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May 18, 2012

Scott Lefaver, Chairman and
Members of the Santa Clara County Planning Commission
70 W. Hedding Street, 7th Floor
San Jose, CA 95110

Re: Permanente Quarry Reclamation Plan Amendment
Economic Benefits

Dear Chairman Lefaver and Members of the Planning Commission:

The purpose of this letter is to make sure that the Planning Commission members are fully informed regarding the economic and community benefits of mining activities at the Permanente Quarry, and specifically, the benefits to the community of approving the Planning Commission's approval of the Reclamation Plan Amendment.

As President of Lehigh Hanson ("Lehigh"), Region West, I am responsible for Lehigh's operations at the Permanente site, which include the Permanente Quarry and Lehigh Southwest Cement Company's cement plant. The information presented in this letter is personally known to me based on my knowledge of Lehigh's operations.

Project Approval Preserves a Local Supply of Construction Materials

Limestone mined at the Quarry is the raw material for an estimated 65% of all cement used in Santa Clara County, 55% of cement in the Bay Area, and 18% of the cement used in Northern California, based on Lehigh's records for recent years. Since 2000, the Quarry has produced up to 2.2 million tons of cement-grade limestone each year, which is processed into cement products at Lehigh's adjacent cement plant.

The specific type of limestone mined from the Quarry allows cement produced from such material to meet the highest industry specifications. Permanente cement displays high alkali-silica resistance characteristics that exceed CalTrans' performance specifications for use in public infrastructure projects.

To illustrate the widespread use of these materials, the following is a list of publicly-funded projects that are using or have recently used cement made from the Quarry's limestone in Santa Clara County and the San Francisco Bay Area region:

- CalTrans Interstate 680 lean base paving (San Jose)
- CalTrans Interstate 680 structures and concrete paving (Livermore)
- CalTrans Interstate 580 structures and concrete paving (Danville)
- BART – Warm Springs Station (Fremont)
- San Francisco General Hospital new construction

- San Francisco Trans-Bay Terminal
- Rincon Center high rise buildings (San Francisco)
- San Francisco Public Utilities Commission (SFPUC) new building
- San Francisco PUC Hetch Hetchy Water Delivery System reconstruction
- Stanford Hospital and Parking Garage (Palo Alto)
- CalTrans Doyle Drive (Golden Gate Bridge) retrofit
- Golden Gate Bridge Seismic upgrade
- San Francisco Mission Bay development
- CalTrans San Francisco – Oakland Bay Bridge new construction
- San Jose Mineta International Airport expansion
- Oakland International Airport expansion
- Highway 17 reconstruction
- CalTrans Highway 880 reconstruction and expansion (Oakland)
- CalTrans Highway 101 reconstruction and expansion (Marin/Sonoma)
- Oakland 12th Street Lake Merritt Bridge reconstruction
- Contra Costa Water Los Vaqueros Dam reconstruction (Byron)
- CalTrain San Bruno Grade Separation (San Bruno)
- SFPUC Bay Division Tunnel (Palo Alto)
- CalTrans Hwy 1 Bridge (Lucia)
- SFPUC San Joaquin Pipeline (Tracy)
- SFPUC New Irvington Tunnel (Newark)
- SFPUC Crystal Springs Reservoir (San Mateo)
- CalTrans Highway 4 Structures (Antioch)
- SFPUC Lake Merced

Approving the Reclamation Plan Amendment enables the Quarry to continue supplying the community, and these types of projects, with a local source of materials. In the absence of this supply, substitute limestone supplies would need to be trucked, railed or barged into the region at greater cost, because other facilities capable of supplying replacement material are not local and are significantly farther away.

The nearest alternative sources of cement-grade limestone for Santa Clara County and San Francisco Bay Area region is in Redding, California, approximately 250 miles away from Santa Clara County. The next closest alternative supplier is outside the state of California, in Fernley, Nevada, which is approximately 280 miles away.

Preserving a local supply of materials from the Quarry allows the community to retain the important economic and social benefits of a local supply of construction materials, and avoid the high costs of alternatives.

Project Approval Preserves Local Employment

Lehigh directly employs approximately one hundred fifty-one (151) workers at the Quarry. These are skilled workers, including engineers, geologists, chemists, environmental scientists, managers, salesmen, and other professionals.

Lehigh's operations also support employment at other businesses that use, rely upon, or support the Quarry's products and operations. These include service and supply firms that are directly associated with the Quarry's daily operations, and indirect employment from the induced economic activity resulting from monies generated by the Quarry moving through the local and regional economy.

When all direct and indirect employment activity attributable to the Quarry's operations is considered, Lehigh estimates that the Quarry supports an estimated one thousand seventeen (1,017) jobs throughout the County and Bay Area. The County's approval of the Reclamation Plan Amendment helps to preserve these jobs in the region.

Lehigh appreciates the opportunity to provide this information, and will be prepared to elaborate, if necessary, during the upcoming Planning Commission hearings.

Sincerely,

Kari D. Saragusa
President, Region West
Lehigh Hanson

cc: Elizabeth Pianca
Marvin Howell
Gary Rudholm
Mark Harrison

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May 18, 2012

Scott Lefaver, Chairman and
Members of the Santa Clara County Planning Commission
70 W. Hedding Street, 7th Floor
San Jose, CA 95110

Re: Permanente Quarry Reclamation Plan Amendment
Economic Data Regarding Benefits of Permanente Operations

Dear Chairman Lefaver and Members of the Planning Commission:

The purpose of this letter is to provide, at the request of Hanson Permanente Cement, Inc. and Lehigh Southwest Cement Company (together, "Lehigh"), information and analysis of the economic benefits of the Lehigh's Permanente Quarry ("Quarry") operations.

Introduction

By way of background, I have a Ph.D. in region economics with 48 years of experience completing economic impact analyses for a wide variety of industries, including the construction materials industry. I am the principal owner and research economist with Economics & Politics, Inc.

Economics & Politics, Inc. evaluated the overall economic impact of Lehigh's Quarry operations on both the local and regional economy. More specifically, our analysis evaluated the direct, indirect and induced economic impact of quarry operations to determine the Quarry's relative contribution to economic activity in the Santa Clara County ("County") and the nine-county bay area region as a whole.

Direct Economic Impacts and Tax Benefits

Based on the Quarry's average production volumes for cement and aggregate products between 2007 and 2010, the Quarry generates annual average sales of approximately one hundred million dollars ($100,000,000.00). This estimate is conservative and assumes normalized sales figures that are reflective of the economic downturn in the national, regional and local economy over that same time period.

Based on established economic modeling principles, the Quarry's total annual economic impact on the County economy is approximately thirty million three hundred twenty-six thousand seven hundred ninety seven dollars ($30,326,797.00). This figure includes nineteen million four hundred twenty-seven thousand three hundred fifty-seven ($19,427,357) directly injected into the County through external investment (i.e. out-of-county sales), as well as ten million eight hundred ninety-nine thousand four hundred forty dollars ($10,899,440) in "secondary" economic activity, including the indirect and induced economic impact of funds reaching local suppliers of goods and services and funds changing hands as local firms and people re-spend the money with other local companies.

The Quarry currently generates approximately two million four hundred sixty-five thousand two hundred fifty-nine dollars ($2,465,259) in annual property taxes to the County and approximately one hundred thirty-five thousand four hundred forty-one ($135,441) in total sales tax collections in the County, not including those collected from local retail firms using the Quarry's products. Without the mining operations, the value of the land would likely drop significantly and tax payments from the Quarry operation to the county would be largely or entirely eliminated.

The Quarry currently supplies approximately 55% of the cement used in the Bay Area and, as such, it is vital to overall economic activity in the nine-county region (*Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma*). Applying the same economic principles to the Bay Area as a whole, the economic impact of the Quarry on the nine counties that constitute the Bay Area is approximately one hundred thirty-two million one hundred sixty-three thousand two hundred eighty-eight dollars ($132,163,288.00) on an annualized basis.

Direct and Indirect Employment Benefits

The Quarry currently employs one hundred fifty-one (151) workers. This figure does not reflect the thirty-nine (39) workers in suppliers and service firms assisting the company, as well as the twenty-one (21) workers in unaffiliated firms as funds move through the general economy.

Total direct and indirect employment activity attributable to the Quarry is approximately one thousand seventeen (1,017) jobs throughout the Bay Area. These jobs include those at affiliate firms, as well as those at service and supply firms that are directly associated with the Quarry's daily operations. In addition, the total employment impact of the Quarry includes jobs associated with the induced economic activity that results from monies generated by the Quarry moving through the local and regional economy. Importantly, from 2007-2010, the County economy went through a downturn with local employment reducing by 6.4%, dropping from 900,300 jobs to 843,100.

High Costs of Alternative Supplies

If the Quarry was not available to supply cement in the Bay Area, those supplies would have to come from other facilities currently serving the market. Using Oakland as the approximate center of activity for the Bay Area, these other facilities are much farther than the 45 mile distance that the Quarry is from the center of the markets. Currently, the closest alternative cement supplier for the bay area market is the LSW plant in Redding, California which is 211 miles away from the center of the market. The next closest alternative supplier is outside the state of California in Fernley, Nevada which is 247 miles away.

The incremental cost associated with the need to provide replacement supplies from the distant sources is substantial. Our analysis concludes that supplying the Bay Area market from these distant source would result in approximately forty-seven million eight hundred thousand dollars ($47,800,000.00) in additional transportation related costs when compared to the existing operations the Quarry.

Our analysis also concludes that wear and tear on California's freeway system would occur due to the impact of having heavy trucks moving so much tonnage of cement such long distances on the state's highways. The 6,651,792 extra truck miles needed to handle 22,548 trips of an average of 295 miles to handle the Bay Area's cement needs would add at least $2.1 million to California's already expensive highway maintenance costs.

Our analysis further concludes that California air quality would be harmed by the diesel emissions related to 6,651,792 extra vehicle miles traveled by trucks, each hauling 80,000 pounds of cement.

Economics & Politics, Inc. will be prepared to present further information during the public hearings on this matter.

Very truly yours,

John E. Husing, Ph.D

cc: Kari D. Saragusa
Marvin E. Howell
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May 21, 2012

Scott Lefaver, Chairman and
Members of the Santa Clara County Planning Commission
70 W. Hedding Street, 7th Floor
San Jose, CA 95110

Re: Permanente Quarry Reclamation Plan Amendment
Market Information for Construction Materials

Dear Chairman Lefaver and Members of the Planning Commission:

This firm represents Hanson Permanente Cement, Inc. and Lehigh Southwest Cement Company (together, "Lehigh"), the owner and operator of the Permanente Quarry. The purpose of this letter is to provide the County with information regarding the market demands for the Quarry's limestone and construction materials, based on published data.

In addition, please note that Lehigh has already submitted, and will be submitting, additional information regarding the economic benefits of the project.

Market Demand for Limestone

- The northern California construction materials market, which includes Santa Clara County and the broader San Francisco Bay Area, needs 86 million tons of Portland cement in the next 20 years to maintain infrastructure and support conservative growth. This is based on United States Geologic Survey (USGS) reports of the cement shipments to Northern California, averaged for 1993 through 2009 (approximately 4.3 million tons per year), projected over a 20-year horizon. Exhibit 1 contains copies of these reports.

- This level of market demand for Portland cement will, in turn, require approximately 130 million tons of limestone in the same period, which amounts to an average of over 6.5 million tons annually. This is based on the USGS data in Exhibit 1, using a conversion factor of 1.5 tons of limestone to manufacture 1.0 tons of Portland cement.

- The Quarry has produced up to 2.2 million tons of cement-grade limestone annually since 2000. This information is in Attachment H to the Reclamation Plan Amendment on file with the County, in Table B-1.

Market Demand for Construction Aggregates

- The California Department of Conservation identifies Santa Clara County as within the South San Francisco Bay Production-Consumption ("P-C") Region for the purpose of classifying aggregate production. According to the Department, an average person in the Region has historically consumed 5.7 tons of aggregate every year. (Exhibit 2, Kohler-Antablin, Susan, *Update of Mineral Land Classification: Aggregate Materials in the South San Francisco Bay Production-Consumption Region* (1996) Cal. Dept. of Conservation, Div. Mines & Geology, Open-File Report 96-03, p. xi.)

- In the next 50 years, the South San Francisco Bay P-C Region is expected to require approximately 1,244 million tons of construction aggregates. (Exhibit 3, Map Sheet 52, *Aggregate Availability in California* (2006) Cal. Dept. of Conservation, Cal. Geologic Survey.) Such demand is a consequence of an urban population, projected growth, and the corresponding need for building and maintaining infrastructure.

- The South San Francisco Bay P-C Region currently does not have enough permitted aggregate supplies to meet the long-term demand. The permitted aggregate resources in this region account for approximately 37% of the projected 50-year demand. This represents a shortfall of approximately 786 million tons over the 50-year horizon. This makes the South San Francisco Bay P-C Region among those with the greatest projected need for aggregate resources statewide. (Exhibit 3, Map Sheet 52, *Aggregate Availability in California* (2006) Cal. Dept. of Conservation, Cal. Geologic Survey.)

- Currently, the South San Francisco Bay P-C Region imports construction aggregates from the Monterey Bay P-C Region to meet its needs. (Exhibit 4, Kohler-Antablin, Susan, *Update of Mineral Land Classification: Aggregate Materials in the Monterey Bay Production-Consumption Region* (1999) Cal. Dept. of Conservation, Div. Mines & Geology, Open-File Report 99-01, p. 34.)

- Adjacent P-C regions are also facing shortfalls of available construction aggregates. The North San Francisco Bay P-C Region, which also is served by the Quarry's materials, has approximately eight percent permitted of the 50-year demand for construction aggregates. (Exhibit 3, Map Sheet 52, *Aggregate Availability in California* (2006) Cal. Dept. of Conservation, Cal. Geologic Survey.)

- The Quarry is currently the largest local supplier of construction aggregates within the South San Francisco Bay P-C Region. While volumes fluctuate with market demand, the Quarry produced, on average, more than 1.2 million tons annually of construction aggregates annually since 2000. This information is in Attachment H to the Reclamation Plan Amendment on file with the County, in Table B-1.

Lehigh would be pleased to present any additional information requested at or before the public hearings on this matter.

Very truly yours,

Sean K. Hungerford

cc: Kari D. Saragusa, Lehigh Hanson
Marvin E. Howell, Lehigh Hanson
Elizabeth G. Pianca, Esq., Office of County Counsel
Mark D. Harrison, Esq.

CEMENT

By Cheryl Solomon

The industry's main product, portland cement, makes up 95% of the total domestic production. The remainder comes from masonry, hydraulic, and aluminous cements.

In 1994, U.S. demand for cement increased by approximately 7%. Domestic production of portland cement increased by 5%. Cement imported for consumption increased to 11.3 million metric tons. Portland cement values increased to approximately $61 per metric ton.

Legislation and Government Programs

At the beginning of the year, the Environmental Protection Agency announced the availability of the agency's Report to Congress on Cement Kiln Dust. The Report to Congress contained a detailed study of cement kiln dust which fell within the scope of the exemption from hazardous waste regulations provided by the Bevill Exemption. The report presented the Agency's decision making rationale and a series of options being considered regarding regulatory options for cement kiln dust waste.

Production

Domestic production and consumption data for cement are developed by means of the portland and masonry cement voluntary survey. Of the 120 cement manufacturing plants to which an annual survey collection request was made, 115 responded, representing 95% of the cement production and consumption data shown in table 1. Estimates were made for nonrespondents using monthly survey data and data received from previous annual surveys. *(See table 1.)* One State agency and 45 companies operated 118 plants in 37 States. In addition, two companies operated two plants in Puerto Rico, manufacturing hydraulic cement. The production data obtained are listed by State or groups of States that form cement districts. A cement district may represent a group of States or a portion of a State. The States of California, Illinois, New York, Pennsylvania, and Texas are divided to provide more definitive marketing information within those States, as follows:

California, Northern.—Points north and west of the northern borders of San Luis Obispo and Kern Counties and the western borders of Inyo and Mono Counties.

California, Southern.—All other counties in California.

Chicago, Metropolitan.—The Illinois counties of Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will.

Illinois.—All other counties in Illinois.

New York, Western.—All counties west of a dividing line following the eastern boundaries of Broome, Chenango, Lewis, Madison, Oneida, and St. Lawrence Counties.

New York, Eastern.—All counties east of the aforementioned dividing line, except Metropolitan New York.

New York, Metropolitan.—The five counties of New York City (Bronx, Kings, New York, Queens, and Richmond) plus Nassau, Rockland, Suffolk, and Westchester Counties.

Pennsylvania, Eastern.—All counties east of the eastern boundaries of Centre, Clinton, Franklin, Huntingdon, and Potter Counties.

Pennsylvania, Western.—All other counties in Pennsylvania.

Texas, Northern.—All counties north of a dividing line following the northern borders of Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, and Williamson Counties.

Texas, Southern.—All counties south of the aforementioned dividing line.

Clinker Production.—Clinker production in the United States, excluding Puerto Rico, increased by 4% to 68.5 million metric tons. California led all States in clinker production, followed by Texas, Pennsylvania, Missouri, and Michigan.

By yearend, multiplant operations were being run by 18 companies. The size of individual companies, as a percentage of total U.S. clinker production capacity, ranged from 0.4% to 12.7%. The 5 largest companies with clinker capacity provided about 40% of total clinker capacity; the 10 largest companies with clinker capacity provided a combined 63%. The 10 largest companies, in decreasing order of size of clinker production, were Holnam Inc.; Lafarge Corp.; Essroc Materials Inc.; Southdown Inc.; Ash Grove Cement Co.; Blue Circle Inc.; Lone Star Industries Inc.; Lehigh Portland Cement Co.; California Portland Cement; and RC Cement.

Portland Cement.—Portland cement production, excluding Puerto Rico, increased by 5% to 74.3 million metric tons.

The industry operated 118 plants, including 8 grinding facilities, to produce various types of finished hydraulic cement.

The size of individual companies, as a percentage of total U.S. finished cement production capacity, ranged from 0.4% to 12.7%. The top 10 producing companies, in declining order of production, were Holnam Inc.; Lafarge Corp.; Essroc Materials, Inc., Southdown Inc.; Ash Grove Cement Co.; Blue Circle Inc.; Lone Star Industries, Inc.; Lehigh Portland Cement Co.; California Portland; and RC Cement Co., Inc.

Masonry Cement.—Production of masonry cement increased by 22% to 3.6 million metric tons. At yearend, 84 plants were manufacturing masonry cement in the United States.

Aluminous Cement.—Aluminous cement continued to be produced by Lehigh, Buffington, IN; Lafarge, Chesapeake, VA; and Aluminum Co. of America, Bauxite, AR.

