that prevents pass through trips in either direction.

Instead of passing through the Southgate and Evergreen Park neighborhoods, travelers accessing the Stanford Campus would use Churchill Avenue along the northern edge of the Southgate neighborhood or Oregon Expressway and El Camino Real to the south and west, respectively. As these roadways are located on the edge of the neighborhoods, through traffic is not expected to travel within the neighborhoods. Therefore, these neighborhoods were not included in the Neighborhood Streets assessment that focuses on pass through trips.

The three East Palo Alto neighborhoods are experiencing increased cut-through traffic during the economic recovery over the past few years. The Palo Alto Parks neighborhood lies between Willow Road and University Avenue and extends between US 101 on the south and Newbridge-Bay Road on the north. This neighborhood experiences cut-through by commuters traversing between Willow Road and University Avenue in order to avoid congestion on the arterials. The Weeks-Gateway 101 and Pulgas Garden neighborhoods, located east of University Avenue, experience cut-through traffic on Clarke Avenue and Pulgas Avenue between East Bayshore and Bay Road. These roadways parallel University Avenue and serve as bypasses of the congestion on University Avenue. Traffic using these roadways typically cross US 101 at Embarcadero Road. The level of cut-through traffic in the East Palo Alto neighborhoods is related to the growth in both local and regional traffic combined with the limited available capacity on the major roadways that serve the Dumbarton Bridge.

Based on the effectiveness of prior mitigation strategies described above, the current conditions within the neighborhoods, and the expected 2018 General Use Permit trip distribution and assignment, two neighborhoods in Palo Alto (College Terrace and Crescent Park) were identified as locations where neighborhood traffic impacts might occur with the proposed growth in the 2018 General Use Permit. These locations were selected for the following reasons:

- College Terrace – The neighborhood lies along the southern boundary of the campus and shares access with Stanford Avenue, which is a primary access route to the campus. Even though the traffic calming measures instituted in this neighborhood appear to have been effective, there remains a concern that there are routes through the neighborhood that drivers from Stanford might use to travel between Stanford Avenue and California Avenue to access Page Mill Road or El Camino Real.
- Crescent Park – The neighborhood lies along University Avenue which is a major access route to regional roadways such as US 101 and SR 84 (Dumbarton Bridge). There is existing congestion on the corridor that includes spillover traffic to parallel roadways such as Hamilton Avenue. Because some of the drivers accessing Stanford University travel along University Avenue, this neighborhood has been selected for further study.

While there is existing cut-through traffic in the East Palo Alto neighborhoods, the potential for traffic generated by the Stanford 2018 General Use Permit on the area is small. Based on the trip distribution

analysis, approximately 5% of the peak period traffic would use the Dumbarton Bridge. This is approximately 40 peak hour trips using both Willow Road and University Avenue. This relative small percentage of the total auto trips added to the network likely is due in part to Stanford's TDM program that includes the provision of free shuttle service for employees traveling to/from the East Bay. Stanford employees have free access to the Dumbarton Express shuttles along with the U-Line commuter bus service. The U-Line service is supplemental East Bay service funded by Stanford University. Because of the small number of peak hour trips, further analysis of cut-through traffic in East Palo Alto neighborhoods is not warranted.

8.3.1 NEIGHBORHOOD DESCRIPTIONS

8.3.1.1 College Terrace Neighborhood

The College Terrace neighborhood is a primarily residential neighborhood bounded by Stanford Avenue on the north, California Avenue on the south, El Camino Real on the east, and Amherst Street on the west. The neighborhood is twelve blocks long and two blocks wide. Stanford Avenue forms a boundary between College Terrace and Stanford University. The principal roadway connecting College Terrace to the Stanford University campus is Bowdoin Street. College Avenue parallels Stanford Avenue and forms the central east-west street in the neighborhood. Several other smaller roadways connect Stanford Avenue to the residential campus community, Escondido Village, located on the north side on Stanford Avenue.

College Terrace was designed as a grid roadway network; however, in the 1970s the grid pattern was modified with a number of road-closures to discourage travel between Stanford Avenue and California Avenue. By 2012, additional permanent traffic calming strategies were implemented within the neighborhood including traffic circles at two locations on Yale Street, multiple speed tables on Stanford Avenue, College Avenue, and California Avenue, and several locations where bollards prevent through vehicle traffic. These devices were designed to slow vehicles and further deter travel through the neighborhood. **Figure 8-2** shows the existing traffic calming infrastructure within College Terrace. These devices prevent direct access between California Avenue and Stanford Avenue without making multiple turns.

Daily traffic counts (24-hour) were collected on Columbia Street, Hanover Street, Harvard Street, Oberlin Street, Princeton Street and Cornell Street to understand the extent of traffic diversion within the neighborhood. As there were no obvious signs of neighborhood traffic impacts in these counts, Stanford traffic was not observed to use these neighborhood streets to access the campus.

8.3.1.2 Crescent Park Neighborhood

The Crescent Park residential neighborhood straddles University Avenue and is bounded by Middlefield Road, Channing Avenue, Newell Road, Woodland Avenue, and San Francisquito Creek. University Avenue is a residential arterial within the Crescent Park neighborhood, providing access to and from Stanford

University, US 101, and the East Bay via the Dumbarton Bridge. **Figure 8-3** shows the existing traffic calming infrastructure and potential travel routes that parallel University Avenue within Crescent Park.