Fuel Consumption.—Approximately 71% of all U.S. clinker was produced by the dry process method. Fuels consumed in making cement with both the wet and dry process included coal, 10.5 million metric tons; natural gas, 650.1 million cubic feet; and oil, 48.8 million liters. In addition, 120,000 metric tons of tires, 74,000 metric tons of solid waste fuel, and 600 million liters of liquid waste fuel were consumed in the cement kilns.

Corporate Changes.—Florida Crushed Stone sought permits for a new kiln to be built at its Brooksfield, FL, plant.[2] Florida Rock Industries announced plans to build a new cement plant in western Alachua County, FL. The site contained about 75 years of limerock reserves.[3] Holnam Inc. sold its Tijeras, NM, cement plant to Grupo Cementos de Chihuahua, S.A. de C.V.[4] Holderbank Financiere Glarus A.G. agreed to acquire 84.1% of the share capital of Ciments et Engraise de Dannes et de l'Est, ore Cedest, France's fifth largest cement producer.[5] Lafarge Corp. sold its New Braunfels, TX, cement plant, related cement terminals and an interest in Parker Lafarge Inc., a construction materials company based in Houston, TX, to Sunbelt Acquisitions, Inc., a U.S. subsidiary of Cementos Mexicanos, S.A. (Cemex). The purchase price for all of the assets was approximately US $100 million.[6]

Lafarge Coppee sold 20% stake in Vencemos Pertigalete of Venezuela to Mexico's Cemex.[7]

Lone Star Industries Inc. appeared to have successfully emerged from the threat of bankruptcy since filing for Chapter 11 protection in December 1990.[8] Through the sale of assets, Lone Star was considerably downsized and reorganized. Lone Star Industries sold its Medley, FL, cement plant to Tarmac America Inc., which had operated the plant under lease since 1988.[9] Lone Star Industries' subsidiary, Rosebud Holdings Inc., sold its interest in a Santa Cruz California cement plant to California Readymix, Inc., a wholly owned subsidiary of RMC Lonestar. Lone Star Industries also sold its Nazareth plant to Essroc Materials Inc.[10] Rosebud Holdings also sold its Texas cement terminals to Gulf Coast Portland Cement Co.[11]

National Portland Cement Co. of Palmetto, FL, was purchased by Vencemos, Venezuela's largest cement company. Vencemos was purchased just prior by Cemex of Mexico.[12]

Lafarge Corp. sold its 12,000 ton capacity terminal in Amarillo, TX, to Southdown, Inc.[13] The terminal was to receive cement from the Southdown Odessa plant in Texas.

Southdown, Inc., announced that it was planning to leave the environmental services business. The company planned to sell its three hazardous waste processing facilities and to end the burning of hazardous waste in its cement kilns by the end of 1995.[14]

Tarmac Plc in Woverhamption, England, relocated its Tarmac America headquarters to Norfolk, VA. The company's product lines were established into three groups—aggregates and cement, ready-mix concrete, and concrete products.[15]

Consumption

Consumer demand for cement in the United States, excluding Puerto Rico, increased by 7%. According to U.S. Department of Commerce (DOC) data, housing starts increased 13% to 1.5 million units, in 1994. The value of new construction increased 9% to $507 billion. The value of residential construction increased 13% to $238 billion, primarily in single-unit structures. The value of nonresidential construction increased 9% to $97.8 billion, owing to increases in commercial building construction other than hospitals and other institutions, and hotels and motels. Public construction increased only slightly to $52 billion, with highways and streets, sewer and other public construction experienced small upward movements in spending. Military facility construction declined by 5%.[16]

California continued to lead all States in the amount of portland cement consumed, followed by, in order of shipments received, Texas, Florida, Illinois, Ohio, and Pennsylvania. Together, these States consumed 38% of the total U.S. tonnage.

On a regional basis, all nine of the Census districts experienced increases in consumption. The largest increases were experienced by the West North Central, East North Central (shown as Midwest, West, and East in table 12), New England and South Atlantic districts with increases, respectively, of 15.7%, 8.4%, 8.3%, and 7.2%. The East South Central, Pacific, and Middle Atlantic districts showed increases in consumption of 7.1%, 6.9%, and 6.4%. The West South Central and Mountain districts had the smallest increases in consumption with 4.7% and 3.4%, respectively. Particularly in the Mountain district, States such as Colorado and Montana had experienced very high levels of consumption in prior years, and therefore, actually had decreases in consumption, compared with 1993, of 16% and 31%, respectively.

Shipments of domestically produced portland cement from U.S. mills increased by 6%, while masonry cement shipments climbed 13%. *(See table 11.)* Cement shipments that were not reported to the U.S. Bureau of Mines (USBM) according to the type of customers are shown under Government and Miscellaneous *(See table 13.)* Of the cement shipments that were reported by type of customer, ready-mix concrete producers were the primary consumers of cement, accounting for about 56% of the total, followed by concrete product manufacturers, 11%; building material dealers, 5%; roadpaving contractors, 2%; and other contractors, including those that were unspecified contractors, 4%. Smaller amounts were consumed by Federal, State, and other government agencies, and by a variety of uses, such as waste stabilization and mining.

Prices

The average mill value of portland cement was approximately $61.07 per metric ton and the value of masonry cement was $79.40 per metric ton. The average value of cement by yearend reported by Engineering News Record (ENR), was $ 74.31 per metric ton. The ENR prices are based on an average per-ton value of cement delivered to 20 cities. The average price change for portland cement for December 1994 increased by 6.3% compared with December 1993.[17]

Foreign Trade

The European Commission found more than 33 European cement companies guilty of participating in an illegal price fixing cartel said to have operated in 15 countries. Italcementi SpA of Italy received the highest penalty followed by Ciments Francais and Lafarge Coppee of France.[18]

The U.S. International Trade Commission (ITC) ruled that imports of calcium aluminate cement and cement clinker from France did not injure industries in the United States. The decision meant that no antidumping duties would be imposed in this case. The original petition was filed by the Lehigh Portland Cement Co. of Allentown, PA.[19]

The ITC conducted an administrative review of the antidumping duty order on gray portland cement and clinker from Japan. The review covered one manufacturer, Onoda Cement Co., Ltd. and the period May 1, 1992 through April 30, 1993. The review indicated the existence of dumping margins during this period. As a result of the review, the Department preliminarily determined to assess antidumping duties equal to the difference between the United States price and the foreign market value.[20]

At the beginning of 1993, the International Trade Administration received a request from the Ad Hoc Committee of Florida Producers of Gray Portland Cement to conduct an administrative review of the suspension agreement on gray portland cement and clinker from Venezuela. Then at the beginning of 1994, the petitioners withdrew their request for administrative review. Accordingly, the Department terminated this administrative review.[21]

The DOC conducted an administrative review of the antidumping duty order on gray portland cement and clinker from Mexico. The review covered exports of the cement during the period August 1, 1992 through July 31, 1993, and one firm, Cemex, S.A. The results of this review indicated dumping margins for the period. On August 3, 1992, the DOC had published a notice of Opportunity to Request Administrative Review for the above time period. The petitioners, the Ad Hoc Committee of Arizona-New Mexico-Texas-Florida Producers of Gray Portland Cement and the National Cement Co. of California, Inc., requested the review. On September 30, 1993, the Department published a notice of "Initiation of Antidumping Review" for Cemex. In June 1994, interested parties were requested to comment on the results.[22]

The DOC notified the public of its revocation of the antidumping finding on portland cement from the Dominican Republic because it was no longer of any interest to domestic interested parties. The Department served written notice of its intent to revoke this antidumping finding on each domestic interested party on the service list.[23] Exports of hydraulic cement and clinker, as reported by the Bureau of the Census, increased 1% to 633,000 metric tons. Canada received 2% of the total.

New York led all States in the amount of imports received, with 14% of total U.S. imports, or 1,526,000 metric tons. Of this total, 35% was shipped through the Buffalo Customs District, 39% was shipped through the New York City Customs District, and 26% was shipped through the Ogdensburg Customs District. These imports comprised 65% of New York's portland cement consumption compared with total imports representing 13% of apparent consumption nationally. Sixty-two percent of imports into New York came from Canada, 19% came from Greece, 14% came from Spain, and 5% from Norway. Michigan was the second largest recipient of imported cement, receiving 1.17 million tons or 10% of the total. All of the Michigan imports were shipped through the Detroit Customs District, and virtually all came from Canada.

Chinese cement entered the United States mainly through the Columbia Snake River, 77%, through Anchorage, AL, 18% and less, through the port of Seattle, 0.5%. By yearend, the Chinese had exported 317,000 tons.

World Review

World cement production increased by 5% to 1.37 billion tons. China continued to lead all nations with 29% of production, followed by Japan with 7%, and the United States with 6%.

The year saw major purchases and plans to build new cement plants by Holderbank of Switzerland, Lafarge Coppee of France, and Cemex of Mexico, among others, as shown below.

China.—U.S. Dominion Bridge Inc. of Lachine announced plans to build a massive cement plant, in conjunction with Chongqing Cement Plant Co., a state-owned corporation. The plant was to be erected 13 kilometers from Chongqing in Sichuan province, China's largest province with a population of 110 million.[24] Lafarge planned to set up a cement plant in Beijing with a joint-venture project. The investment was expected to total $130 million.[25]

France.—Holderbank acquired the majority of the shares of Cedest in a major move to reinforce its position in Western Europe. Cedest was France's fifth largest cement producer with two plants, one at Dannes and one at Heming. The company had a total annual production capacity of 2.7 million tons per year.[26]

Gaza.—A consortium of Palestinian investors was established to set up a new company, the Arab Cement Company, in order to build a cement plant in Gaza, the West Bank. The cement plant was to have a capacity of 1 million tons per year. The project was to be implemented in three stages: initial import, packaging and marketing venture, and construction of a clinker grinding plant and installation of a full-scale cement plant. The project could range from $50 to $150 million depending on where the equipment was sourced.[27]

Indonesia.—Blue Circle Industries sold its 23% share in PT Semen Andalas, Indonesia, to the Swiss-based Cementia, owned by Lafarge Coppee of France. The purchase was thought to be for about $6 million. Semen Andalas operated a 1 million ton factory on the western tip of Sumatra, Indonesia, and the accompanying port terminal. In addition to serving the domestic market in Sumatra the plant exported cement to Sri Lanka, Bangladesh, and Singapore. This purchase marked the expansion of Lafarge into a new area of the world.[28]

Israel.—Cement consumption was approximately 4.86 million metric tons, about the same amount as production. Cement production was up from 4.46 million metric tons in 1993, when cement was imported from eastern Mediterranean countries in order to fill the demand. Nesher Cement was the sole cement producer, having three plants with 4.5 million metric tons of clinker capacity and more than 5.6 million tons of clinker grinding capacity.[29]

Japan.—The Sumitomo Cement Co. and Osaka Cement Co. were to merge to form the second largest cement company in Japan. The company was to be called Sumitomo Osaka Cement Co.[30]

Mexico.—Cementos Mexicanos, among the top five largest cement companies in the world, purchased Cementos Bayano in Panama City for 60 million, and four facilities in Venezuela.[31] The purchase was part of Cemex's strategy to increase its market from Venezuela, through Panama, and Mexico, to the Carribean and to Spain. The company also purchased the former Lafarge New Braunfels plant (See Corporate Changes).

Philippines.—Cement sales in the Philippines were 12% greater in 1994 than in 1993 and were expected to surge upwards due to the country's recovering economy and emphasis on infrastructure development.[32]

Singapore.—Singapore had no fully integrated production facilities but operated five grinding facilities. Jurong Cement was the largest company with 1 million tons per annum capacity, while SsangYong Cement and Malaysia Cement had .9 million tons per annum each, and Asia Cement and Indocement had .5 million tons per annum.[33] Cement consumption, moved up steadily from 2.83 million tons in 1991 through a high of 3.74 million tons in 1993. The total cement consumption was thought to have dropped back to 3.3 million tons in 1994.

National Cement completed the first phase of a major cement terminal at Jurong Port. The facility was to comprise a 28,000 ton silo complete with a newly designed ship unloader. The facility was formerly a grain silo and was purchased in 1993 by a group made up of Queensland Cement, Australia, Partek, Finland and Eastern Industries, a local group, with affiliations in the construction, steel and ready-mix industries.[34]

Vietnam.—Vietnam produced 5.2 million tons of cement in 1994, 1.3 million tons was imported in order to meet demand.[35]

A number of new cement plants were to be constructed in Vietnam. Lafarge Coppee and a local Vietnamese partner were to build a new plant with 1,200-ton-per-day capacity. The total project cost was estimated at $40 million.[36] Technip-CLE of France was to be the main contractor for the new But Son cement plant to be located 70 kilometers south of Hanoi in northern Vietnam and was to have a capacity of 1.4 million tons per year.[37]

Current Research and Technology

Soils and sludges, contaminated with heavy metals or organic compounds, were stabilized and solidified by using readily available, conventional, or byproduct cementitious (hydraulic or pozzolanic) materials, such as portland cement, cement kiln dust, lime kiln dust, slag cement, hydrated lime, and fly ash. The research focused on the use of various combinations of cements, fly ash, and byproduct kiln dusts, to stabilize and solidify a wide range of contaminated materials.[38]

The heat of hydration of normal portland cement could cause an increase in concrete temperatures that may result in undesired cracks upon hardening of the cement. The paper discussed alternatives to lowering the heat of hydration and the benefits of adding mineral admixtures such as natural pozzolan, fly ash, and granulated blast furnace slag to control heat of hydration development. For this study, blended cements were prepared using an ordinary portland cement clinker, gypsum, and mineral admixtures, previously ground in a laboratory mill.[39]

The hydration behavior of blended cements containing fly ash, silica fume, and granulated blast furnace slag over the temperature range of 10° to 55°C was studied by isothermal calorimetry. The rates of heat evolution during the first 24 hours of hydration were examined. The results were analyzed to determine the kinetics of hydration of portland and blended cements. Relationships between the reactivities of these blended cements and the curing temperature were established. The results showed that the rates of hydration reactions increased with an increase in temperature in all instances. Comparison among the blends containing fly ash, silica fume, and slag was made to establish activation energies for the hydration reactions.[40]

An investigation was carried out to study the effect of the magnesium-sodium sulfate environment on the performance of two plain and three blended cements; and to determine the sulfate mechanisms on these cements in the mixed magnesium and sodium sulfate environment. After 2 years of exposure, deterioration was observed in all cements, however, the deterioration was more pronounced in blast furnace slag and silica fume cements. Deterioration in these cements significantly exceeded that observed in plain and fly ash blended cements. X-Ray diffraction analyses indicated that the greater deterioration in blast furnace and silica fume blended cements could be attributable to the depletion of the hydrated calcium hydroxide as a result of pozzolanic reaction. In the absence of calcium hydroxide, magnesium ions react more directly and extensively with the cementitious calcium silicate hydrate to generate gypsum and noncementitious magnesium silicate hydrate resulting in aggravated deterioration.[41]

Outlook

Portland cement consumption was expected to decline somewhat from the historic level reached in 1994, since that year witnessed a strong economy and major rebuilding from flooding. However, it was expected to remain high for a couple of years. Cement plants were expected to run at full capacity utilization, with shortages of cement in some areas.

Cement prices were expected to remain at the same levels that had been attained in 1993 and 1994.

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TABLE 1
SALIENT CEMENT STATISTICS

(Thousand metric tons unless otherwise specified)

		1990	1991	1992	1993	1994
United States 1/						
Production 2/		69,954	67,193	69,585	73,807	77,948
Shipments from mills 2/ 3/		78,199	68,999	69,203	74,079 r/ 4/	80,490 4/
Value 2/ 3/ 4/	thousands	$4,280,105	$3,832,096	$3,779,286	$4,174,818 r/ 4/	$4,981,017 4/
Average value per ton 2/ 3/ 5/		$54.73	$55.54	$54.61	$56.36 r/ 4/	$61.88 4/
Stocks at mills, 2/ Dec. 31		5,637	6,009	5,272	4,788	4,805
Exports		503	633	746	625	633
Imports for consumption		12,041	7,893	6,166	7,060	11,303
Consumption, apparent 6/ 7/		81,305	74,000	75,400	80,514 r/	91,160
World: Production		1,149,369	1,184,530	1,241,217	1,303,360	

e/ Estimated. r/ Revised.
1/ Excludes Puerto Rico and the U.S. Virgin Islands.
2/ Portland and masonry cement only.
3/ Includes imported cement shipped by domestic producers.
4/ Includes Puerto Rico.
5/ Value received, f.o.b. mill, excluding cost of containers.
6/ Quantity shipped plus imports minus exports.
7/ Adjusted to eliminate duplication of imported clinker and cement shipped by domestic cement manufacturers.

TABLE 2
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES BY DISTRICT 1/

District	1993					1994				
			Capacity 2/		Stocks 3/			Capacity 2/		Stocks 3/
	Plants active during year	Production 4/ (thousand metric tons)	Finish grinding (thousand metric tons)	Percent utilized	at mills, Dec. 31 (thousand metric tons)	Plants active during year	Production 4/ (thousand metric tons)	Finish grinding (thousand metric tons)	Percent utilized	at mills, Dec. 31 (thousand metric tons)
New York and Maine	5	3,298	4,550	72.5	227	5	3,005	4,141	72.6	217
Pennsylvania, eastern	8	3,848	4,833	79.6	339	8	4,014	4,878	82.3	196
Pennsylvania, western	4	1,517	1,961	77.4	139	4	1,616	2,009	80.4	111
Illinois	4	2,431	2,971	81.8	102	4	2,585	3,217	80.4	127
Indiana	4	2,065	2,708	76.3	165	4	2,291	2,867	79.9	116
Michigan	5	5,115	5,756	88.9	314	5	5,160	6,532	79.0	226
Ohio	4	1,494	2,064	72.4	78	3	1,054	1,588	66.4	37
Iowa, Nebraska, South Dakota	6	3,656	5,761	63.5	265	6	3,891	5,758	67.6	291
Kansas	4	1,382	1,796	76.9	109	4	1,644	1,801	91.3	127
Missouri	5	4,057	4,808	84.4	334	5	4,725	5,059	93.4	340
Florida	6	3,470	4,770	72.7	193	6	3,371	4,382	76.9	291
Georgia and South Carolina	5	3,212	4,368	73.5	246	5	3,256	4,599	70.8	154
Maryland, Virginia, West Virginia	6	3,036	4,082	74.4	244	6	3,237	3,987	81.2	203
Alabama	5	3,748	4,481	83.6	219	5	3,976	4,573	86.9	268
Kentucky, Mississippi, Tennessee	4	2,010	2,129	94.4	178	4	1,983	2,128	93.2	139
Arkansas and Oklahoma	4	2,461	2,762	89.1	167	4	2,434	2,694	90.3	166
Texas, northern	6	3,519	4,466	78.8	191	6	3,809	4,512	84.4	209
Texas, southern	6	4,609	5,529	83.4	131	6	4,815	5,529	87.1	182
Arizona and New Mexico	3	1,707	2,288	74.6	46	3	1,967	2,288	86.0	51
Colorado and Wyoming	4	1,867	2,377	78.5	100	4	1,822	2,377	76.7	97
Idaho, Montana, Nevada, Utah	6	2,064	2,312	89.3	142	6	2,180	2,422	90.0	174
Alaska, Hawaii, Oregon, Washington	4	1,769	2,204	80.3	143	4	1,861	2,295	81.1	180
California, northern	3	2,427	2,867	84.7	80	3	2,616	2,776	94.2	141
California, southern	8	6,084	7,725	78.8	236	8	7,023	7,933	88.5	258
Total or average 5/	119	70,845	89,567	79.1	4,389	118	74,335	90,346	82.3	4301
Puerto Rico	2	1,310	1,957	66.9	33	2	W	W	71.8	W

W Withheld to avoid disclosing company proprietary data; included in "Total or average."
1/ Includes Puerto Rico. Includes data for three white cement facilities as follows: California (1), Pennsylvania (1), and Texas (1).
Includes data for grinding plants as follows: California (1), Florida (2), Iowa (1), Michigan (1), Ohio (1), Pennsylvania (1), and Texas (1).
2/ Grinding capacity based on fineness necessary to grind Types I and II cement, making allowance for downtime required for maintenance.
3/ Includes imported cement. Source of imports withheld to avoid disclosing company proprietary data.
4/ Includes cement produced from imported clinker.
5/ Data may not add to totals shown because of independent rounding.

TABLE 3
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 1994, 1/ BY DISTRICT

District	Active plants, Process used: Wet	Dry	Both	Total	Number of kilns	Daily capacity (thousand metric tons)	Average number of days mainte-nance	Apparent annual capacity 2/ (thousand metric tons)	Produc-tion 3/ (thousand metric tons)	Percent utilized
New York and Maine	4	1	--	5	6	11	105	2,985	2,804	93.9
Pennsylvania, eastern	2	5	--	7	15	14	48	4,334	3,881	89.5
Pennsylvania, western	3	1	--	4	8	6	49	1,891	1,630	86.2
Illinois	--	4	--	4	8	8	28	2,568	2,332	90.8
Indiana	2	2	--	4	8	9	43	2,758	2,317	84.0
Michigan	1	2	--	3	8	13	40	4,147	3,896	93.9
Ohio	1	1	--	2	3	3	17	1,094	901	82.4
Iowa, Nebraska, South Dakota	--	4	1	5	9	13	41	4,123	3,637	88.2
Kansas	2	2	--	4	11	6	37	1,823	1,588	87.1
Missouri	2	3	--	5	7	13	36	4,411	4,322	98.0
Florida	2	2	--	4	7	9	36	2,971	2,826	95.1
Georgia and South Carolina	2	2	1	5	11	11	36	3,759	3,192	84.9
Maryland, Virginia, West Virginia	2	3	--	5	15	11	38	3,563	3,110	87.3
Alabama	--	5	--	5	7	14	36	4,495	3,816	84.9
Kentucky, Mississippi, Tennessee	2	2	--	4	5	6	31	1,971	1,887	95.7
Arkansas and Oklahoma	2	2	--	4	10	8	41	2,532	2,373	93.7
Texas, northern	3	3	--	6	14	12	35	4,014	3,770	93.9
Texas, southern	--	4	1	5	6	13	35	4,242	3,817	90.0
Arizona and New Mexico	--	3	--	3	9	7	18	2,448	1,881	76.8
Colorado and Wyoming	1	3	--	4	6	6	30	1,938	1,699	87.7
Idaho, Montana, Nevada, Utah	4	2	--	6	9	6	24	2,010	2,069	102.9
Alaska, Hawaii, Oregon, Washington	1	3	--	4	4	5	30	1,775	1,652	93.1
California, northern	--	3	--	3	3	9	61	2,616	2,567	98.1
California, southern	--	7	--	7	15	22	46	7,187	6,556	91.2
Total or average 4/	36	69	3	108	204	234	NA	75,653	68,525	90.6
Puerto Rico	--	2	--	2	2	5	42	1,546	1,262	81.6

NA Not available.
1/ Includes Puerto Rico and white cement producing facilities.
2/ Calculated on individual company data; 365 days minus average days for maintenance times the reported 24 hour capacity.
3/ Includes production reported for plants that added or shut down kilns during the year.
4/ Data may not add to totals shown because of independent rounding.

TABLE 4
RAW MATERIALS USED IN PRODUCING PORTLAND CEMENT
IN THE UNITED STATES 1/

(Thousand metric tons)

Raw materials	1993	1994
Calcareous:		
Limestone (includes aragonite, marble, chalk)	78,958	78,427
Cement rock (includes marl)	19,186	24,243
Coral	754	675
Argillaceous:		
Clay	4,200	4,189
Shale	5,066	5,514
Other (includes staurolite, bauxite, aluminum dross, alumina, volcanic material, other)	442	500
Siliceous:		
Sand and calcium silicate	2,046	2,095
Sandstone, quartzite, other	571	588
Ferrous: Iron ore, pyrites, millscale, other iron bearing material	1,097	1,186
Other:		
Gypsum and anhydrite	3,696	3,873
Blast furnace slag	38	33
Fly ash	888	1,125
Other, n.e.c.	224	135
Total 2/	117,165	122,582

1/ Includes Puerto Rico.
2/ Data may not add to totals shown because of independent rounding.

TABLE 5
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT

District	1993 Plants active during year	1993 Production (thousand metric tons)	1993 Stocks 1/ at mills, Dec. 31 (thousand metric tons)	1994 Plants active during year	1994 Production (thousand metric tons)	1994 Stocks 1/ at mills, Dec. 31 (thousand metric tons)
New York and Maine	5	84	19	5	89	17
Pennsylvania, eastern	6	165	39	6	161	25
Pennsylvania, western	4	83	13	4	84	13
Illinois	--	--	(2/)	1	W	W
Indiana	4	W	W	4	W	31
Michigan	5	216	38	5	235	24
Ohio	3	W	W	2	W	W
Iowa, Nebraska, South Dakota	4	49	6	4	58	12
Kansas	4	W	20	3	24	W
Missouri	3	W	W	1	W	W
Florida	4	351	29	4	400	W
Georgia and South Carolina	4	374	30	4	417	39
Maryland, Virginia, West Virginia	5	199	20	6	571	52
Alabama	4	277	39	5	312	36
Kentucky, Mississippi, Tennessee	3	105	13	3	105	11
Arkansas and Oklahoma	4	102	17	4	104	14
Texas, northern	4	93	9	4	106	10
Texas, southern	5	152	16	5	151	15
Arizona and New Mexico	3	W	4	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	2	W	W	4	W	W
Alaska, Hawaii, Oregon, Washington	2	W	4	2	W	2
California, northern	1	W	W	1	W	W
California, southern	2	W	W	2	W	W
Total or average 3/	83	2,962	399	84	3,613	400

W Withheld to avoid disclosing company proprietary data; included in "Total or average."
1/ Includes imported cement.
2/ Less than 1/ 2 unit.
3/ Data may not add to totals shown because of independent rounding.

TABLE 6
CLINKER PRODUCED AND FUEL CONSUMED BY THE PORTLAND CEMENT INDUSTRY
IN THE UNITED STATES, 1/ BY PROCESS

Process	Clinker produced: Plants active during year	Clinker produced: Quantity (thousand metric tons)	Clinker produced: Percent of total	Fuel consumed: Coal (thousand metric tons)	Fuel consumed: Oil (thousand liters)	Fuel consumed: Natural gas (thousand cubic meters)	Waste fuel: Tires (thousand metric tons)	Waste fuel: Solid (thousand metric tons)	Waste fuel: Liquid (thousand liters)
1993:									
Wet	37	19,700	29.4	3,328	10,152	231,111	20	74	489,988
Dry	72	44,696	66.8	6,298	35,386	375,769	50	15	253,706
Both	4	2,561	3.8	408	8	61,143	--	--	--
Total 2/	113	66,957	100.0	10,034	45,546	668,024	70	90	743,693
1994:									
Wet	36	18,605	26.7	3,197	10,913	174,815	26	58	369,078
Dry	71	49,333	70.7	6,984	37,858	411,657	90	16	230,577
Both	3	1,849	2.6	303	--	63,676	4	--	--
Total 2/	110	69,787	100.0	10,484	48,771	650,148	120	74	599,655

1/ Includes Puerto Rico.
2/ Data may not add to totals shown because of independent rounding.

TABLE 7
ELECTRIC ENERGY USED AT PORTLAND CEMENT PLANTS
IN THE UNITED STATES, 1/ BY PROCESS

Process	Electric energy used: Generated at portland Cement plants: Plants active during year	Quantity (million kilowatt-hours)	Purchased: Plants active during year	Quantity (million kilowatt-hours)	Total: Quantity (million kilowatt-hours)	Percent	Finished cement produced (Thousand metric tons)	Average electric energy used (per ton of cement produced kilowatt-hours)
1993:								
Wet	1	149	34	2,412	2,562	25.6	20,303	12.6
Dry	6	571	65	6,449	7,020	70.2	47,290	14.8
Both	--	--	4	421	421	4.2	2,677	15.7
Total 2/	7	720	103	9,282	10,002	100.0	70,270	14.2
Percent of total electric energy used	--	7.2	--	92.8	--	--	--	--
1994:								
Wet	--	--	35	2,675	2,675	24.6	19,295	13.9
Dry	5	593	69	7,288	7,882	72.5	51,409	15.3
Both	--	--	3	310	310	2.9	1,957	15.8
Total 2/	5	593	107	10,273	10,866	100.0	72,661	15.0
Percent of total electric energy used	--	5.5	--	94.5	--	--	--	--

1/ Includes Puerto Rico.
2/ Data may not add to totals shown because of independent rounding.

TABLE 8
SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, 1/ IN BULK AND
IN CONTAINERS, BY TYPE OF CARRIER

(Thousand metric tons)

	Shipments from plant to terminal: In bulk	In containers	Shipments to ultimate consumer: From plant to consumer: In bulk	In containers	From terminal to consumer: In bulk	In containers	Total shipments 3/
1993:							
Railroad	8,879	89	3,782	495	490	41	4,808
Truck	2,955	131	41,040	1,822	19,063	454	62,378
Barge and boat	6,319	12	582	--	477	--	1,059
Unspecified 2/	484	--	2,377	12	455	15	2,859
Total 3/	18,637	232	47,780	2,329	20,485	510	71,104 4/
1994:							
Railroad	8,871	56	3,205	419	840	15	4,479
Truck	2,667	124	41,701	2,010	25,712	818	70,241
Barge and boat	8,046	--	659	3	294	--	956
Unspecified 2/	1,742	--	643	36	533	16	1,228
Total 3/	21,326	180	46,208	2,468	27,378	849	76,903 5/

1/ Includes Puerto Rico.
2/ Includes cement used at plant.
3/ Data may not add to totals shown because of independent rounding.
4/ Bulk shipments were 96.0% and container (bag) shipments were 4.0%.
5/ Bulk shipments were 95.7% and container (bag) shipments were 4.3%.

TABLE 9

PORTLAND CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/

District	1993 Quantity (thousand metric tons)	1993 Value (thousands)	1993 Average per ton	1994 Quantity (thousand metric tons)	1994 Value (thousands)	1994 Average per ton
New York and Maine	3,055	$154,901	$50.70	3,099	$163,141	$52.64
Pennsylvania, eastern	3,780	195,824	51.81	4,141	221,121	53.40
Pennsylvania, western	1,484	81,501	54.92	1,520	95,171	62.61
Illinois	2,592	130,962	50.53	2,524	147,721	58.53
Indiana	2,235	117,638	52.63	2,293	132,487	57.78
Michigan	4,922	301,425	61.24	5,135	329,409	64.15
Ohio	1,428	86,338	60.46	1,063	70,273	66.11
Iowa, Nebraska, South Dakota	3,467	210,971	60.85	3,722	239,483	64.34
Kansas	1,560	83,390	53.46	1,708	104,988	61.47
Missouri	4,274	211,765	49.55	5,054	283,013	56.00
Florida and Puerto Rico	4,737	298,328	62.98	5,242	395,381	75.43
Georgia and South Carolina	3,442	181,546	52.74	3,334	215,100	64.52
Maryland, Virginia, West Virginia	3,092	157,658	50.99	3,338	185,519	55.58
Alabama	3,345	170,300	50.91	3,839	239,220	62.31
Kentucky, Mississippi, Tennessee	2,255	113,196	50.20	2,323	144,977	62.41
Arkansas and Oklahoma	2,335	107,946	46.23	2,401	140,899	58.68
Texas, northern	3,377	178,152	52.75	3,350	192,328	57.41
Texas, southern	4,677	215,887	46.16	4,872	242,347	49.74
Arizona and New Mexico	1,707	107,621	63.05	1,932	126,565	65.51
Colorado and Wyoming	2,120	138,420	65.29	1,951	135,254	69.33
Idaho, Montana, Nevada, Utah	2,034	147,731	72.63	2,341	175,730	75.07
Alaska, Hawaii, Oregon, Washington	1,518	131,399	86.56	1,568	124,158	79.18
California, northern	1,935	109,608	56.64	1,933	123,062	63.66
California, southern	5,732	312,291	54.48	6,341	339,231	53.50
Total 2/ 3/ 4/ 5/ 6/ or average	71,104	3,944,796	55.48	76,903	4,696,198	61.07

1/ Includes Puerto Rico. Includes data for three white cement facilities as follows:
California (1), Pennsylvania (1), and Texas (1). Includes data for grinding plants as follows:
California (1), Florida (2), Iowa (1), Michigan (1), Ohio (1), Pennsylvania (1), and Texas (1).
2/ Includes cement produced from imported clinker.
3/ Data may not add to totals shown because of independent rounding.
4/ Cement imported and distributed by domestic producers only.
5/ Does not include cement consumed at plant.
6/ Total includes imports shipped by independent importers.

TABLE 10

MASONRY CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, 1/ BY DISTRICT

District	1993 Quantity (thousand metric tons)	1993 Value (thousands)	1993 Average per ton	1994 Quantity (thousand metric tons)	1994 Value (thousands)	1994 Average per ton
New York and Maine	85	$6,319	$74.34	91	$6,823	$75.21
Pennsylvania, eastern	171	12,240	71.58	187	13,518	72.34
Pennsylvania, western	79	6,692	84.71	83	7,658	92.76
Illinois, Indiana, Michigan, Ohio	668	56,785	85.05	723	60,056	83.06
Iowa, Kansas, Missouri, Nebraska, South Dakota	181	10,539	58.09	206	12,852	62.41
Florida	356	27,645	77.65	358	31,022	86.57
Georgia and South Carolina	360	27,859	77.39	396	36,406	91.83
Maryland, Virginia, West Virginia	204	16,184	79.33	531	35,151	66.23
Alabama	260	20,610	79.27	317	29,401	92.86
Kentucky, Mississippi, Tennessee	106	8,108	76.49	119	8,848	74.45
Arkansas, Oklahoma, Texas	322	24,381	75.71	354	26,075	73.70
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	82	5,146	63.03	110	8,821	80.36
Alaska, California, Hawaii, Oregon, Washington	103	7,515	73.31	110	7,738	70.49
Total 2/ 3/ 4/ or average	2,975	230,022	77.32	3,587	284,819	79.40

1/ Does not include quantities produced on the job by masons.
2/ Calculated on unrounded data.
3/ Data may not add to totals shown because of independent rounding.
4/ Total includes imports shipped by independent importers.

TABLE 11
CEMENT SHIPMENTS, BY DESTINATION AND ORIGIN 1/

(Thousand metric tons)

Destination and origin	Portland cement		Masonry cement	
	1993	1994	1993	1994
Destination:				
Alabama	1,296	1,432	122	131
Alaska	106	103	W	W
Arizona	1,845	2,158	W	W
Arkansas	818	880	51	56
California, northern	2,820	2,872	--	--
California, southern	4,846	5,328	W	W
Colorado	2,086	1,746	19	29
Connecticut 2/	587	624	15	12
Delaware 2/	233	230	9	9
District of Columbia 2/	108	112	(3/)	(3/)
Florida	5,262	5,623	437	458
Georgia	2,483	2,751	186	201
Hawaii	442	396	7	6
Idaho	405	456	1	1
Illinois	1,301	1,516	23	30
Chicago, metropolitan 2/	1,998	2,077	50	49
Indiana	1,757	1,876	91	98
Iowa	1,308	1,515	12	13
Kansas	1,124	1,277	15	18
Kentucky	1,180	1,163	86	94
Louisiana 2/	1,689	1,706	46	52
Maine	224	227	5	5
Maryland	1,015	1,083	79	84
Massachusetts 2/	1,002	1,119	24	27
Michigan	2,285	2,585	115	120
Minnesota 2/	1,388	1,518	34	39
Mississippi	880	920	45	75
Missouri	1,882	2,386	38	48
Montana	415	278	1	1
Nebraska	877	1,014	11	12
Nevada	1,131	1,358	(3/)	(3/)
New Hampshire 2/	222	242	6	7
New Jersey 2/	1,425	1,427	54	62
New Mexico	688	665	6	6
New York, eastern	569	514	24	22
New York, western	815	821	34	33
New York, metropolitan 2/	783	1,010	35	38
North Carolina 2/	1,946	2,151	237	253
North Dakota 2/	239	245	3	3
Ohio	3,225	3,482	169	199
Oklahoma	1,051	1,114	35	43
Oregon	818	946	(3/)	(3/)
Pennsylvania, eastern	1,756	1,967	57	61
Pennsylvania, western	1,080	1,102	73	73
Rhode Island 2/	134	152	3	3
South Carolina	970	981	106	113
South Dakota	331	338	5	5
Tennessee	1,536	1,711	165	187
Texas, northern	3,784	3,817	133	134
Texas, southern	3,810	4,053	83	108
Utah	910	1,020	2	2
Vermont 2/	107	101	4	3
Virginia	1,621	1,716	145	146
Washington	1,623	1,723	5	6
West Virginia	441	437	32	33
Wisconsin	1,811	1,889	41	41
Wyoming	230	275	1	2
U.S. total 4/	76,717	82,232	2,984	3,250
Foreign countries 5/	345	377	53	75
Puerto Rico	1,306	1,392	--	--
Total shipment 4/	78,368	84,001	3,037	3,325

See footnotes at end of table.