Daily traffic counts (24-hour) were collected at three locations on University Avenue, Hamilton Avenue, and Lytton Avenue to understand the extent of traffic diversion off University Avenue within the neighborhood. These counts show that during the PM peak period Hamilton Avenue sees an increase in traffic due to congestion on University Avenue. On a daily basis Hamilton Avenue, just west of Lincoln Avenue, carries 16% of the combined volume (University Avenue plus Hamilton Avenue). However, between 4:00 – 7:00 PM it carries 67%. This higher percent is due to a combination of factors, including (1) commuters destined for US 101 and points east diverting from University Avenue, and (2) local traffic that avoids University Avenue due to the congestion.

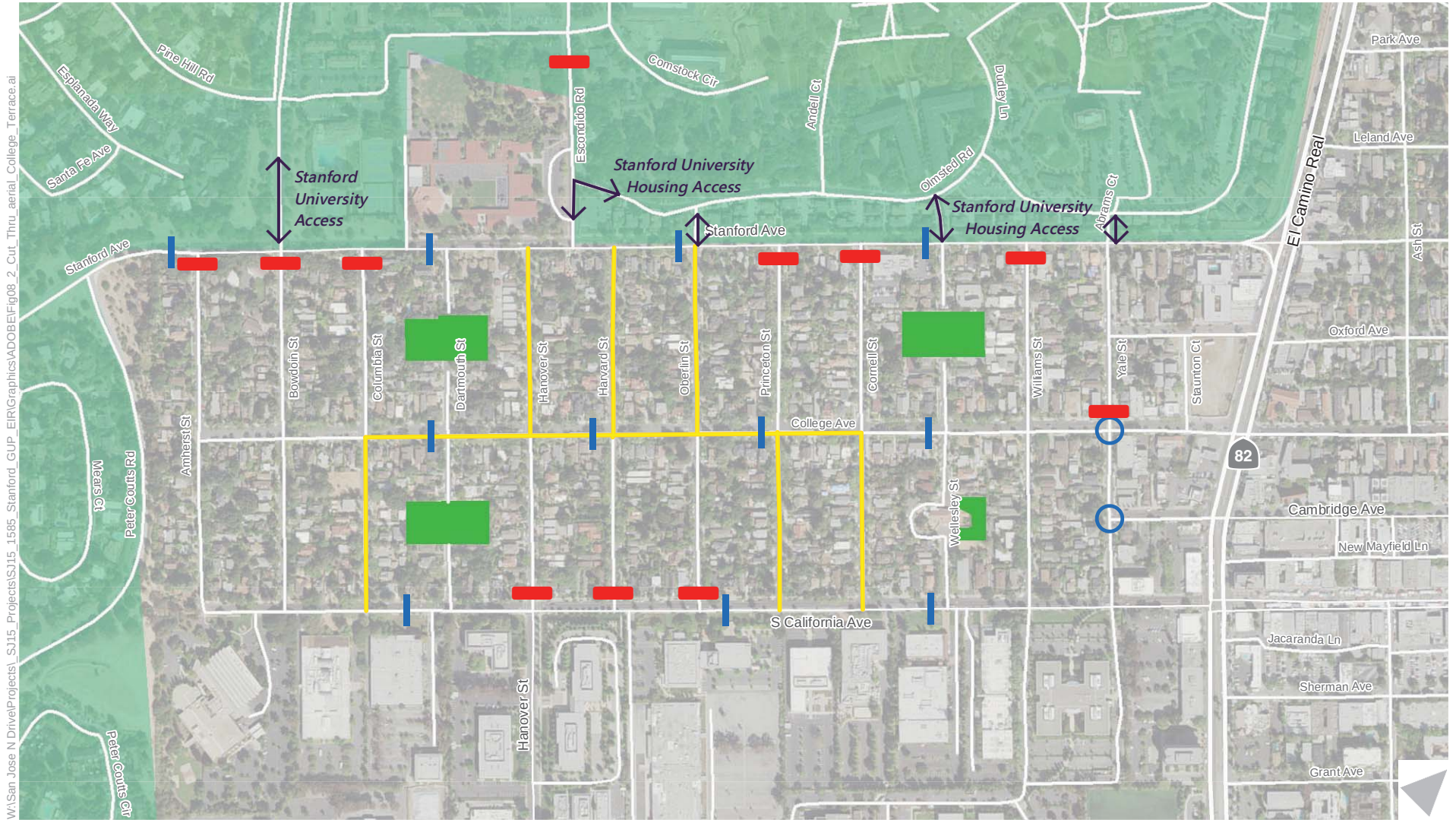
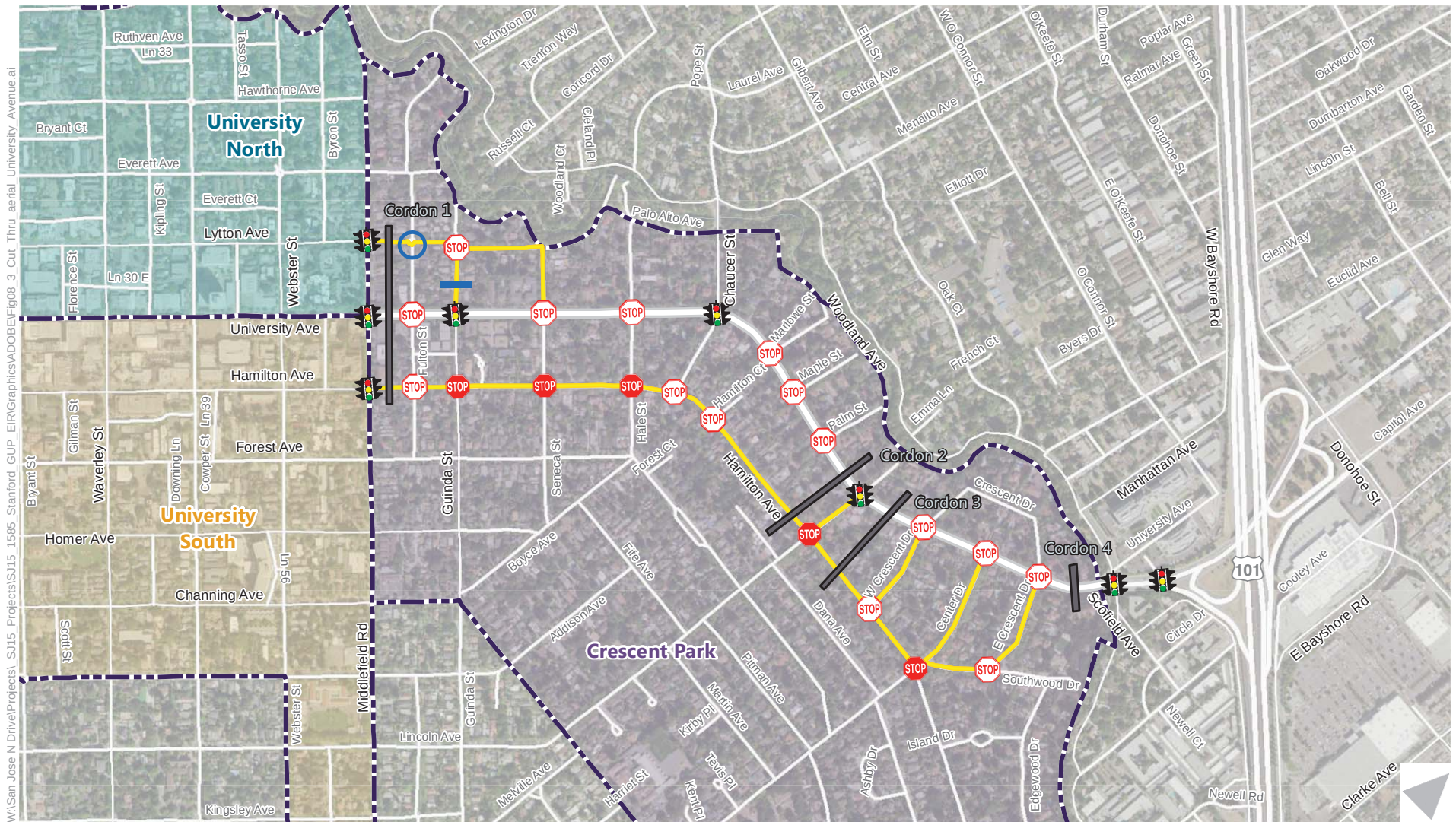