TABLE 11-Continued
CEMENT SHIPMENTS, BY DESTINATION AND ORIGIN 1/

(Thousand metric tons)

Destination and origin	Portland cement 1993	Portland cement 1994	Masonry cement 1993	Masonry cement 1994
Origin:				
United States 6/	71,053	75,130	2,901	3,283
Puerto Rico	1,306	1,392	--	--
Foreign: 7/	6,009	8,870	136	42
Total shipment 4/	78,368	84,001	3,037	3,325

W Withheld to avoid disclosing company proprietary data; included with "Foreign countries."
1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers, Canadian cement manufacturers, and other importers. Includes Puerto Rico.
2/ Has no cement producing plants.
3/ Less than 1/2 unit.
4/ Data may not add to totals shown because of independent rounding.
5/ Direct shipments by producers to foreign countries and U.S. possessions and territories; includes States indicated by the symbol W.
6/ Includes cement produced from imported clinker by domestic producers.
7/ Imported cement distributed by domestic producers, Canadian cement manufacturers, and other importers. Origin of imports withheld to avoid disclosing company proprietary data.

TABLE 12
CEMENT SHIPMENTS 1/, BY DESTINATION (REGION AND SUBREGION)

Region and subregion 2/	Portland cement: Thousand metric tons 1993	Portland cement: Thousand metric tons 1994	Portland cement: Percent of grand total 1993	Portland cement: Percent of grand total 1994	Masonry cement: Thousand metric tons 1993	Masonry cement: Thousand metric tons 1994	Masonry cement: Percent of grand total 1993	Masonry cement: Percent of grand total 1994
Northeast:								
New England	2,276	2,466	3	3	56	57	2	2
Middle Atlantic	6,428	6,841	8	8	278	289	9	9
Total	8,704	9,307	11	11	334	346	11	11
South:								
Atlantic	14,078	15,084	19	18	1,233	1,297	41	40
East Central	4,892	5,226	6	6	419	487	14	15
West Central	11,152	11,570	15	14	348	392	12	12
Total 3/	30,122	31,881	39	39	2,000	2,176	67	67
Midwest:								
East	12,377	13,425	16	16	490	537	16	17
West	7,149	8,294	9	10	118	137	4	4
Total	19,526	21,719	25	26	608	674	20	21
West:								
Mountain	7,710	7,956	10	10	30	42	1	1
Pacific	10,655	11,368	14	14	12	12	--	(4/)
Total 3/	18,365	19,325	24	24	42	54	1	2
Grand total 3/	76,717	82,232	100	100	2,984	3,250	100	100

1/ Includes imported cement shipped by importers.
2/ Geographic regions as designated by the U.S. Department of Commerce, Bureau of the Census.
3/ Data may not add to totals shown because of independent rounding.
4/ Less than 1/2 unit.

TABLE 13

PORTLAND CEMENT SHIPMENTS IN 1994, BY DISTRICT OF ORIGIN AND TYPE OF CUSTOMER 1/

(Thousand metric tons)

District of origin	Building Material Dealers	Concrete Product Manufacturers 2/	Ready Mixed Concrete	Contractors 3/	Oil Well, Mining, Waste 4/	Government and Miscellaneous. 5/	Total 6/
New York and Maine	135	304	1,893	78	--	686	3,099
Pennsylvania, eastern	258	615	1,602	172	27	1,467	4,141
Pennsylvania, western	82	231	941	139	19	109	1,520
Illinois	11	220	1,124	145	8	1,017	2,524
Indiana	41	151	1,066	20	--	1,016	2,293
Michigan	268	598	2,112	215	14	1,928	5,135
Ohio	13	141	411	32	4	461	1,063
Iowa, Nebraska, South Dakota	22	424	2,345	397	46	488	3,722
Kansas	17	101	924	96	11	559	1,708
Missouri	118	440	2,838	452	--	1,207	5,054
Florida and Puerto Rico	628	650	2,267	252	20	1,426	5,242
Georgia and South Carolina	154	636	2,272	229	--	42	3,334
Maryland, Virginia, West Virginia	147	506	1,985	168	7	523	3,338
Alabama	302	573	2,526	306	40	93	3,839
Kentucky, Mississippi, Tennessee	148	233	1,788	118	3	33	2,323
Arkansas and Oklahoma	30	92	1,318	258	39	665	2,401
Texas, northern	102	215	1,785	454	348	445	3,350
Texas, southern	346	196	2,193	304	173	1,661	4,872
Arizona and New Mexico	59	318	1,226	84	11	235	1,932
Colorado and Wyoming	51	193	1,477	156	50	24	1,951
Idaho, Montana, Nevada, Utah	19	205	1,382	162	12	559	2,341
Alaska, Hawaii, Oregon, Washington	75	107	1,006	99	--	282	1,568
California, northern	67	242	1,532	54	2	36	1,933
California, southern	353	1,025	4,556	251	124	33	6,341
Total 6/ 7/ or average	3,638	8,482	42,825	4,643	960	16,357	76,903

1/ Includes Puerto Rico.

2/ Concrete product manufacturers included in thousand metric tons: brick/ block- 1,288 in U.S.; precast-800 in U.S. ; pipe- 562 in U.S.; and others- 5,832 in U.S. Other includes unspecified amounts of brick/ block, precast, and pipe.

3/ Contractors included in thousand metric tons: roadpaving- 1,842 in U.S; soil cement- 363 in U.S. and other- 2,340 in U.S. Other includes unspecified amounts of road paving, and soil cement.

4/ Oil well, mining, and waste included in thousand metric tons in U.S.: oil well drilling- 736; mining- 43; and waste stabilization- 181.

5/ Included in this amount are cement shipments which were unspecified by type of customer.

6/ Data may not add to totals shown because of independent rounding.

7/ Total includes imports shipped by independent importers.

TABLE 14

PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES, 1/ 2/ BY TYPE

Type	1993 Quantity (thousand metric tons)	1994 Quantity (thousand metric tons)
General use and moderate heat (Types I and II)	64,806	69,810
High early strength (Type III)	2,659	2,618
Sulfate resisting (Type V)	1,570	1,763
Block	471	463
Oil well	804	937
White	263	519
Portland slag and portland pozzolan	264	422
Expansive	W	W
Regulated fast setting	W	W
Miscellaneous 3/	137	304
Total 4/ 5/ or average	71,104	76,903

W Withheld to avoid disclosing company proprietary data; included in "Total or average."

1/ Includes Puerto Rico.

2/ The value of grey portland cement $54.97 in 1993 and $60.28 in 1994; value of white portland cement $192.40 in 1993 and $177.04 in 1994.

3/ Includes waterproof,and lowheat (Type IV).

4/ Data may not add to totals shown because of independent rounding.

5/ Does not include cement consumed at plant.

TABLE 15

AVERAGE MILL VALUE, IN BULK OF CEMENT IN THE UNITED STATES 1/

(Per metric ton)

Year	Portland cement	Prepared masonry cement 2/	All classes of cement
1993	55.48	77.32	56.36
1994	61.07	79.4	61.88

1/ Includes Puerto Rico. Mill value is the actual value of sales to customers, f.o.b. plant, less all discounts and allowances, less all freight charges from producing plant to distribution terminal if any, less total cost of operating terminal, if any, less cost of paper bags and pallets.

2/ Masonry cement made at cement plants only.

TABLE 16
U.S. EXPORTS OF HYDRAULIC CEMENT AND CEMENT CLINKER, BY COUNTRY

(Thousand metric tons and thousand dollars)

Country	1993		1994	
	Quantity	Value 1/	Quantity	Value 1/
Bahamas, The	44	2,227	9	546
Canada	502	36,028	510	35,272
Ghana	2	145	(2/)	31
Mexico	21	3,424	62	4,221
Netherlands	2	307	1	223
Other	54	5,641	52	4,896
Total 3/	625	47,772	633	45,189

1/ Free alongside ship (f.a.s.) value is the value of exports at the U.S. seaport, or border port of export, based on the transaction price, including inland freight, insurance, and other changes incurred in placing the merchandise alongside the carrier at the U.S. port of exportation. The value excludes the cost of loading.
2/ Less than 1/2 unit.
3/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 17
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY

(Thousand metric tons and thousand dollars)

Country	1993			1994		
	Quantity	Value		Quantity	Value	
		Customs 1/	C.i.f. 2/		Customs 1/	C.i.f. 2/
Canada	3,629	147,747	158,670	4,268	168,603	183,314
Colombia	550	18,017	23,201	709	24,830	31,351
France	216	14,833	17,237	474	27,088	32,538
Greece	282	8,884	11,931	914	31,919	44,060
Japan	43	1,667	2,116	14	668	891
Korea, Republic of	33	891	1,254	--	--	--
Mexico	783	29,074	35,482	640	25,573	31,097
Spain	597	25,745	31,382	1,342	54,585	64,771
Venezuela	269	9,837	12,344	803	32,735	42,090
Other	659	26,436	37,721	2,139	77,036	107,620
Total 3/	7,060	283,131	331,337	11,303	443,038	537,731

1/ Customs value price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
2/ C.i.f. (Cost, insurance and freight) import value represents the landed value of the merchandise at the first port of arrival in the United States. It is computed by adding "import charges" to the "customs value."
3/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 18

U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY

(Thousand metric tons and thousand dollars)

Country	1993 Quantity	1993 Value Customs	1993 Value C.i.f. 1/	1994 Quantity	1994 Value Customs	1994 Value C.i.f. 1/
Australia	133	4,518	6,417	103	3,675	5,414
Canada	883	27,917	28,262	913	31,674	32,261
Colombia	239	6,724	9,060	212	6,370	7,914
France	118	9,458	10,717	154	13,535	15,319
Greece	26	814	1,179	--	--	--
Mexico	--	--	--	(2/)	7	8
New Zealand	78	2,282	3,344	27	837	1,253
Spain	--	--	--	33	912	1,262
Other	30	800	1,074	766	22,773	31,540
Total 3/	1,508	52,513	60,054	2,208	79,783	94,970

1/ Cost, insurance, and freight.

2/ Less than 1/2 unit.

3/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 19

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

Customs district and country	1993 Quantity	1993 Value Customs	1993 Value C.i.f. 1/	1994 Quantity	1994 Value Customs	1994 Value C.i.f. 1/
Anchorage:						
Canada	6	655	895	1	13	28
China	14	504	679	56	2,147	3,097
Japan	43	1,392	1,782	14	478	672
Total 2/	62	2,551	3,355	71	2,638	3,797
Baltimore:						
Brazil	(3/)	12	14	(3/)	39	46
France	(3/)	2	2	--	--	--
Greece	--	--	--	9	289	410
Japan	(3/)	46	56	(3/)	24	24
Netherlands	(3/)	57	60	--	--	--
Spain	--	--	--	53	1,618	3,094
United Kingdom	(3/)	18	22	(3/)	68	92
Venezuela	--	--	--	13	507	507
Total 2/	(3/)	135	154	74	2,545	4,173
Boston:						
Canada	--	--	--	13	632	707
Germany	--	--	--	(3/)	16	22
Netherlands	(3/)	24	27	--	--	--
Niger	(3/)	12	14	--	--	--
United Kingdom	--	--	--	(3/)	9	9
Total 2/	(3/)	36	41	14	656	739
Buffalo:						
Canada	621	32,841	35,225	532	27,683	30,046
United Kingdom	--	--	--	(3/)	1	1
Total	621	32,841	35,225	532	27,685	30,048
Charleston:						
Canada	--	--	--	43	1,451	2,147
Germany	--	--	--	(3/)	6	8
Greece	--	--	--	23	627	1,020
United Kingdom	(3/)	24	31	(3/)	58	78
Venezuela	--	--	--	12	443	598
Total	1	24	31	78	2,585	3,852
Chicago:						
Japan	(3/)	46	56	(3/)	47	56
Switzerland	(3/)	3	3	--	--	--
Total 2/	(3/)	49	59	(3/)	47	56

See footnotes at end of table.

TABLE 19-Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

Customs district and country	1993			1994		
	Quantity	Value		Quantity	Value	
		Customs	C.i.f. 1/		Customs	C.i.f. 1/
Cleveland: Canada	319	10,801	11,243	522	18,032	19,145
ColumbiaSnake:						
China	188	6,891	9,122	243	9,241	11,660
Colombia	--	--	--	4	123	125
Japan	(3/)	2	2	--	--	--
Netherlands	--	--	--	(3/)	1	1
Total 2/	189	6,893	9,124	248	9,366	11,786
Detroit:						
Canada	1,021	39,866	41,070	1,171	45,712	47,525
Japan	(3/)	4	4	--	--	--
Netherlands	--	--	--	(3/)	10	10
Total 2/	1,021	39,869	41,074	1,171	45,721	47,535
Duluth: Canada	93	3,352	3,900	239	8,620	9,964
El Paso: Mexico	91	3,322	4,313	80	3,037	3,944
Great Falls:						
Canada	279	9,679	10,303	220	6,373	7,092
United Kingdom	(3/)	40	47	(3/)	29	35
Total 2/	279	9,719	10,350	220	6,402	7,127
Honolulu:						
Australia	132	4,518	6,417	103	3,675	5,414
Colombia	42	1,134	2,084	--	--	--
New Zealand	78	2,282	3,344	27	837	1,253
Venezuela	--	--	--	26	814	1,404
Total	253	7,933	11,845	157	5,326	8,071
Houston-Galveston:						
Colombia	--	--	--	7	324	438
Denmark	--	--	--	6	308	309
France	--	--	--	68	2,868	3,219
Japan	(3/)	90	111	(3/)	70	82
Singapore	(3/)	2	3	--	--	--
Spain	33	1,365	1,365	529	21,811	23,203
Switzerland	--	--	--	33	1,404	1,734
United Kingdom	(3/)	11	15	(3/)	23	31
Total	33	1,469	1,494	644	26,807	29,016
Laredo:						
China	1	242	266	--	--	--
Mexico	28	2,376	2,710	48	3,978	4,560
Total	29	2,618	2,976	49	3,978	4,560
Los Angeles:						
France	--	--	--	(3/)	22	26
Japan	(3/)	46	54	(3/)	50	57
Mexico	376	14,338	16,747	355	13,393	15,811
Spain	--	--	--	24	828	1,103
Total 2/	376	14,384	16,801	380	14,293	16,996
Miami:						
Belgium	2	219	296	3	251	340
Colombia	208	7,528	9,539	306	11,523	14,636
Denmark	24	1,397	2,138	31	1,886	2,841
Greece	18	664	874	35	1,275	1,647
Norway	--	--	--	64	2,275	2,892
Spain	210	9,911	12,058	288	13,331	15,364
Sweden	--	--	--	158	4,425	6,469
United Kingdom	(3/)	11	11	(3/)	3	3
Venezuela	51	1,910	2,390	47	1,755	2,336
Total 2/	513	21,641	27,307	932	36,724	46,527
Milwaukee:						
Canada	139	4,147	4,884	179	6,056	6,226
Germany	--	--	--	(3/)	1	2
Total 2/	139	4,147	4,884	179	6,057	6,228
Minneapolis: Germany	(3/)	25	28	(3/)	25	26
Mobile:						
Bulgaria	--	--	--	56	1,407	2,201
France	--	--	--	54.4311	1491	1843

See footnotes at end of table.

TABLE 19-Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

Customs district and country	1993 Quantity	1993 Value Customs	1993 Value C.i.f. 1/	1994 Quantity	1994 Value Customs	1994 Value C.i.f. 1/
Macao	--	--	--	24	619	850
Morocco	--	--	--	20	543	778
Total 2/	--	--	--	155	4,060	5,673
New Orleans:						
Belgium	(3/)	28	31	--	--	--
Bulgaria	--	--	--	24	599	917
Colombia	--	--	--	43	1,610	2,197
Denmark	--	--	--	103	3,618	5,438
France	37	3,567	3,989	230	9,741	12,755
Greece	--	--	--	363	12,486	17,357
Italy	--	--	--	179	6,165	8,612
Spain	196	7,479	9,224	99	3,613	4,726
Tunisia	--	--	--	26	741	1,115
Turkey	--	--	--	474	14,162	20,311
Ukraine	--	--	--	34	900	1,247
Venezuela	--	--	--	34	1,351	1,826
Total 2/	233	11,074	13,244	1,612	54,988	76,500
New York:						
Greece	182	5,529	7,705	300	11,102	15,300
Netherlands	(3/)	6	7	(3/)	107	114
Norway	--	--	--	78	2,522	3,496
Spain	22	2,008	2,551	208	8,157	10,614
United Kingdom	22	698	904	(3/)	10	11
Total 2/	227	8,242	11,167	586	21,899	29,535
Nogales: Mexico	287	8,848	11,456	156	5,110	6,724
Norfolk:						
Denmark	--	--	--	117	5,865	7,198
France	40	7,192	8,104	84	11,740	12,998
Greece	81	2,691	3,352	183	6,140	8,325
Netherlands	(3/)	57	65	(3/)	16	17
Spain	--	--	--	(3/)	180	199
Venezuela	--	--	--	33	1,260	1,701
Total 2/	122	9,940	11,521	418	25,200	30,438
Ogdensburg:						
Canada	305	10,408	11,260	408	13,246	14,688
Mexico	(3/)	13	13	--	--	--
United Kingdom	(3/)	13	14	--	--	--
Total	306	10,434	11,286	408	13,246	14,688
Pembina: Canada	69	2,148	2,657	120	5,104	5,983
Philadelphia:						
France	(3/)	11	13	--	--	--
Germany	--	--	--	(3/)	6	15
United Kingdom	(3/)	13	16	--	--	--
Total	(3/)	25	29	(3/)	6	15
Portland:						
Bulgaria	--	--	--	28	733	1,028
Canada	5	192	253	10	469	622
Total	5	192	253	38	1,201	1,649
San Diego:						
Mexico	(3/)	13	18	1	56	58
Spain	38	1,652	2,047	28	1,261	1,545
Total 2/	38	1,666	2,065	29	1,317	1,603
San Francisco:						
China	--	--	--	(3/)	2	2
France	--	--	--	(3/)	32	37
Germany	(3/)	2	4	--	--	--
Japan	(3/)	2	4	--	--	--
Korea, Republic of	33	891	1,254	--	--	--
New Zealand	(3/)	13	16	1	738	977
Total 2/	33	908	1,278	1	771	1,016
San Juan:						
Belgium	10	860	1,819	10	838	1,418
Colombia	--	--	--	(3/)	22	29

See footnotes at end of table.

TABLE 19-Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

Customs district and country	1993 Quantity	1993 Value Customs	1993 Value C.i.f. 1/	1994 Quantity	1994 Value Customs	1994 Value C.i.f. 1/
Denmark	9	746	1,259	13	1,157	1,853
Germany	--	--	--	(3/)	5	5
Mexico	1	165	226	--	--	--
Spain	--	--	--	(3/)	7	8
Turkey	--	--	--	(3/)	4	7
Total 2/	20	1,772	3,304	23	2,033	3,319
Savannah: Germany	(3/)	2	3	--	--	--
Seattle:						
Canada	665	30,382	32,634	663	31,141	33,400
China	83	3,041	4,083	17	646	896
Colombia	44	1,485	1,789	100	3,349	3,963
Japan	(3/)	39	47	--	--	--
Total 2/	792	34,946	38,552	780	35,136	38,259
St Albans:						
Canada	67	1,819	2,263	78	2,699	3,543
Netherlands	(3/)	60	68	(3/)	102	116
Total 2/	68	1,878	2,331	79	2,801	3,660
Tampa:						
Canada	29	968	1,429	44	481	877
Colombia	239	7,097	8,902	241	7,531	9,427
Denmark	72	4,135	6,344	79	4,510	6,931
France	139	4,061	5,129	37	1,195	1,661
Spain	100	3,329	4,136	113	3,779	4,915
Sweden	--	--	--	79	2,721	3,705
Turkey	--	--	--	38	1,248	1,616
Venezuela	121	4,396	5,443	450	17,578	22,406
Total 2/	699	23,985	31,384	1,081	39,043	51,538
U.S. Virgin Islands:						
Barbados	11	79	92	--	--	--
Colombia	18	773	887	8	348	536
Denmark	(3/)	1	1	--	--	--
Martinique	--	--	--	4	28	30
Panama	3	94	119	--	--	--
Trinidad and Tobago	9	296	339	8	284	337
Venezuela	44	1,479	1,765	49	3,683	4,130
Total 2/	85	2,721	3,202	70	4,343	5,034
Washington:						
Netherlands	--	--	--	(3/)	3	4
Venezuela	5	244	338	--	--	--
Total 2/	5	244	338	(3/)	3	4
Wilmington:						
Canada	13	492	654	25	893	1,321
Venezuela	47	1,807	2,407	139	5,344	7,183
Total 2/	60	2,300	3,061	164	6,237	8,503
Grand total 2/	7,060	283,131	331,337	11,303	443,038	537,731

1/ Cost, insurance, and freight.
2 /Data may not add to totals shown because of independent rounding.
3/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF CEMENT AND CLINKER

(Thousand metric tons and thousand dollars)

Year	Roman, portland, other hydraulic cement Quantity	Roman, portland, other hydraulic cement Value (customs)	Hydraulic cement clinker Quantity	Hydraulic cement clinker Value (customs)	White nonstaining portland cement Quantity	White nonstaining portland cement Value (customs)	Total 1/ Quantity	Total 1/ Value (customs)
1993	5,178	199,499	1,508	52,513	375	31,118	7,060	283,131
1994	8,635	329,012	2,208	79,783	459	34,243	11,303	443,038

1/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 21
HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1990	1991	1992	1993	1994 e/
Afghanistan e/	112	112	115	115	115
Albania e/	750	600	200	200	200
Algeria	6,340	6,320	6,400	6,400 e/	6,400
Angola e/	260	260	300	250	300
Argentina	3,610 r/	3,400 r/	5,050 r/	5,650 r/	6,000
Armenia e/	XX	XX	500	200	200
Australia	7,070	6,110	5,410	5,500 e/	6,000
Austria	4,900	5,020	5,030 r/	4,940 r/	5,000
Azerbaijan e/	XX	XX	600	400	300
Bahrain	148	150	220 r/	225 r/	225
Bangladesh 3/	337	275	273	275	280
Barbados e/	200	200	175	175	200
Belgium	6,930	7,180	8,070	7,570 r/	8,000
Belarus e/	XX	XX	1,600	1,000	800
Benin e/	300	320	370	380	380
Bolivia	560	592	600	480 r/	500
Bosnia and Herzegovina e/	XX	XX	150	150	150
Brazil	25,800	27,500	24,900	25,900 r/	26,000
Bulgaria	4,710	2,370	2,130 r/	2,500 e/	2,300
Burma	414 r/	435	465	401 r/	453
Cameroon	624	622	620	620 e/	620
Canada	11,700	9,400	5,700	6,670	10,600 4/
Chile	2,120	2,250	2,650	2,600 e/	2,600
China	210,000 r/	253,000	308,000 r/	368,000 r/	400,000 4/
Colombia	6,250	6,300	6,810	6,900 e/	7,000
Congo	90	103	115	114 e/	114
Costa Rica e/	620 4/	700	700	750 r/	780
Côte d'Ivoire e/	500	500	510	500	500
Croatia	XX	XX	1,770 r/	1,680 r/	1,700
Cuba e/	3,000	2,000	2,000	1,000 r/	1,000
Cyprus	1,130	1,130	1,130	1,090 e/	1,040
Czech Republic	XX	XX	XX	5,390 r/	5,300 4/
Czechoslovakia 5/	10,200	8,300	8,500	XX	XX
Denmark (sales)	1,660	2,020	2,070	2,270 r/	2,300
Dominican Republic	1,060	1,230	1,370	1,300 e/	1,200
Ecuador	2,250	2,300	2,250	2,200 e/	2,250
Egypt	14,100	16,400	17,000	16,000 r/	16,000
El Salvador	641	680	419	861 r/	850
Eritrea e/	--	--	--	30	40
Estonia e/	XX	XX	600	500	500
Ethiopia	340	290	300 r/	270 r/ e/	260 4/
Fiji	78	79	84	80 r/	94 4/
Finland	1,670	1,320	1,130	835 r/	870 4/
France	26,400	26,500	21,200	19,300 r/	20,200
Gabon	116	117	116	132	126
Georgia e/	XX	XX	1,000	700	500
Germany:					
Eastern states	7,230	XX	XX	XX	XX
Western states	30,500	XX	XX	XX	XX
Total	37,700	34,400	37,500	36,600 r/	40,400 4/
Ghana	675	750	1,020	1,200	1,350 4/
Greece	13,600	11,800 r/	10,700 r/	12,600 r/	12,600 4/
Guadeloupe e/	225	240	235	230	230
Guatemala	1,680	1,440	1,400 e/	1,450 r/	1,480
Haiti e/	200	250	200	100	75
Honduras	652	693	650 e/	645 e/	645
Hong Kong	1,810	1,680	1,640	1,710	1,930 4/
Hungary	3,930	2,530	2,240	2,530 r/	2,810 4/
Iceland	114	106	100	86 r/	83 4/
India	49,000	51,000	50,000 e/	53,800 r/	54,000
Indonesia	13,800	16,200	17,300	18,900 r/	19,000
Iran e/	13,000	15,000	18,000	18,000 r/	20,000
Iraq e/	10,000	5,000	10,000	12,000 r/	12,000
Ireland e/	1,630	1,600	1,600	1,600	1,550

See footnotes at end of table.

TABLE 21--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1990	1991	1992	1993	1994 e/
Israel	2,870	3,550 e/	3,500	3,500 e/	3,500
Italy	40,000	40,800	41,300	42,000 e/	40,000
Jamaica	442	395	481	451 r/	446 4/
Japan	84,400	89,600	88,300	88,000 r/	91,500 4/
Jordan	1,820	1,750	2,730	681 r/	680
Kazakhastan e/	XX	XX	6,000	5,000	4,000
Kenya	1,510	1,420	1,510	1,500	1,500
Korea, North e/	16,000	16,000	17,000	17,000	17,000
Korea, Republic of	33,600	35,000	44,400 r/	47,300 r/	52,100 4/
Kuwait	900	300	500	500 e/	800
Kyrgyzstan e/	XX	XX	1,000	800	600
Latvia e/	XX	XX	400	300	300
Lebanon e/	900	900	1,000	1,000	1,000
Liberia	49	2	8	8 e/	--
Libya	2,700	2,370	2,300	2,300 e/	2,300
Lithuania e/	XX	XX	2,000	1,500	1,500
Luxembourg	636	688	600 e/	600 e/	620
Macedonia e/	XX	XX	500	500	560
Madagascar e/	60	60	60	60	60
Malawi	99	120	112	127 r/	130
Malaysia	5,880	7,450	8,370	8,800 r/	9,970 4/
Mali e/	20	20	20	20	20
Martinique e/	250	245	240	220	225
Mauritania	104 r/	105 r/	122 r/	111 r/	374 4/
Mexico	23,800	25,100	26,900	27,100	29,700 4/
Moldova e/	XX	XX	1,700	1,500	1,000
Mongolia	441	227	133	82 r/	86 4/
Morocco e/	4,200	5,770	6,340 4/	6,300	6,300
Mozambique e/	79 4/	80	30	20	20
Nepal	107	136	196	190 r/	190
Netherlands	3,730	3,550	3,300 r/	3,400 e/	3,400
New Caledonia	65 e/	90	90	90 e/	90
New Zealand	750 e/	576	579	600 e/	605
Nicaragua	1,200 r/	219 r/	239 r/	277 r/	275
Niger	20	20	29	29 e/	30
Nigeria e/	3,500	3,500	3,500	3,500	3,500
Norway	1,260	1,150	1,270	1,340 r/	1,440 4/
Oman	1,000	995	970	1,000 r/	1,000
Pakistan	7,490	7,760	7,790	8,320 r/	8,300
Panama e/	300 4/	300	250	300	350
Paraguay e/	326	326	326	326	326
Peru	2,190	2,200 e/	2,090	2,090	2,100
Philippines	6,360	6,910	6,730	7,960 r/	9,600 4/
Poland	12,500	12,000	11,900	12,200	13,900 4/
Portugal e/	7,280	7,470	7,640	7,600	7,500
Qatar	267	527	544	544 e/	545
Romania	9,470 r/	6,690 r/	6,270 r/	6,240 r/	8,000
Russia e/	XX	XX	64,000	60,000	50,000
Rwanda e/	60 4/	60	60	60	10
Saudi Arabia	12,000	11,400	15,300	15,300 e/	16,000
Senegal	470	503	601	590 r/	589
Serbia and Montenegro	XX	XX	2,040	1,090 r/	1,610 4/
Singapore e/	1,850 4/	2,000	1,900	1,900	1,900
Slovakia e/	XX	XX	XX	2,500	2,500
Slovenia e/	XX	XX	950	950	1,000
Somalia e/	40	10	25	25	25
South Africa, Republic of	7,810	7,430 r/	7,030 r/	7,360 r/	7,910 4/
Spain (including Canary Islands)	28,100	28,000	25,100	26,000 e/	26,000
Sri Lanka	400 e/	400 e/	817	676 r/	925 4/
Sudan e/	167 4/	170	250	250	250
Suriname e/	50	50	50	50	50
Sweden	2,480	2,400	2,290 r/	2,200	2,100
Switzerland	5,210	4,700	4,260	4,000 e/	4,000

See footnotes at end of table.

TABLE 21--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1990	1991	1992	1993	1994 e/
Syria	3,500	3,500	3,700	3,800 e/	3,800
Taiwan	18,500 r/	19,400	21,600 r/	24,000	22,700 4/
Tajikistan e/	XX	XX	300	250	200
Tanzania e/	540	540	540	540	540
Thailand	18,100	18,100	21,800	26,900 r/	28,000
Togo	399	388	350	350 e/	350
Trinidad and Tobago	438	485	482	527 r/	583 4/
Tunisia e/	3,300	3,300	3,300	3,300	3,300
Turkmenistan e/	XX	XX	700	500	400
Turkey	24,500 r/	26,100	28,600	31,400 r/	30,600
Uganda e/	27 4/	50	50	5	5
Ukraine e/	XX	XX	20,000	17,000	13,000
U.S.S.R .6/	137,000	127,000 e/	XX	XX	XX
United Arab Emirates	3,260	3,470	3,800	3,500 e/	3,600
United Kingdom	14,700 r/	12,200 r/	11,000 r/	11,200 r/	11,500
United States (including Puerto Rico)	71,400	66,800	71,400	75,100	77,900 4/
Uruguay e/	500	500	500	500	500
Uzbekistan e/	XX	XX	6,000	5,000	5,000
Venezuela	5,230	6,340	6,590	6,840 r/	6,900
Vietnam e/	2,500	3,000	5,000 r/	6,500 r/	7,200
Yemen	828	850	800	800 e/	800
Yugoslavia 7/	7,950	7,500 e/	XX	XX	XX
Zaire	461	250 e/	174	149 r/	150
Zambia	437	367	347 e/	350 e/	350
Zimbabwe	700	865	900 e/	1,000 e/	900
Total	1,160,000 r/	1,180,000 r/	1,240,000 r/	1,300,000 r/	1,370,000

e/ Estimated. r/ Revised. XX Not applicable.
1/ Previously published and 1994 data are rounded by the U.S. Bureau of Mines to three significant digits; may not add to totals shown.
2/ Table includes data available through July 13, 1995.
3/ Data are for the year ending June 30 of that stated.
4/ Reported figure.
5/ Dissolved Dec. 31, 1992.
6/ Dissolved in Dec. 1991.
7/ Dissolved in Apr. 1992.

CEMENT

By Hendrik G. van Oss

Cement is the binding agent in concrete and mortars and is thus a critical component of the construction industry. As shown in tables 1 through 3, overall production of (portland and masonry) cement in the United States declined about 1% in 1995 to about 77 million metric tons, of which 95% was portland cement. The United States remained the world's third largest cement producer; world output was estimated to have increased 3% in 1995 to about 1.4 billion tons.

In contrast to production, overall U.S. cement consumption increased modestly, with a large increase in imports more than offsetting the drop in production. Exports increased significantly in 1995 but remained a small fraction of total U.S. cement commerce. Plant valuation of U.S. cement shipments (from mills) in 1995, including those in Puerto Rico, was almost \$5.5 billion and total shipments were worth about \$6 billion. Both were up about 10% from the values in 1994, reflecting a significant unit price increase for the year. Using typical cement-to-concrete mass ratios, the value (delivered) of concrete in the United States in 1995 was estimated at about \$22 billion.

In this report, “cement” refers exclusively to hydraulic cement, which is cement that will set and harden under water, and which is overwhelmingly the dominant category of cement manufactured in the United States and elsewhere in the world. Further, unless otherwise stated, only the portland and masonry varieties of hydraulic cement are covered in this report. Notably, with the exception of the trade tables, pure pozzolan cements and aluminous cements are not included; these account for only a small fraction of the total U.S. cement market.

Concrete is a controlled mixture of cement, fine and coarse aggregates, and water that, through complex cement hydration reactions, hardens into a rocklike mass of specifiable properties. Cement use largely mirrors the concrete market, which is served in the United States by more than 3,000 concrete manufacturers. Mortar is a mixture of masonry or similar cement, fine aggregate, and water that is used to bind together building blocks, such as bricks and stones.

Strictly, portland cement is an interground mixture of portland cement clinker and about 5% gypsum. The clinker mainly is composed of calcium silicates and is made through controlled burning at high temperature of a measured blend of calcareous rocks (usually limestone) with lesser quantities of silicious, aluminous, and ferriferous materials. The blend is adjusted according to the chemical composition of the raw materials and the type of portland cement desired. In the United States, there are basically five types (Types I through V) of portland cement, denoting such properties as high sulfate resistance, high early strength, etc. Elsewhere in the world, other designations may be used for portland cements of similar properties. Portland cement is almost always gray, but if care is taken to burn only iron-free raw materials, a more valuable version, white cement, can be obtained. Masonry cements are broadly similar to portland cements and can be made from the same clinker; chemical and other admixtures commonly are introduced during grinding to adjust the cement's final properties.

Portland cement can be interground with pozzolans to produce a variety of so-called blended cements. These are included under the portland cement designation in this report. Pozzolans are materials, such as certain rocks (mainly tuffs) and industrial byproducts (e.g., granulated blast furnace slag, fly ash, silica fume), that exhibit hydraulic cementitious properties when finely ground and mixed with free lime. Although popular overseas, blended cement production in the United States in 1995 remained small, particularly that by the cement manufacturers themselves. The majority of production of blended cement, and hence consumption of pozzolans, actually was by U.S. concrete manufacturers. The term masonry cement also is used broadly in this report and includes portland lime and plastic cements.

The data shown in tables 1 through 7, and 10 through 15, were compiled from annual U.S. Bureau of Mines (USBM) and U.S. Geological Survey (USGS)[1] questionnaires sent to domestic clinker and cement manufacturing plants and importers. In 1995, responses were received from 124 of the 130 facilities canvassed; the responding facilities accounted for 99% of total U.S. cement production and shipments. In 1994, responses were received for 126 of 131 facilities surveyed, recording 96% of total apparent production and shipments. Estimates were incorporated for the nonrespondents, based on monthly shipments data and/or past annual data. During the compilation of tables, data remained unavailable even for estimation purposes for one small plant in Nevada that commenced operations in 1995 and which was thus not included in the tables. Subsequent information shows that its production would not significantly alter the tabulations shown. Concrete producers were not surveyed and hence the true production and consumption of blended cement in the United States is underrepresented in this report.

Not all returned annual cement questionnaires were fully completed. Where followup inquiries were unsuccessful, estimates were made for any missing data and incorporated into the aggregated totals. For 1995, the missing data (and thus the estimates) in most cases constituted only very small percentages of the aggregated totals. The introduced estimation errors are thus considered insignificant. An important exception, as discussed in the Consumption section, is for portland cement shipments by customer type (see table 14), where the cement producers readily admit to having incomplete knowledge.

As in previous years, there is an important discrepancy between the shipments data in the annual tables enumerated above and the shipments-to-final-customers data in tables 8 and 9. Tables 8 and 9 differ from the rest in that they are derived from monthly shipments surveys of cement companies. As a measure of cement consumption, these monthly-based data are preferred, for reasons discussed in more detail under the Consumption section. Integration of tables 8 and 9 data with the other tables has not been done to avoid creating additional internal inconsistencies.

Tables 16-20 show nonproprietary trade data from the Bureau of the Census in lieu of the proprietary data collected through the USGS monthly questionnaires. World production data shown in table 21 were developed by USGS country specialists from a variety of sources.