Figure 8-2

College Terrace Neighborhood Existing Traffic Calming



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- | Speed Tables
- Traffic Circles
- Potential Stanford Traffic Routes on Neighborhood Streets
- STOP All-way Stop Control
- STOP Side-street Stop Control
- 🚦 Signalized Intersection
- Neighborhood Boundary



Figure 8-3
Crescent Park Neighborhood
Existing Traffic Calming

8.3.2 TIRE INDICES ON LOCAL STREETS

To measure existing traffic volumes in the neighborhood, 48-hour machine counts were collected at the following locations:

- College Terrace Neighborhood
 - Columbia Street between College Avenue and California Avenue
 - Hanover Street between Stanford Avenue and College Avenue
 - Harvard Street between Stanford Avenue and College Avenue
 - Oberlin Street between Stanford Avenue and College Avenue
 - Princeton Street between College Avenue and California Avenue
 - Cornell Street between College Avenue and California Avenue
- Crescent Park Neighborhood
 - Lytton Avenue between Middlefield Road and Fulton Street
 - University Avenue between Middlefield Road and Fulton Street
 - Hamilton Avenue between Middlefield Road and Fulton Street
 - University Avenue between Palm Street and Lincoln Avenue
 - Hamilton Avenue between Hamilton Court and Lincoln Avenue
 - University Avenue between Lincoln Avenue and Crescent Drive
 - Hamilton Avenue between Lincoln Avenue and Crescent Drive
 - University Avenue between Crescent Drive and Woodland Avenue

The number of new daily trips generated by the proposed 2018 General Use Permit was estimated as the difference between the fall 2018 and fall 2035 total daily vehicle trips for the commuter, resident, and daily visitor populations presented in the *2018 General Use Permit: VMT Report*. Based on the VMT analysis, the 2018 General Use Permit would be expected to generate 18,920 additional daily trips at the completion of development. This is a conservative estimate because it does not assume further expansion of Stanford's successful Traffic Demand Management Programs to achieve the Stanford Community Plan's No Net New Commute Trips goal. Expansion of the TDM programs would reduce both peak period and daily trips.

8.3.2.1 College Terrace TIRE Analysis

TIRE indices for the local streets serving Stanford University in the College Terrace neighborhood are presented in **Table 8-3**. The TIRE indices for existing volumes range from 2.6 to 3.1. **Appendix N** shows the thresholds for the TIRE index relative to the number of vehicles per day.

A driver traveling through the College Terrace neighborhood on his or her way to the Stanford campus would most likely access the campus at the Bowdoin Street gateway, since Oberlin Street, Wellesley Street

and Yale Street primarily serve the graduate student residents in Escondido Village and access to the main campus is blocked at Escondido Road. Based on traffic counts presented in the *Stanford University Traffic Monitoring Report (2015)* prepared by the County's independent consultant, AECOM, about ten percent of Stanford-related trips travel in and out of the campus at Bowdoin Street. Based on the 2018 General Use Permit Application proposed distribution of development on campus, this percentage is not expected to change significantly under the 2018 General Use Permit. Applying this percentage to the new daily trips estimated for the proposed 2018 General Use Permit yields an estimate that 1,892 daily vehicles would use Bowdoin Street to access Stanford University.

Many of the daily trips that access the Stanford campus at Bowdoin Street do not pass through the College Terrace neighborhood. There is a barrier at the entrance to the College Terrace neighborhood at Bowdoin Street. Accordingly, all vehicles entering or exiting the campus at Bowdoin Street must also use Stanford Avenue. Vehicles traveling to or from the campus by way of the portion of Stanford Avenue that is to the west of Bowdoin Street do not pass through the College Terrace neighborhood. Vehicles traveling to or from the campus by way of the portion of Stanford Avenue that is to the east of Bowdoin Street can continue on Stanford Avenue directly to El Camino Real. These vehicles also do not pass through the College Terrace neighborhood. The only vehicles that travel through the College Terrace neighborhood are those that zig zag through the neighborhood by taking College Avenue or California Avenue to and from El Camino Real, or by taking Hanover Street to or from Page Mill Road. Vehicles cannot travel directly from Stanford Avenue to Page Mill Road on Hanover Street. There is a barrier at the intersection of California Avenue and Hanover Street that prevents through traffic.

Figure 8-4 shows the total daily trips and percentage distributions of Stanford commuters for the College Terrace neighborhood. Morning and afternoon peak period turning movement counts (**Appendix B**) collected at the Bowdoin Street/Stanford Avenue intersection were used to estimate trip distribution along Stanford Avenue. Of the 1,892 additional daily trips accessing the campus at Bowdoin Street, it is estimated that 795 daily trips would travel on Stanford Avenue to the east of Bowdoin Street, thereby having the potential to pass through the College Terrace neighborhood.

Existing daily traffic volumes (**Appendix O**) collected throughout the College Terrace neighborhood where Stanford University traffic may use neighborhood streets were used to estimate trip distribution throughout College Terrace neighborhood. Due to the existing street closures and traffic calming devices, relatively few drivers are likely to choose to negotiate the circuitous route, as well as multiple stop signs and speed humps, to pass through the neighborhood to access El Camino Real given that Stanford Avenue is a direct route to El Camino Real with fewer stops. Similarly, it is unlikely that a large number of drivers would choose to travel from Stanford Avenue to Page Mill Road through the College Terrace neighborhood given that multiple turns would be needed and out of way travel. For example, if a driver were to leave the campus at Bowdoin Street, they would need to turn left on Stanford Avenue, right on Hanover Street, right College Avenue, left on Columbia Street and left on California Avenue to access Page Mill Road. The other options would be to

use Stanford Avenue to access Peter Coutts to Junipero Serra Boulevard, or El Camino Real to access Page Mill Road.

While the traffic calming and circuitous routing minimizes the number of drivers electing to cut through the neighborhood, for the analysis it was assumed, based on professional judgment and knowledge of the neighborhood traffic calming and routing, that 20 percent of drivers who travel to and from the Stanford gateway via the east of Bowdoin Street might elect to pass through the neighborhood streets. Since the TIRE index is a daily calculation and the greatest time savings for drivers cutting through the neighborhood would be during the morning or evening peak periods when El Camino Real, Page Mill Road and Junipero Serra Boulevard are congested, the 20 percent assumption is considered conservative.