Some data are presented for State groupings or “districts” where required to protect proprietary data. Certain major cement-producing States have been subdivided along county lines to provide additional market information.[2]

The data in this report generally support conclusions in company annual reports and the trade literature that 1995 was overall a good year for the U.S. cement industry. Where not constrained by repairs, most plants operated at high capacity utilization levels. Domestic output of cement was inadequate to meet demand, which led to price increases and significantly improved company revenues. Imports increased to make up for the shortfall, but this had little dampening effect on prices. This was in marked contrast to the high import levels in the 1980's, when cheap imports were used to undercut domestic production. The difference in 1995 reflected post-1990 antidumping tariffs and the fact that, in the interim, more than one-half of the U.S. clinker production capacity has become foreign-owned.

A modest number of plant ownership and/or operational changes took place during the year. Lafarge Corp. completed purchase of the National Portland Cement grinding plant near Tampa, FL, from a subsidiary of Vencemos Pertigalete of Venezuela.[3] Lone Star Industries Inc. sold its 50% holdings in Hawaiian Cement to KRC Holdings, Inc.[4] Medusa Cement Corp. sold its Orlando, FL, terminal to Conrad Yelvington, Inc.; the terminal services are contracted to Tarmac America Inc.'s Pennsuco operation in Florida.[5] Tarmac had purchased the Pennsuco plant the previous year. Southdown Inc. bought Eastern Cement's Florida terminal.[6]

UNICEM SpA of Italy became the 100% owner of RC Cement Co., Inc. through the purchase of the 33% stake in RC Cement held by Italcimenti SpA.[7] Sunbelt Cement took over management of the Gulf Coast Portland Cement Co. terminal and grinding plant, near Houston, TX, from their mutual parent company, Cemex S.A. of Mexico. Although the grinding plant was taken out of (cement) operation in May 1995, the facility continued to operate as a terminal.[8] Similarly, Lehigh Portland Cement Co. operated its Cementon, NY, facility solely as a terminal in 1995, having idled its clinker and grinding lines the previous year.[9] Essroc Corp. idled its Egypt, PA, plant in April.[10]

Legislation and Government Programs

Like other heavy industries, the cement industry is affected by any number of Government economic and related policies, including periodic investigations into the cement industry's general business practices. The latest of these, an 18-month antitrust investigation by the Justice Department, was dropped without comment in November 1995. In recent years, Government policies of most concern to the cement industry have been those relating to trade (cement imports) and environmental issues.

Most of the cement trade issues have revolved around recent previous determinations of cement dumping by Japanese and Mexican cement companies and the resulting imposition of antidumping tariffs on imports from these countries. These tariffs have dramatically reduced cement and clinker imports from both countries and were under appeal by the Mexican company involved. U.S. administrative reviews in 1995 confirmed the earlier tariffs; further reviews were expected to be concluded in 1996 as were the findings of a North American Free Trade Agreement (NAFTA) appeals panel.

The Environmental Protection Agency (EPA) was studying a number of environmental issues related to cement manufacturing; these deliberations were of vital interest to the industry. Apart from the mining of 120 to 125 million tons per year of cement raw materials, most cement environmental issues relate to the manufacture of clinker. Clinker kilns burn large quantities of fossil and/or other organic fuels to thermochemically break down (calcine) calcareous rocks and instigate other clinker-forming chemical reactions. Both combustion and calcination evolve large quantities of carbon dioxide—a so-called greenhouse gas—and some form of carbon tax on fuels and electricity to reduce these emissions was under consideration by the EPA, in line with enacted or planned carbon taxes on Western European producers. The production cost increases from the imposition of carbon taxes likely would be high, as there is no known practical way to significantly reduce the calcination component of carbon dioxide emissions in clinker manufacture. Consumption of cement derived from clinker can be reduced through increased use of pozzolan extenders (as blended cement) but, to some degree, such use is constrained by cement specifications in existing construction codes.

Increasingly stringent Government restrictions on fuel-derived emissions of so-called NO_x and SO_x, and of dioxins and furans, are of concern to the industry, particularly to the degree that changing emission limits necessitate changes in testing procedures, equipment, and operating practices. These limits also affect the ability of plants to inexpensively utilize waste fuels.

Another major waste product of clinker manufacturing is cement kiln dust (CKD), made up of particles of clinker, incompletely reacted raw materials and solid fuels, and material eroded from the kiln's refractory brick lining. Almost all CKD is captured either by electrostatic precipitation or baghouse filtration, either for reuse as kiln feed or a soil conditioner for farms, or for storage in a landfill. Nevertheless, worries remain regarding unacceptable levels in some CKD of hazardous trace element or organic contaminants, such as chromium chemicals from refractory bricks, and nickel and vanadium from fossil fuels. Objections have been raised by environmental groups and commercial waste incineration companies to perceived risks of contaminant emissions arising from the cement industry's increasing use of waste fuels.

Under amendments to the Resource Conservation and Recovery Act (RCRA) in 1980, the EPA was instructed to study so-called Bevill (amendment) wastes, including CKD, to see if such were to be regulated under the hazardous waste provisions of RCRA. The EPA completed its Report to Congress on CKD late in 1993; in this, CKD was described as posing little environmental or health risk, but some ground water contamination problems owing to CKD mismanagement were identified. The EPA issued an associated regulatory determination in January 1995 that reaffirmed the risk conclusions of the 1993 Report, and proposed, under the authority of RCRA Subtitle C (hazardous wastes), drafting in consultation with interested stakeholders a tailored set of management standards for CKD. Importantly, the 1995 determination ruled that the standards need not be the stringent ones in Subtitle C; that is, CKD was not ruled to be a hazardous waste. A perceived lack of rigor in the determinations language prompted the cement industry, in March 1995, to present to EPA a so-called Enforceable Agreement that laid out standards for CKD management. The EPA reviewed the industry proposal but, in November 1995, professed itself uncertain of its authority under RCRA to sign such an agreement. Further action on this issue was envisioned for 1996.

Production

In 1995, cement was produced in 37 States and in Puerto Rico by a total of 46 companies, including one State agency. Production and related data are shown in tables 2 through 4. The tables exclude one plant in Nevada that commenced production in 1995 but for which data were unavailable at the time of table compilation. Including this facility, by yearend 1995 there were a total of 118 cement plants in operation.

A number of cement companies were modernizing and/or upgrading their plants, in many cases to reduce energy and other costs. Royal Cement Co., Inc. commenced commercial operations at its Logandale, NV, plant. Installed clinker capacity, according to the company, was 200,000 tons per year. Two companies announced plans to construct new, as opposed to replacement, kilns. Florida Rock Industries was planning to build a 750,000-ton-per-year integrated facility at Newberry, FL, that was expected to be on-line in 1998.[11] Florida Crushed Stone Co. announced that it would be adding a second kiln to its existing Brooksville, FL, plant. The new kiln would double the plant's cement capacity to about 1.2 million tons per year.[12]

Portland Cement.—At yearend, there were 111 integrated portland cement plants making both clinker and cement, and 7 dedicated grinding plants. Table 2 shows the number of plants, reported portland cement production, capacity, and yearend stockpiles, on a district basis, with the single Nevada exception noted beforehand.

As shown in table 2, portland cement production in 1995 fell 1.4% to about 73.3 million tons. Grinding capacity for the country remained essentially unchanged, although there were regional differences resulting, for example, from grinding plant closures in New York in late 1994 and in southern Texas early in 1995, and various upgrades of some grinding facilities elsewhere. There continued to be significant excess grinding capacity. End of year cement stockpiles rose significantly to 5.4 million tons in part because of winter weather downturns in construction coupled with excess imports. The top five portland cement producer States, in descending order, were California, Texas, Pennsylvania, Michigan, and Missouri.

The USGS annual surveys no longer break out production tonnages by type of portland cement, but it may be presumed that output was proportional to the reported shipments of each type (see table 15). It may thus be assumed that Types I and II accounted for about 90% of total reported portland cement production. As previously noted, data on blended cement production (and shipments) are incomplete owing to a lack of information from the concrete sector.

Cement companies in the United States ranged from small, single plant operations, each accounting for less than 0.5% of total U.S. production capacity, to large multiplant corporations, ranging from 3% to almost 13% of U.S. capacity. In 1995, the top 10 portland cement producers, combined, accounted for 57.6% of total U.S. output and 58.5% of total cement grinding capacity. Their combined grinding capacity utilization averaged 79.5%. The top 10 companies, in declining order of production, were Holnam, Inc.; Lafarge Corp.; Southdown, Inc.; Ash Grove Cement Co.; Blue Circle Inc.; Essroc Materials, Inc.; Lone Star Industries, Inc.; Lehigh Portland Cement Co.; Medusa Corp.; and California Portland Cement Co.

Masonry Cement.—Production of masonry cement, as shown in table 3, was essentially stagnant in 1995 at approximately 3.6 million tons—about 5% of total U.S. cement output. Yearend stockpiles increased modestly. Masonry cement, as in 1994, was produced by 32 companies, at 84 plants nationwide.

Clinker.—District information for clinker production and capacity, excepting that for one new plant in Nevada, is given in table 4. Including the Nevada facility and 2 plants in Puerto Rico, clinker was produced in 1995 by 111 integrated cement plants operating a total of 207 kilns. Most clinker continued to be made by dry-process kilns. Clinker production in 1995 increased about 2% over that in 1994 to about 70 million tons. Of the top five clinker-producing States, the largest continued to be California, followed by Texas, Pennsylvania, Missouri, and Michigan.

There was a slight increase in overall kiln capacity utilization in 1995. Unlike the portland cement grinding capacities shown in table 2, which were reported to the USGS on a plant basis, the clinker capacities shown in table 4 were calculated by the USGS based on each kiln's reported daily capacity and number of days reported for the year as scheduled downtime. Not included were any idle kilns requiring more than a few months to restart. The average operational kiln capacity in 1995 was about 371,000 tons per year, virtually unchanged from that in 1994.

The top 5 companies had almost 38% of both clinker capacity and production and the top 10 had 59% of capacity and 62% of production, respectively. The top 10 companies, in declining order of clinker capacity, were Holnam, Inc.; Lafarge Corp.; Southdown, Inc.; Ash Grove Cement Co.; Blue Circle Inc.; Essroc Materials, Inc.; Medusa Corp.; Lone Star Industries, Inc.; Lehigh Portland Cement Co.; and California Portland Cement Co.

Consumption of Raw Materials and Energy.—The nonfuel raw material mix used to produce cement, most of which went into producing the clinker component, is shown in table 5. As expected, almost 85% of the mix was calcareous rocks and the consumption increase thereof in 1995 mirrored that of clinker noted above. Among aluminous feeds, there was a 21% drop in shale consumption in 1995 that evidently was balanced, in terms of alumina credits, by an almost doubling of other aluminous feeds such as bauxite and alumina. The shale decrease appears also to have diminished the iron oxide and silica balances in the clinker meal feed. The iron oxide deficit appears to have been counterbalanced by the significant increase shown in table 5 for ferrous feeds, and possibly by the increase in tonnage of waste tires (some of which contain steel belting) burned as kiln fuel as shown in table 6. Any silica deficit resulting from the reduced consumption of shale appears to have been offset by the increase in purely silicious feeds.

Pozzolan consumption, to the degree split out in table 5, increased 32% in 1995. This would support a qualitative increase in blended cement production, and such is suggested by the apparent increase of at least 70% in blended cements shipments shown in table 15. However, no stoichiometric conclusions can be drawn because there are no unique proportions of pozzolans in blended cements. Further, the pozzolan consumption shown in table 5 greatly exceeds that needed to account for the blended cement shipments. Thus it appears that much of the pozzolan consumption shown was as kiln feed rather than for blended cements.

Fuel consumption, largely reflecting kiln operation, is shown in table 6. Coal use fell about 6% in 1995, only slightly offset by the footnoted 49% increase in the use of coke and a 6% increase in petroleum coke. Fuel oil consumption fell about 15%. Although the data are not shown on a State basis, there were no obvious regional or company trends in these shifts. In contrast, overall natural gas consumption increased by almost 65%, with especially large increases noted in Arkansas, Oklahoma, and Texas, and only a few States showing declines—mainly in the Great Lakes region. Overall consumption of liquid waste fuels (such as recycled/used oils and solvents) increased dramatically, despite the fact that about half of the reporting districts actually reported small declines. Solid wastes continued to be only a small component of total fuel use. Consumption of rubber tires for fuel increased 32%, but that of other solid waste fuels dropped 8%.

Electricity consumption data are dominated by the demands of the grinding circuits of cement mills. As shown in table 7, per unit electricity consumption did not significantly change in 1995.

Consumption

Shipment data for cement are used to approximate cement consumption levels in the United States. Only shipments to final customers are considered to represent "true" consumption. Shipments from a mill to other cement plants or distribution terminals of the same company, and those to other cement companies, are left uncounted until they are transferred to a final customer. "Final customer" is as indicated by the cement producer(s) and ignores the possibility that said customer (likely a concrete manufacturer) might put some cement into stockpiles extending beyond yearend (to be "consumed" the following year) or might resell cement to other users. However, although there are no data available on such storage or transfers, it is likely that the overall tonnage would involve no more than about 5% of any 1 month's shipments and would balance out over a period of months.

Cement shipments and derived data are given in tables 8 through 15. Two data collection methodologies are represented. Tables 8 and 9 are based on monthly shipment surveys of cement company headquarters. These forms generally are returned on a consolidated basis—one form covering all of the company's plants and, importantly, its terminals. In contrast, tables 10 through 15 were collected from general annual surveys of individual plants and certain, but not all, terminals.

Over the years, shipment data from the two sets of tables have shown significantly different totals, for reasons not fully understood. For example, per table 11, portland cement shipments by producers to final customers in 1995 totaled 76.414 million tons, including imported cement and clinker, and including Puerto Rico. Masonry cement shipments (see table 12) totaled 3.510 million tons. In contrast, the data for 1995 in table 8 show total portland cement shipments to final customers of 84.724 million tons, and masonry shipments of 3.243 million tons. Both sets of tables purport to include shipments of imported cement.

Differences are also seen on a State or district level. However, these are to be expected because whereas tables 8 and 9 show the district destinations of the shipments to final customers, tables 11, 12, and 14 show the originating districts of the cement shipments to final customers.

The functional reason for the discrepancy in totals appears to be in the data collection methodology. The monthly data (totaled in tables 8 and 9) are those used each month by individual cement companies for their own marketing analyses. There traditionally has been a more complete and prompt response by company headquarters to the monthly questionnaires than by individual plants to the lengthier annual surveys. The difference in total shipment tonnages is believed largely to reflect the activities of certain cement distribution terminals. Annual shipment data submitted by the manufacturing facilities themselves would include shipments (including imports by the plant) to final customers via distribution terminals. However, the data could be incomplete because the plants might be unaware of some shipments by terminals of stockpiled material, or of cement imported directly by the terminals. Consolidated company monthly shipment data (tables 8 and 9) would track both plant and terminal activity and are thus considered "better" consumption data.

Although yielding the preferred consumption data, the monthly-based shipments surveys do not query details such as type of portland cement shipped, type of transportation used, and cement value. These data are available only from the annual surveys. For this reason, and to maintain internal consistency to the degree possible, the annual-based shipment data are retained for tables 10 through 15.

National Consumption.—As shown in table 8, overall portland cement consumption, defined as shipments to final customers in the United States, increased slightly in 1995 to about 82.9 million tons, excluding Puerto Rico. Exports also increased slightly, but remained a small component of the total market. Of the total shipments, those originating in the United States declined about 3% to about 71.8 million tons, in line with the decline in production shown in table 2. More than offsetting the decline was a 30% increase in portland cement imports (shown in table 8 as shipments of foreign origin). Overall, the consumption pattern reflected an increase in multiple-family residential construction and public construction. Partly offsetting this was a drop in single-family residential construction—this type of construction is sensitive to short-term changes in interest rates, which increased modestly in 1995.

Regional consumption of portland cement was mixed (see table 9). Winter and/or wet weather-related declines were seen in the Northeast and Midwest. The South showed a large increase and continued to be the dominant consumption region for the country. The greatest growth in the South was in Georgia, related in part to preparatory construction for the 1996 Summer Olympics. In the West, strong growth was seen in most of the Mountain States, owing in part to rapid population growth, much of it at the expense of California. Several of the Mountain States, especially Nevada, also had strong demand for cement in their burgeoning mining sectors. Colorado showed the most significant decline in the region, but even this was largely a return to more normal consumption patterns following the completion of Denver's new airport. As shown in table 8, the largest five portland-cement-consuming States, in declining order, were Texas, California, Florida, Ohio, and Georgia.

Masonry cement consumption fell slightly in 1995, with small declines seen in most States and/or regions.

Prices.—The price or value data shown in tables 11 through 13 represent ex-plant valuations by the mill. Unlike shipment tonnages by type (table 15), the USGS annual surveys do not query the values by type of portland cement. Instead, the values are supplied as totals for all shipments—one total for gray portland cement (all types), another for white portland, and another for masonry cement. Accordingly, the calculated unit values shown should be viewed as price indices rather than as actual prices for some specific type of cement. It may be assumed that the values shown for gray portland cement are dominated by those for Types I and II.

As shown in table 11, the total value of portland cement shipments from mills rose 10% to almost $5.2 billion. If the average price shown is applied to the total shipments by destination shown in table 8, the figure rises to about $5.7 billion. Although masonry cement shipments from mills rose in overall value 5.5% to about $300 million (see table 12), the same price applied to table 8 data would total about $278 million only. The lower value for table 8 reflects a significantly lower tonnage in that table. This suggests that some shipments to final customers reported by individual mills (table 12) may have in fact gone into stockpiles at terminals.

As shown in table 13, prices at the plant for gray portland cement rose 11% in 1995 to $66.89 per ton, and 8% for masonry cement to $85.64 per ton. Only white portland cement showed a decline, and that of only about 1% to $174.66 per ton.

The only data for domestic delivered prices for cement are those for Type I portland (per short ton) and masonry cement (per 70-pound bag) published monthly by the journal *Engineering News Record* (ENR). The data represent a survey of customers (likely to be ready mixed concrete producers for portland cement and building supply depots for masonry) in 20 cities in the United States. The ENR 20-city average delivered price in 1995 for Type I portland converts to $75.78 per metric ton, with a range over the year of only $3.52 per ton. Prices showed a general increase from January to December ($77.82). The ENR city data show a number of regional price differences, some of which differ significantly from those district (ex-plant) data shown in table 11. The variations probably reflect regional differences in shipment methods and local per-kilometer costs for the same. The 20-city average masonry cement price for the year was $4.33 per bag (literally converts to $136.37 per metric ton) and ranged only $0.35 per bag over the year.

Table 10 shows portland cement shipments from mills by method of transportation. As in previous years, bulk shipments dominated deliveries to both terminals and final customers. Trucks were by far the preferred form of cement deliveries to final customers.