To determine whether an upward or downward shift in this assumption would be likely to affect the results, a sensitivity analysis was completed to determine the percent of added Stanford traffic east of Bowdoin Street that would need to travel through the College Terrace streets in order to surpass the 0.1 TIRE index threshold. This analysis determined that more than 50 percent of added daily Stanford traffic traveling east of Bowdoin Street on Stanford Avenue would need to travel through the neighborhood in order to surpass the 0.1 TIRE index threshold. Given the extent of the existing traffic calming throughout the College Terrace neighborhood and the more direct routes that are available, it is not considered to be reasonably probable that 50 percent of drivers would choose to pass through the College Terrace neighborhood.

While it is unlikely that even 20 percent of the added daily Stanford traffic traveling east of Bowdoin Street on Stanford Avenue would travel through the neighborhood, this percentage was used to demonstrate a conservatively high scenario for the College Terrace neighborhood. Project trip estimates along Oberlin Street, Harvard Street, Hanover Street, Cornell Street, Princeton Street, and Columbia Street were distributed based on the relative existing daily volumes on these roadways. These values were compared to the volume changes needed to create a 0.1 TIRE index increase for each roadway to ascertain whether an impact would result, as shown in **Table 8-3**.

TABLE 8-3: COLLEGE TERRACE NEIGHBORHOOD TIRE INDEX RESULTS

Segment	Existing			Project Daily Trips ¹	Volume Required for 0.1 Change in TIRE Index	
	Lanes	ADT	TIRE Index		Volumes ²	Surpass the 0.1 Threshold?
Columbia Street, between College Avenue and California Avenue	2	640	2.8	57	140	No
Hanover Street, between Stanford Avenue and College Avenue	2	1,160	3.1	76	290	No
Harvard Street, between Stanford Avenue and College Avenue	2	430	2.6	28	97	No
Oberlin Street, between Stanford Avenue and College Avenue	2	850	2.9	55	170	No
Princeton Street, between College Avenue and California Avenue	2	610	2.8	54	140	No
Cornell Street, between College Avenue and California Avenue	2	370	2.6	33	97	No

Notes:

1. Assumes 20% of the added daily Stanford traffic east of Bowdoin Street on Stanford Avenue.

Minimum daily traffic volume increase to produce an impact.