Cement Customer Types.—Although presented in unrounded form, the data in table 14—on portland cement shipments by customer type—are probably the least reliable of all the data collected by the USGS annual cement survey. This lack of reliability is not because of a lack of cooperation by the industry in providing data, but reflects the fact that the questionnaire asks for more details than most cement plants or companies have. Disregarding incomplete or incompatible accounting by some mills, the inherent problem is that knowing a customer's identity (type) is not necessarily the same thing as knowing a customer's use(s) for the cement. Qualitative knowledge of a customer's uses of cement does not equate to quantitative knowledge. Quantitative knowledge does not eliminate conflicts in assigning tonnages to the 15 use(r) categories on the questionnaire.

For example, it may be known that a certain ready mixed concrete customer used X tons of cement (in ready mixed concrete) for road paving contracts. The dilemma for the cement company is whether to register those tons under the ready mixed category or under road paving. Another example would be the “government agencies” use category on the questionnaire—perhaps some government cement purchases really are for ready mixed concrete, or road paving, or other duplicative use(s). And there is an “Other” category on the questionnaire that some cement plants use as a catchall. Further, although generally listed as exact tonnages, some data back-calculate to simple (broad) percentages of the total shipments—the breakdown being the “best guess” of that cement plant. In a few instances, the apportioning appears to have been guided by past breakdowns published by the USBM.

Within these limitations, it is still clear from table 14 that the dominant customer type/use for portland cement in 1995, as in previous years, was for ready mixed concrete. As listed, cement for ready mixed concrete (customers) accounted for about 61% of total cement shipments (56% in 1994). However, it is likely that 50% to 60% of total shipments listed as “Government and miscellaneous” also are ready mixed concrete, which would then have that use accounting for about 70% of total shipments. The (footnoted) breakout of the “Contractors” category likely understates true consumption for road paving—some cement for this purpose no doubt resides under the “Government and miscellaneous” and “ready mixed concrete” categories. In contrast, the data for concrete products manufacturers, buildings materials dealers, and oil well cement use are probably fairly accurate. Overall, the usage breakdowns are broadly similar to those in 1994.

The district-level breakdowns of shipments, by customer type, in table 14 reflect the origin of the cement. Accordingly, they are only an indirect regional indicator of portland cement usage.

Types of Portland Cement Consumed.—General use (Types I and II) portland continued to dominate cement consumption, accounting for almost 91% of total portland cement shipments from mills shown in table 15. Types I through V together accounted for about 97% of total portland cement shipments for both 1994 and 1995. Shipments, by type, were largely unchanged in 1995 for most types of portland cement. Oil well cement consumption declined significantly in 1995, reflecting lackluster demand by the petroleum exploration industry. Blended cement shipments rose almost 80% but still accounted for only about 1% of total portland cement shipments. However, as previously noted, the blended cement data underrepresent true consumption because they exclude such cements mixed by concrete manufacturers. Data on this consumption are very incomplete and estimates would be further limited by the wide range of permissible pozzolan contents in blended cements.

Foreign Trade

Bureau of the Census trade data on hydraulic cement and clinker, including pozzolan and aluminous cements, are shown in tables 16 through 20. As can be inferred from some value entries, the material traded included high value specialty cements.

Total exports of cement and clinker rose significantly in 1995 (see table 16) but, overall, continued to be very small compared to imports. By comparison with table 8, about 65% of total export tonnage was of portland and/or masonry cement. Most of the exports went to Canada.

As shown in table 17, total imports of cement and clinker increased almost 23% by tonnage in 1995, due in part to a generally strong dollar during the year and shortfalls in supplies from domestic sources. The cement component of imports was about 11 million tons, or about 80% of the total. This is about 5% less than the import component of portland and masonry cement shipments to final customers in table 8. The difference, if not just an artifact of different data sources, would appear to indicate a component of stockpiled material in sales to final customers of imported cement. Canada was the largest source of cement plus clinker imports, accounting for 35% of the total. Imports from Canada were up 15% in 1995. Other major sources were Spain, up 12%; Venezuela, up 79%; and Greece, up 36%. Imports from Mexico, although up 33%, were still well below levels prior to the imposition of antidumping tariffs. Clinker imports rose 29% in 1995 (see table 18) and were dominated by material from Canada. Imports by customs district are given in table 19.

The white cement component of imports in 1995 totaled about 0.4 million tons (see table 20). The top five sources[13] were Canada, at about 38% of the imports; Denmark, 20%; Spain, 17%; Mexico, 14%; and Colombia, 5%.

World Review

World hydraulic cement production, which likely included a much higher component of blended cements than was the case in the United States, was estimated to have risen 3% in 1995 to about 1.4 billion tons (see table 21). China was overwhelmingly the dominant cement producer, with about 31% of total world output. The remaining top 10 producers, in descending order of production, were Japan, the United States, India, the Republic of Korea, Germany, Russia, Italy, Turkey, and Thailand.

It is evident from even a cursory review of the 1995 cement trade literature that the centers of new cement plant construction are now firmly entrenched outside of Western Europe, the United States, and Canada. Worldwide, literally dozens of new plants—seemingly all of them boasting state-of-the-art technologies and many of them very large—were either under construction or in advanced stages of planning. Another trend evident was that of privatization of state-owned facilities.

Although home to most of the world's largest cement companies, Western Europe's cement consumption was stagnating in 1995 and most capital investment in the industry there was on plant modernization. In contrast, a number of both new plants and plant upgrades were underway in several Eastern European countries. A lot of Western European capital was moving into Eastern Europe and the former Soviet Union, in step with privatization opportunities and liberalized investment and taxation laws, and in line with the perception that these countries not only had significant market growth potential but could also provide inexpensive cement for export.

Many countries in the Middle East and some in North Africa were expanding or upgrading their cement capacities, for reasons of low energy costs (e.g., Persian Gulf region), abundant raw materials (e.g., Iran and Turkey), or strategic locations with respect to exports (e.g., Saudi Arabia and Turkey). Much of the expansion was geared toward exports. Iran and Turkey probably had the greatest domestic demand potentials. In much of Africa, the cement industry was less active. Probably the greatest growth potential was in South Africa, where public spending on housing was expected to increase dramatically. Although recommissioning of mothballed production capacity in South Africa was likely, installation of new capacity was less certain, given market disruptions anticipated from the mandated dissolution of the controlling cement cartel scheduled for September 1996.

In Latin America, new capacity was being added in a number of countries, especially Brazil and Mexico, both to meet burgeoning domestic demand and for exports. Most notably, Cemex S.A. of Mexico brought on line in 1995 its Tepeaca plant which, at 3.1-million-ton-per-year capacity, was reportedly one of the largest single-kiln operations in the world.

The other major area of growth in cement capacity and demand was Asia, particularly in China, India, Indonesia, the Philippines, and Vietnam. Japan and Taiwan were among the few Asian countries expected to experience significant declines in production, Japan because of rising production costs and a slowing economy, and Taiwan because of rapid exhaustion of cement raw materials reserves. For some high-growth countries, especially Indonesia, the rapid growth in cement capacity planned over the next 4 years was predicted to lead to large surpluses. These surpluses, anticipated to be available at low cost, are expected to become a major factor in world cement trade and could constrain expansion programs in Europe and North America.

Outlook

World cement demand and production is anticipated to grow steadily at 2% to 4% over the next decade, with the developing world generating and absorbing much of the increase. Demand could grow even more if current research to find new uses for cement is successful—particularly for high-strength cement/concrete substitutes for other construction materials.

Cement production and demand in the United States is anticipated to grow only modestly in both the near and intermediate terms. In the near term, an important constraint is likely to be interest rates, which especially influence the important single-family residential construction market. A modest production constraint for 1996 could be the growth seen in 1995 of yearend cement stockpiles. In both the near and longer terms, the availability of public construction funding will be important, including disruptions caused by any shifting of project authority from the Federal to the State level. For the underpenetrated road paving market, an important factor will be the degree to which the cement industry can persuade construction planners to emphasize long-term costs, where concrete has an advantage, over short-term costs, where asphalt is cheaper.

A dilemma for the U.S. cement industry is the degree and timetable for upgrading its clinker manufacturing capacity. A large percentage of current U.S. capacity is installed either in wet kilns or in old, small-capacity, dry kilns. These are relatively energy-inefficient and have higher per-unit production costs than modern, high-capacity plants. The cost differential is likely to grow in the future. To remain competitive, these older plants will need (costly) equipment upgrades or replacements, but such may not be economical given increased availability of low-cost cement for importation. And much of this imported material is likely to be sourced from modern plants owned by the same giant European cement firms that currently dominate the U.S. industry.

A critical factor for the U.S. cement industry will be future restrictive environmental legislation, particularly any governing the industry's ability to cheaply utilize waste fuels and any that restrict or tax carbon dioxide emissions. Given increasing cooperative participation of the U.S. Government in the global environmental debate, some form of future U.S. carbon dioxide regulation is possible. Such would lead to higher cement production costs and would put U.S. cement at increasing competitive disadvantage to imports from countries lacking equivalent legislation. Absent tariff protection from such imports, some shutdown of domestic capacity could occur. Environmental cost increases could lead to a significant rise in production and consumption of blended cements in the United States. Although partial substitution of pozzolans for portland cement reduces the per-unit environmental costs of finished cement production, the advantage is partly illusory because (synthetic) pozzolan production itself has an environmental cost, albeit assigned to other industries, such as iron- and steelmaking.

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[1]Minerals information activities of the former U.S. Bureau of Mines were transferred to the U.S. Geological Survey in Jan. 1996.

[2]State subdivisions are as follows:

California, northern.—Counties north of San Luis Obispo and Kern Counties and west of Inyo and Mono Counties.

California, southern.—Inyo, Kern, Mono, San Luis Obispo, and all counties further south.

Chicago, metropolitan.—Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.

Illinois.—All other counties in the State.

New York, eastern.—All counties east of Broome, Chenango, Lewis, Madison, Oneida, and St. Lawrence Counties, but excluding counties within Metropolitan New York.

New York, western.—Broome, Chenango, Lewis, Madison, Oneida, and St. Lawrence Counties, and all those further west.

New York, metropolitan.—The five counties of New York City (Bronx, Kings, New York, Queens, and Richmond) plus Nassau, Rockland, Suffolk, and Westchester Counties.

Pennsylvania, eastern.—All counties east of Centre, Clinton, Franklin, Huntingdon, and Potter Counties.

Pennsylvania, western.—Centre, Clinton, Franklin, Huntingdon, and Potter Counties, and all those further west.

Texas, northern.—All counties north of Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, and Williamson Counties.

Texas, southern.—The named counties above and all those further south.

[3]Lafarge Corp., 1995, Annual Report.

[4]Reuters News Service, Sept. 20, 1995, quoted in The Monitor, Portland Cement Assoc. July 1995.

[5]Rock Products Cement Edition, May 1995, p. 9.

[6]———. July 1996, pp. 35-36.

[7]Reuters News Service, July 10, 1995, quoted in The Monitor, Portland Cement Assoc. May 1995.

[8]Sunbelt Cement, tel. communication to USGS.

[9]Company report to the USGS, 1996.

[10]Company report to the USGS, 1996.

[11]International Cement Review, Mar. 1995, p. 12.

[12]———. Dec. 1995, p. 5.

[13]Bureau of the Census, data quoted in: Cement in Jan. 1996, Mineral Industry Surveys, USGS, table 5.

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World Cement.

Zement-Kalk-Gyps International.

TABLE 1
SALIENT CEMENT STATISTICS

(Thousand metric tons unless otherwise specified)

		1991	1992	1993	1994	1995
United States 1/						
Production 2/		67,193	69,585	73,807	77,948	76,906
Shipments from mills 2/ 3/		68,999	69,203	74,079 4/	80,490 4/	79,924 4/
Value 2/ 3/	thousands	3,832,096	3,779,286	4,174,818 4/	4,981,017 4/	5,471,268 4/
Average value per ton 2/ 3/ 5/		56	55	56 4/	62 4/	68 4/
Stocks at mills, 2/ Dec. 31		6,009	5,272	4,788	4,805	5,813
Exports 6/		633	746	625	633	759
Imports for consumption 4/ 6/		7,893	6,166	7,060	11,303	13,848
Consumption, apparent 7/		72,413 r/	74,124 r/	79,198 r/	86,370 r/	86,612
World: Production e/		1,181,793 r/	1,239,683 r/	1,301,527 r/	1,380,052 r/	1,421,342

e/ Estimated. r/ Revised.
1/ Excludes Puerto Rico.
2/ Portland and masonry cement only. Includes imported cement, and cement made from imported clinker.
3/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.
4/ Includes Puerto Rico.
5/ Value received, f.o.b. mill.
6/ Hydraulic cement plus clinker.
7/ Production of cement plus imports of cement (excluding clinker) minus exports of cement minus change in stocks.

TABLE 2
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

	1994					1995				
			Capacity 2/		Stocks 3/			Capacity 2/		Stocks 3/
District	Plants active	Produc- tion 4/	Finish grinding	Percent utilized	at mills, Dec. 31	Plants active	Produc- tion 4/	Finish grinding	Percent utilized	at mills, Dec. 31
New York and Maine	5	3,005	4,141	72.6	217	4	2,937	3,937	74.6	317
Pennsylvania, eastern	8	4,014	4,878	82.3	196	8	4,045	5,019	80.6	355
Pennsylvania, western	4	1,616	2,009	80.4	111	4	1,565	2,009	77.9	146
Illinois	4	2,585	3,217	80.4	127	4	2,559	3,379	75.7	210
Indiana	4	2,291	2,867	79.9	116	4	2,328	2,597	89.6	253
Michigan	5	5,160	6,532	79.0	226	5	5,399	6,999	77.1	336
Ohio	3	1,054	1,588	66.4	37	3	1,049	1,588	66.1	94
Iowa, Nebraska, South Dakota	6	3,891	5,758	67.6	291	5	3,724	5,576	66.8	364
Kansas	4	1,644	1,801	91.3	127	4	1,725	1,774	97.2	185
Missouri	5	4,725	5,059	93.4	340	5	4,362	5,059	86.2	395
Florida	6	3,371	4,382	76.9	291	6	3,166	4,382	72.3	195
Georgia and South Carolina	5	3,256	4,599	70.8	154	5	3,226	4,587	70.3	187
Maryland, Virginia, West Virginia	6	3,237	3,987	81.2	203	6	3,079	4,018	76.6	358
Alabama	5	3,976	4,573	86.9	268	5	4,091	4,755	86.0	261
Kentucky, Mississippi, Tennessee	4	1,983	2,128	93.2	139	4	2,107	2,474	85.2	216
Arkansas and Oklahoma	4	2,434	2,694	90.3	166	4	2,544	2,717	93.6	202
Texas, northern	6	3,809	4,512	84.4	209	6	3,807	4,512	84.4	229
Texas, southern	6	4,815	5,529	87.1	182	5 5/	4,285	4,717	90.8	227
Arizona and New Mexico	3	1,967	2,288	86.0	51	3	2,061	2,333	88.3	47
Colorado and Wyoming	4	1,822	2,377	76.7	97	4	1,851	2,377	77.9	90
Idaho, Montana, Nevada, Utah	6	2,180	2,422	90.0	174	6 6/	2,206	2,445	90.2	155
Alaska, Hawaii, Oregon, Washington	4	1,861	2,295	81.1	180	4	1,824	2,295	79.5	179
California, northern	3	2,616	2,776	94.2	141	3	2,554	2,867	89.1	107
California, southern	8	7,023	7,933	88.5	258	8	6,808	7,899	86.2	250
Total or average 7/	118	74,335	90,346	82.3	4,301	115 6/	73,303	90,316	81.2	5,358
Puerto Rico	2	1,405	1,956	71.8	31	2	1,414	2,004	70.6	40

1/ Includes Puerto Rico. Includes data for three white cement facilities as follows: California (1), Pennsylvania (1), and Texas (1). Includes data for grinding plants as follows: California (1), Florida (2), Iowa (1), Michigan (1), Ohio (1), Pennsylvania (1), and Texas (1).
2/ Grinding capacity based on fineness necessary to grind Types I and II cement, making allowance for downtime required for maintenance.
3/ Includes imported cement.
4/ Includes cement produced from imported clinker.
5/ One additional plant was operational January through April; data for it are included in tonnages shown.
6/ Excludes one plant that commenced production in 1995 but for which data were unavailable at the time of data compilation.
7/ Data may not add to totals shown because of independent rounding.

TABLE 3
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

District	1994 Plants active	1994 Production	1994 Stocks 2/ at mills, Dec. 31	1995 Plants active	1995 Production	1995 Stocks 2/ at mills, Dec. 31
New York and Maine	5	89	17	4	100	18
Pennsylvania, eastern	6	161	25	6	186	38
Pennsylvania, western	4	84	13	4	81	13
Illinois	1	W	W	1	--	W
Indiana	4	W	31	4	W	W
Michigan	5	235	24	5	229	26
Ohio	2	W	W	2	W	W
Iowa, Nebraska, South Dakota	4	58	12	4	51	17
Kansas	3	24	W	3	31	10
Missouri	1	W	W	1	W	W
Florida	4	400	W	4	383	31
Georgia and South Carolina	4	417	39	4	436	43
Maryland, Virginia, West Virginia	6	571	52	6	528	79
Alabama	5	312	36	5	306	45
Kentucky, Mississippi, Tennessee	3	105	11	3	108	15
Arkansas and Oklahoma	4	104	14	4	110	19
Texas, northern	4	106	10	4	W	8
Texas, southern	5	151	15	5	98	7
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	4	W	W	4	W	W
Alaska, Hawaii, Oregon, Washington	2	W	2	2	W	2
California, northern	1	W	W	1	W	W
California, southern	2	W	W	3	149	W
Total or average 3/	84	3,613	400	84	3,603	455

W Withheld to avoid disclosing company proprietary data; included in "Total or average."
1/ Puerto Rico did not produce any masonry cement.
2/ Includes imported cement.
3/ Data may not add to totals shown because of independent rounding.