Source: Fehr & Peers, March 2017

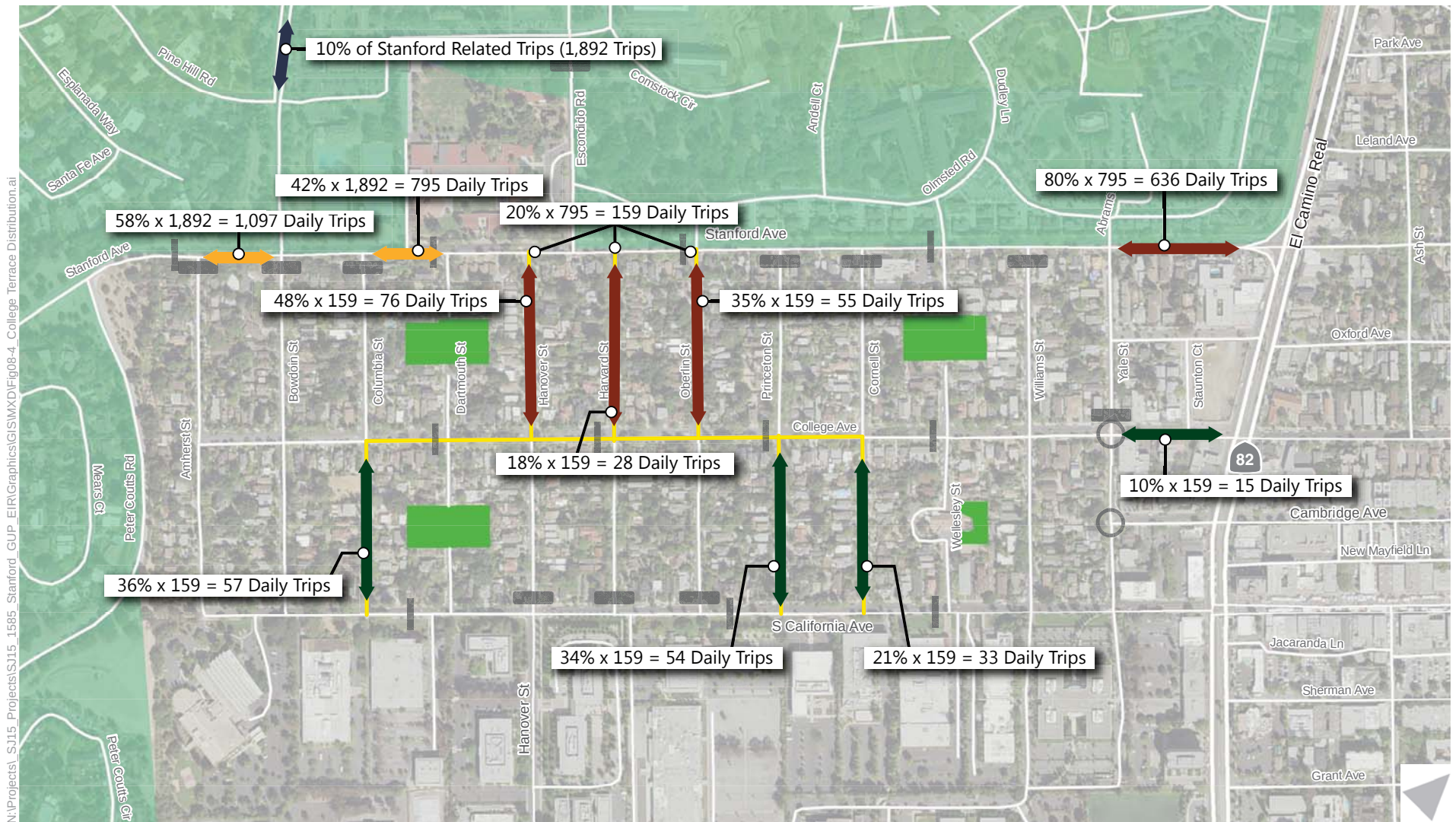


Figure 8-4

College Terrace Neighborhood Distribution of Potential Stanford Trips

8.3.2.2 Crescent Park TIRE Analysis

The TIRE indices for existing volumes in the Crescent Park neighborhood range from 3.5 to 3.7.

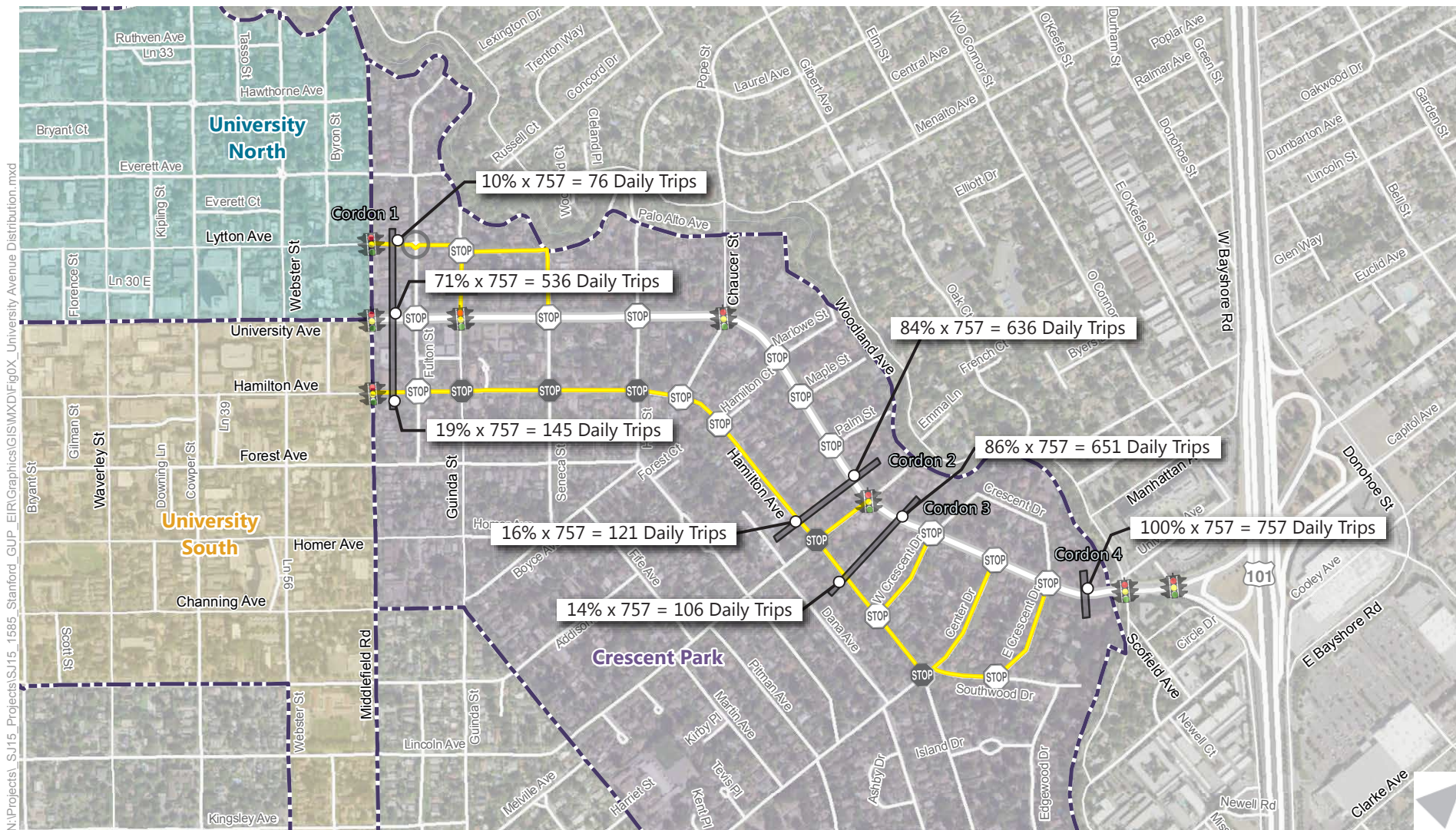
A driver traveling through the Crescent Park neighborhood on his or her way to the Stanford campus may be expected to access the campus at the University Avenue gateway. While the annual monitoring data from the *Stanford University Traffic Monitoring Report (2015)* was used for the College Terrace roadway analysis, the campus monitoring data could not be used for the Crescent Park neighborhood because the Crescent Park neighborhood is too far from the campus. For the Crescent Park neighborhood analysis, the percentage of Stanford-related trips that use University Avenue between downtown Palo Alto and US 101 was first calculated. An estimated four percent trip distribution was applied along University Avenue between downtown Palo Alto and US 101, based on the existing travel patterns to and from the campus as presented in the *2018 General Use Permit: TIA Part 1*.

The percentage of trips using University Avenue that would be likely to divert to neighborhood roadways when passing through Downtown Palo Alto was then calculated. The potential diversion of this volume to parallel routes within the Crescent Park neighborhood was based on an analysis of the relative existing daily traffic volumes (**Appendix O**) on University Avenue, Lytton Avenue, and Hamilton Avenue for four different segments: east of Middlefield Road, west of Lincoln Avenue, east of Lincoln Avenue, and west of Woodland Avenue. The existing daily traffic volumes along each roadway in each segment were used to estimate potential daily trip distributions. For example, if the Stanford 2018 General Use Permit is estimated to contribute 15 trips on University Avenue, while University Avenue has an existing 100 daily trips and Hamilton Avenue has an existing 50 trips, then 10 additional Stanford trips would be assumed to use University Avenue and five trips would be assumed to use Hamilton Avenue. The estimated potential daily trip distributions of new Project trips in Crescent Park neighborhood are shown in **Table 8-4** and **Figure 8-5**.

TABLE 8-4: CRESCENT PARK NEIGHBORHOOD TRIP DISTRIBUTION CALCULATIONS

Roadway Description		ADT	Percent of Total Volumes	Estimated Project Daily Trips
Cordon 1	University Avenue E of Middlefield Road	20,640	71%	536
	Lytton Avenue E of Middlefield	2,940	10%	76
	Hamilton Avenue E of Middlefield Road	5,580	19%	145
	Total for Cordon 1	29,160	100%	757
Cordon 2	University Avenue W of Lincoln Avenue	19,500	84%	636
	Hamilton Avenue W of Lincoln Avenue	3,700	16%	121
	Total for Cordon 2	23,200	100%	757
Cordon 3	University Avenue E of Lincoln Avenue	20,920	86%	651
	Hamilton Avenue E of Lincoln Avenue	3,400	14%	106
	Total for Cordon 3	24,320	100%	757
Cordon 4	University Avenue W of Woodland Avenue	24,890	100%	757
	Total for Cordon 4	24,890	100%	757

Source: Fehr & Peers, March 2017.



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- Speed Tables
- Traffic Circles
- Potential Stanford Traffic Routes on Neighborhood Streets
- All-way Stop Control
- Side-street Stop Control
- Signalized Intersection
- Neighborhood Boundary



Figure 8-5

Crescent Park Neighborhood Distribution of Potential Stanford Trips

These values were compared to the volume changes needed to create a 0.1 TIRE index increase for each roadway to ascertain whether an impact would result, as shown in **Table 8-5**.

TABLE 8-5: CRESCENT PARK NEIGHBORHOOD TIRE INDEX RESULTS

Segment	Existing			Project Daily Trips	Required Volume for 0.1 Change in TIRE Index	
	Lanes	ADT	TIRE Index		Volume ¹	Impact
Lytton Avenue, between Middlefield Road and Fulton Street	2	2,940	3.5	76	825	No
Hamilton Avenue, between Middlefield Road and Fulton Street	2	5,580	3.7	145	1,250	No
Hamilton Avenue, between Hamilton Court and Lincoln Avenue	2	3,700	3.6	121	1,025	No
Hamilton Avenue, between Lincoln Avenue and Crescent Drive	2	3,400	3.5	106	825	No

Notes:

1. Minimum daily traffic volume increase to produce an impact.

Source: Fehr & Peers, March 2017

8.3.3 RESULTS

The TIRE method is based on the premise that any traffic change that would cause an index increase of 0.1 or more would be noticeable to residents. As shown in **Table 8-3** and **Table 8-5**, the Project would not surpass the 0.1 change in TIRE index on any of the local residential street segments evaluated in this analysis.

8.4 TRANSIT, BICYCLE AND PEDESTRIAN IMPACTS

8.4.1 TRANSIT IMPACTS

Generally, a project causes a significant impact to transit facilities and services if an element of it conflicts with existing or planned transit services. The 2018 General Use Permit application does not propose infrastructure changes outside the campus and, thus, would not interfere with transit agencies' ability to modify or expand service. Therefore, the Project's impact on transit services would be **less-than-significant**. In addition, as shown in Sections 6.3 and 7.3, the Project would not result in substantial delay for transit vehicles operating on surrounding roadways.

The intersection capacity mitigation measures discussed in Section 8.1.2 and 8.1.3 would add capacity to serve all vehicles, including transit vehicles, and would not obstruct any existing or planned transit route. Stanford's proposed mitigation approach for traffic impacts, discussed in Section 8.1.1, would reduce traffic

growth relative to that analyzed in the traffic analysis, which would benefit all vehicular traffic including transit vehicles.

8.4.2 BICYCLE AND PEDESTRIAN IMPACTS

A significant impact to bicycle or pedestrian facilities occurs when the Project creates a hazardous condition that currently does not exist for pedestrians or bicyclists, or conflicts with planned facilities or local agency policies regarding bicycle and pedestrian facilities. The 2018 General Use Permit application does not propose any infrastructure changes outside the campus and, thus, would not create hazardous conditions where none exist today, nor conflict with planned facilities or County policies. Therefore, the Project's impact on pedestrian and bicycle facilities would be **less-than-significant**.

In addition, the intersection capacity mitigation measures discussed in Sections 8.1.2 and 8.1.3 would not adversely affect quality of service for pedestrians and bicyclists in all but two cases. At one Cumulative (2035) mitigation location, Middlefield Road/Marsh Road (Intersection #59), the bicycle quality of service would decrease from QOS 2.7 to QOS 3. While the rest of the traffic mitigation measures do not change the quality of service index at the mitigation location, in some cases the mitigations do add another vehicle lane to cross or navigate as a bicyclist. However, these changes do not affect the QOS rating because it is already at 4 (the worst rating). In several cases, the mitigation measures may result in a slight improvement for bicyclists by removing a right-turn conflict zone due to re-striping. As noted in the traffic mitigation discussions, the implementation of the traffic mitigation measures would ultimately be the decision of the responsible jurisdiction, and considerations for bicyclist and pedestrian comfort and convenience may enter into those decisions, resulting in a modified improvement project that adds or enhances pedestrian and/or bicycle facilities, or rejection of the improvement project.

Separate from the above analysis, it is noted that the 2018 General Use Permit application describes several bicycle and pedestrian supportive projects that Stanford plans to construct on campus property that are designed to serve local area student trips to the Nixon and Escondido Elementary Schools. Stanford proposes to construct the improvements on its lands in unincorporated Santa Clara County that have been identified by the Palo Alto Unified School District (PAUSD) and the City of Palo Alto as the Suggested Routes to Schools shown on the Walkabout Maps for Nixon and Escondido Elementary Schools. These improvements would benefit both pedestrian and bicycle circulation in the immediate area of both schools. Circulation improvements on Stanford lands in unincorporated Santa Clara County, in and around Nixon Elementary School, could include such items as improved crosswalks with high-visibility yellow markings, pavement markings, additional signage, and wayfinding signs. Circulation improvements in and around Escondido Elementary School similarly could include such items as improved crosswalks with high-visibility yellow markings, pavement markings, additional signage, additional traffic control. Specific improvements on Stanford property could include an enhanced mid-block crosswalk on Escondido Road.

8.5 SAFETY AND EMERGENCY ACCESS IMPACTS

8.5.1 SAFETY IMPACTS

As described in Section 3.8.2, the safety impacts of the 2018 General Use Permit are evaluated based on whether any identified intersection mitigation measure would cause an adverse safety effect for vehicles, transit, pedestrians, or bicyclists. These mitigation measures would be constructed according to the relevant City or Caltrans design standards, which can be assumed to conform to industry standards for roadway and intersection design and operations. Therefore, the mitigation measures would not cause adverse safety effects for vehicles, transit, pedestrians or bicyclists, and the Project's impact on safety is **less-than-significant**.

It is also noted that Stanford's proposed mitigation approach described in Section 8.1.1 aims to eliminate the significant congestion impacts and the need for the intersection mitigation measures. The approach includes a combination of trip reduction measures for trips to and from the Stanford campus, and trip reduction measures for trips outside the campus within the impact area, incorporating both infrastructure projects and programs supporting non-auto modes. If successful, this approach would avoid the need to construct any of the intersection capacity mitigations described in Sections 8.1.2 and 8.1.3.

8.5.2 EMERGENCY ACCESS IMPACTS

As described in Section 3.9.2, the emergency access impacts of the 2018 General Use Permit are evaluated based on whether the Project would result in inadequate emergency access. The 2018 General Use Permit application does not propose any infrastructure changes outside the campus, and thus would not create barriers to or impede emergency access. The Project traffic analysis indicates significant impacts at intersections in both the Background (2018) and Cumulative (2035) Conditions, and identifies intersection capacity mitigations for some, but not all, of the impact locations. Emergency responders are charged with developing fastest-response travel routes and assessing traffic conditions and developing alternate routes in real time to provide emergency services. Therefore, the identified significant impacts would not result in inadequate emergency access within the traffic study area, and the impact on emergency access is **less-than-significant**.

It is also noted that Stanford's proposed traffic mitigation approach, described in Section 8.1.1, aims to eliminate the significant congestion impacts and the need for the intersection mitigation measures by limiting trip growth and achieving a No Net New Commute Trips goal. The approach includes a combination of trip reduction measures for trips to and from the Stanford campus, and trip reduction measures for trips outside the campus within the impact area, incorporating both infrastructure projects and programs supporting non-auto modes. If successful, this approach would avoid the congestion impacts and correspondingly reduce the impacts of congestion on emergency responders.