TABLE 4
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 1995, BY DISTRICT

District	Active plants 1/ Process used: Wet	Active plants 1/ Process used: Dry	Active plants 1/ Process used: Both	Active plants 1/ Total	Number of kilns	Daily capacity (thousand metric tons)	Average number of days mainte-nance	Apparent annual capacity 2/ (thousand metric tons)	Produc-tion 3/ (thousand metric tons)	Percent utilized
New York and Maine	3	1	--	4	5	9	61	2,904	2,915	100.4
Pennsylvania, eastern	2	5	--	7	14	13	30	4,461	4,245	95.2
Pennsylvania, western	3	1	--	4	8	6	37	1,942	1,711	88.1
Illinois	--	4	--	4	8	8	33	2,508	2,345	93.5
Indiana	2	2	--	4	8	8	28	2,854	2,435	85.3
Michigan	1	2	--	3	8	13	27	4,464	4,150	93.0
Ohio	1	1	--	2	3	3	16	1,094	902	82.4
Iowa, Nebraska, South Dakota	--	4	1	5	9	13	49	4,120	3,472	84.3
Kansas	2	2	--	4	11	6	41	1,796	1,643	91.5
Missouri	2	3	--	5	7	13	35	4,349	4,160	95.7
Florida	2	2	--	4	7	9	34	2,992	2,787	93.1
Georgia and South Carolina	2	2	1	5	11	11	35	3,722	3,250	87.3
Maryland, Virginia, West Virginia	2	3	--	5	15	11	19	3,726	3,096	83.1
Alabama	--	5	--	5	7	14	31	4,462	3,683	82.5
Kentucky, Mississippi, Tennessee	2	2	--	4	5	6	21	2,161	2,096	97.0
Arkansas and Oklahoma	2	2	--	4	10	8	28	2,609	2,500	95.8
Texas, northern	3	3	--	6	14	12	38	3,903	3,688	94.5
Texas, southern	--	4	1	5	6	13	29	4,263	4,174	97.9
Arizona and New Mexico	--	3	--	3	9	6	13	2,267	1,975	87.1
Colorado and Wyoming	1	3	--	4	6	6	28	1,986	1,840	92.6
Idaho, Montana, Nevada, Utah	4	2	--	6	9	6	28	2,016	2,090	103.7
Alaska, Hawaii, Oregon, Washington	1	3	--	4	4	4	45	1,372	1,600	116.6
California, northern	--	3	--	3	3	9	55	2,589	2,553	98.6
California, southern	--	8	--	8	17	22	47	7,145	6,674	93.4
Total or average 4/	35	70	3	108	204	232	33	75,702	69,983	92.4
Puerto Rico	--	2	--	2	2	5	W	1,583	1,274	80.5

W Withheld to avoid disclosing company proprietary data.
1/ Includes white cement producing facilities.
2/ Calculated, based on individual company data, using 365 days minus reported days for maintenance multiplied by the reported 24 hour capacity.
3/ Includes production reported for plants that shut down during the year.
4/ Data may not add to totals shown because of independent rounding.

TABLE 5

RAW MATERIALS USED IN PRODUCING CEMENT

IN THE UNITED STATES 1/ 2/ 3/

(Thousand metric tons)

Raw materials	1994	1995
Calcareous:		
Limestone (includes aragonite, marble, chalk)	78,427	80,142
Cement rock (includes marl)	24,243	24,164
Coral	675	680
Aluminous:		
Clay	4,189	4,294
Shale	5,514	4,378
Other (includes staurolite, bauxite, aluminum dross, alumina, volcanic material, other)	500	967
Siliceous:		
Sand and calcium silicate	2,095	2,210
Sandstone, quartzite, other	588	741
Ferrous: Iron ore, pyrites, millscale, other	1,186	1,523
Other:		
Gypsum and anhydrite	3,873	3,997
Blast furnace slag	33	130
Fly ash	1,125	1,396
Other, n.e.c.	135	82
Total 4/	122,582	124,704

1/ Includes Puerto Rico.

2/ Nonfuel materials only.

3/ Includes portland and masonry cement.

4/ Data may not add to totals shown because of independent rounding.

TABLE 6

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY 1/

IN THE UNITED STATES, 2/ BY PROCESS

	Clinker produced			Fuel consumed			Waste fuel		
Kiln process	Plants active	Quantity (thousand metric tons)	Percent of total	Coal (thousand metric tons)	Oil (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
1994:									
Wet	36	18,605	26.7	3,197	10,913	174,815	26	58	369,078
Dry	71	49,333	70.7	6,984	37,858	411,657	90	16	230,577
Both	3	1,849	2.6	303	--	63,676	4	--	--
Total 3/	110	69,787	100.0	10,484 4/	48,771	650,148	120	74	599,655
1995:									
Wet	35	18,775	26.3	2,965	13,624	327,798	31	62	626,436
Dry	72	50,529	70.9	6,954	28,190	635,786	122	6	258,150
Both	3	1,953	2.7	253	--	105,459	5	--	--
Total 3/	110	71,257	100.0	10,171 5/	41,814	1,069,044	158	68	884,586

1/ Includes portland and masonry cement.

2/ Includes Puerto Rico.

3/ Data may not add to totals shown because of independent rounding.

4/ Includes 305,000 tons of coke and 1,389,000 tons of petroleum coke.

5/ Includes 455,000 tons of coke and 1,475,000 tons of petroleum coke.

TABLE 7
ELECTRIC ENERGY USED AT CEMENT PLANTS 1/
IN THE UNITED STATES, 2/ BY PROCESS

Kiln process	Electric energy used: Generated by cement plants: Number of plants	Electric energy used: Generated by cement plants: Quantity (million kilowatt-hours)	Electric energy used: Purchased: Number of plants	Electric energy used: Purchased: Quantity (million kilowatt-hours)	Electric energy used: Total: Quantity (million kilowatt-hours)	Electric energy used: Total: Percent	Finished cement produced (thousand metric tons) 3/	Average consumption (kilowatt-hours per ton of cement produced) 3/
1994:								
Wet	--	--	35	2,675	2,675	24.6	19,295	139
Dry	5	593	69	7,288	7,882	72.5	51,409	153
Both	--	--	3	310	310	2.9	1,957	158
Total 4/	5	593	107	10,273	10,866	100.0	72,661	150
Percent of total electric energy used	--	5.5	--	94.5	--	--	--	--
Adjustments 5/	--	--	3	--	--	--	3,079	--
1995:								
Wet	--	--	34	2,682	2,682	24.6	19,317	139
Dry	5	574	70	7,355	7,930	72.7	51,730	153
Both	--	--	3	298	298	2.7	1,946	153
Total 4/	5	574	107	10,465	11,039	100.0	72,994	149
Percent of total electric energy used	--	5.3	--	94.7	--	--	--	--
Adjustments 5/	--	--	3	--	--	--	1,723	--

1/ Includes portland and masonry cement.

2/ Includes Puerto Rico.

3/ This table continues the past practice of allocating total electricity consumed to portland cement instead of total cement. The electricity data are, in fact, for the cement plants overall and include usage for masonry cement. If masonry cement is included, the total average electricity consumption becomes 145 kilowatt-hours per ton of cement for both 1994 and 1995.

4/ Data may not add to totals shown because of independent rounding.

5/ Tonnage of cement by three plants that did not report any electricity consumption.

TABLE 8
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement: 1994	Portland cement: 1995	Masonry cement: 1994	Masonry cement: 1995
Destination:				
Alabama	1,432	1,389	131	121
Alaska	103	108	W	W
Arizona	2,158	2,266	W	W
Arkansas	880	937	56	54
California, northern	2,872	2,984	--	2
California, southern	5,328	5,118	W	W
Colorado	1,746	1,634	29	21
Connecticut 3/	624	607	12	13
Delaware 3/	230	223	9	9
District of Columbia 3/	112	107	(4/)	(4/)
Florida	5,623	5,769	458	465
Georgia	2,751	3,045	201	214
Hawaii	396	358	6	5
Idaho	456	463	1	1
Illinois, excluding Chicago	1,516	1,439	30	31
Chicago, metropolitan 3/	2,077	1,864	49	45
Indiana	1,876	1,859	98	92
Iowa	1,515	1,429	13	12
Kansas	1,277	1,339	18	15
Kentucky	1,163	1,195	94	91
Louisiana 3/	1,706	1,747	52	50
Maine	227	210	5	5
Maryland	1,083	1,092	84	79
Massachusetts 3/	1,119	1,036	27	26
Michigan	2,585	2,712	120	126
Minnesota 3/	1,518	1,579	39	32
Mississippi	920	865	75	52
Missouri	2,386	2,234	48	44

See footnotes at end of table.

TABLE 8-Continued
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1994	Portland cement 1995	Masonry cement 1994	Masonry cement 1995
Montana	278	274	1	1
Nebraska	1,014	982	12	9
Nevada	1,358	1,483	(4/)	(4/)
New Hampshire 3/	242	256	7	7
New Jersey 3/	1,427	1,410	62	57
New Mexico	665	708	6	7
New York, eastern	514	491	22	29
New York, western	821	754	33	31
New York, metropolitan 3/	1,010	1,078	38	39
North Carolina 3/	2,151	2,218	253	263
North Dakota 3/	245	310	3	3
Ohio	3,482	3,533	199	181
Oklahoma	1,114	1,105	43	38
Oregon	946	1,027	(4/)	(4/)
Pennsylvania, eastern	1,967	1,806	61	57
Pennsylvania, western	1,102	1,002	73	66
Rhode Island 3/	152	117	3	3
South Carolina	981	1,035	113	106
South Dakota	338	302	5	4
Tennessee	1,711	1,805	187	193
Texas, northern	3,817	4,115	134	146
Texas, southern	4,053	4,225	108	91
Utah	1,020	1,286	2	2
Vermont 3/	101	105	3	3
Virginia	1,716	1,757	146	138
Washington	1,723	1,669	6	6
West Virginia	437	412	33	30
Wisconsin	1,889	1,838	41	35
Wyoming	275	215	2	1
U.S. total 5/	82,232	82,925	3,250	3,150
Foreign countries 6/	377	393	75	93
Puerto Rico	1,392	1,405	--	--
Total shipment 5/	84,001	84,724	3,325	3,243
Origin:				
United States 7/	73,739 r/	71,750	3,283	3,185
Puerto Rico	1,392	1,405	--	--
Foreign 8/	8,870	11,568	42	57
Total shipment 5/	84,001	84,724	3,325	3,243

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "Foreign countries."

1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers, Canadian cement manufacturers, and other importers. Includes Puerto Rico.

2/ Data are developed from monthly consolidated surveys of shipments by company and may differ from data in tables in 1, 10, 11, 12, 14, and 15, which are from annual surveys of individual plants.

3/ Has no cement producing plants.

4/ Less than 1/2 unit.

5/ Data may not add to totals shown because of independent rounding.

6/ Includes shipments to U.S. possessions and territories. Includes States indicated by the symbol W.

7/ Includes cement produced from imported clinker by domestic producers.

8/ Imported cement distributed in the United States by domestic producers, Canadian cement manufacturers, and other importers.

TABLE 9

CEMENT SHIPMENTS, BY DESTINATION (REGION AND SUBREGION) 1/ 2/

Region and subregion	Portland cement: Thousand metric tons 1994	Portland cement: Thousand metric tons 1995	Portland cement: Percent of grand total 1994	Portland cement: Percent of grand total 1995	Masonry cement: Thousand metric tons 1994	Masonry cement: Thousand metric tons 1995	Masonry cement: Percent of grand total 1994	Masonry cement: Percent of grand total 1995
Northeast:								
New England 3/	2,466	2,330	3	3	57	56	2	2
Middle Atlantic 4/	6,841	6,540	8	8	289	278	9	9
Total 5/	9,307	8,870	11	11	346	334	11	11
South:								
Atlantic 6/	15,084	15,658	19	19	1,297	1,303	40	41
East Central 7/	5,226	5,255	6	6	487	457	15	15
West Central 8/	11,570	12,129	15	15	392	379	12	12
Total 5/	31,881	33,042	39	40	2,176	2,139	67	68
Midwest:								
East 9/	13,425	13,245	16	16	537	511	17	16
West 10/	8,294	8,174	9	10	137	120	4	4
Total 5/	21,719	21,419	25	26	674	631	21	20
West:								
Mountain 11/	7,956	8,330	10	10	42	32	1	1
Pacific 12/	11,368	11,264	14	14	12	12	(13/)	(13/)
Total 5/	19,325	19,594	24	24	54	44	2	1
Grand total 5/	82,232	82,925	100	100	3,250	3,150	100	100

1/ Includes imported cement shipped by importers. Excludes Puerto Rico.

2/ Data are developed from monthly consolidated surveys of shipments by company and may differ from data in tables 1, 10, 11, 12, 14, and 15, which are from annual surveys of individual plants.

3/ New England includes: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

4/ Middle Atlantic includes: New Jersey, New York, and Pennsylvania.

5/ Data may not add to totals shown because of independent rounding.

6/ Atlantic includes: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.

7/ East Central includes: Alabama, Kentucky, Mississippi, and Tennessee.

8/ West Central includes: Arkansas, Louisiana, Oklahoma, and Texas.

9/ East Includes: Illinois, Indiana, Michigan, Ohio, and Wisconsin.

10/ West includes: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.

11/ Mountain region includes: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

12/ Pacific region includes: Alaska, California, Hawaii, Oregon, and Washington.

13/ Less than 1/2 unit.

TABLE 10

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, 1/ IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER

(Thousand metric tons)

	Shipments from plant to terminal: In bulk	Shipments from plant to terminal: In containers 2/	Shipments to ultimate consumer: From plant to consumer: In bulk	Shipments to ultimate consumer: From plant to consumer: In containers 2/	Shipments to ultimate consumer: From terminal to consumer: In bulk	Shipments to ultimate consumer: From terminal to consumer: In containers 2/	Total shipments to consumer 3/ 4/
1994:							
Railroad	8,871	56	3,205	419	840	15	4,479
Truck	2,667	124	41,701	2,010	25,712	818	70,241
Barge and boat	8,046	--	659	3	294	--	956
Other 5/	1,742	--	643	36	533	16	1,228
Total 3/	21,326	180	46,208	2,468	27,378	849	76,903
1995:							
Railroad	10,388	64	2,396	377	951	78	3,803
Truck	2,763	222	43,917	1,922	25,964	645	72,449
Barge and boat	7,898	--	105	26	32	--	162
Other 5/	1,853	--	--	--	--	--	--
Total 3/	22,902	286	46,418	2,325	26,947	723	76,414

1/ Includes Puerto Rico. Includes imported cement and cement made from foreign clinker.

2/ Includes bags and jumbo bags.

3/ Data may not add to totals shown because of independent rounding.

4/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

5/ Includes cement used at plant.

TABLE 11
PORTLAND CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

	1994			1995		
District	Quantity (thousand metric tons) 4/	Value (thousands)	Average per ton	Quantity (thousand metric tons) 4/	Value (thousands)	Average per ton
New York and Maine	3,099	$163,141	$52.64	2,916	$230,337	$78.99
Pennsylvania, eastern	4,141	221,121	53.40	3,899	241,352	61.90
Pennsylvania, western	1,520	95,171	62.61	1,486	99,139	66.72
Illinois	2,524	147,721	58.53	1,651	109,030	66.04
Indiana	2,293	132,487	57.78	2,510	154,462	61.54
Michigan	5,135	329,409	64.15	5,098	340,461	66.78
Ohio	1,063	70,273	66.11	985	68,237	69.28
Iowa, Nebraska, South Dakota	3,722	239,483	64.34	3,790	262,662	69.30
Kansas	1,708	104,988	61.47	1,703	107,345	63.03
Missouri	5,054	283,013	56.00	4,778	295,352	61.81
Florida and Puerto Rico	5,242	395,381	75.43	5,604	451,319	80.54
Georgia and South Carolina	3,334	215,100	64.52	3,296	236,681	71.81
Maryland, Virginia, West Virginia	3,338	185,519	55.58	3,262	214,854	65.87
Alabama	3,839	239,220	62.31	3,910	272,509	69.70
Kentucky, Mississippi, Tennessee	2,323	144,977	62.41	2,346	156,550	66.73
Arkansas and Oklahoma	2,401	140,899	58.68	2,506	158,566	63.27
Texas, northern	3,350	192,328	57.41	3,556	228,525	64.26
Texas, southern	4,872	242,347	49.74	4,908	293,380	59.78
Arizona and New Mexico	1,932	126,565	65.51	2,309	160,069	69.32
Colorado and Wyoming	1,951	135,254	69.33	1,841	149,462	81.19
Idaho, Montana, Nevada, Utah	2,341	175,730	75.07	2,432	185,221	76.16
Alaska, Hawaii, Oregon, Washington	1,568	124,158	79.18	1,520	136,987	90.12
California, northern	1,933	123,062	63.66	2,032	139,534	68.67
California, southern	6,341	339,231	53.50	6,212	357,611	57.57
Total 5/ 6/ 7/ or average	76,903	4,696,198	61.07	76,414	5,170,697	67.67

1/ Includes data for three white cement facilities as follows: California (1), Pennsylvania (1), and Texas (1). Includes data for grinding plants as follows: California (1), Florida (2), Iowa (1), Michigan (1), Ohio (1), Pennsylvania (1), and Texas (1).

2/ Includes cement produced from imported clinker.

3/ Cement imported and distributed by domestic producers only.

4/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

5/ Data may not add to totals shown because of independent rounding.

6/ Does not include cement consumed at plant.

7/ Total includes imports shipped to final customers.

TABLE 12
MASONRY CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/

	1994			1995		
District	Quantity (thousand metric tons) 2/	Value (thousands)	Average per ton	Quantity (thousand metric tons) 2/	Value (thousands)	Average per ton
New York and Maine	91	$6,823	$75.21	87	$6,986	$80.30
Pennsylvania, eastern	187	13,518	72.34	180	13,211	73.39
Pennsylvania, western	83	7,658	92.76	80	7,394	92.43
Illinois, Indiana, Michigan, Ohio	723	60,056	83.06	678	59,226	87.35
Iowa, Kansas, Missouri, Nebraska, South Dakota	206	12,852	62.41	189	12,678	67.08
Florida	358	31,022	86.57	415	38,023	91.62
Georgia and South Carolina	396	36,406	91.83	413	40,351	97.70
Maryland, Virginia, West Virginia	531	35,151	66.23	480	36,395	75.82
Alabama	317	29,401	92.86	302	30,277	100.25
Kentucky, Mississippi, Tennessee	119	8,848	74.45	117	9,476	80.99
Arkansas, Oklahoma, Texas	354	26,075	73.70	290	24,368	84.03
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	110	8,821	80.36	111	9,099	81.97
Alaska, California, Hawaii, Oregon, Washington	110	7,738	70.49	165	12,288	74.47
Total 3/ 4/ or average	3,587	284,819	79.40	3,510	300,571	85.63

1/ Excludes Puerto Rico (does not produce masonry cement).

2/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

3/ Data may not add to totals shown because of independent rounding.

4/ Total includes imports shipped by independent importers.

TABLE 13
AVERAGE MILL VALUE OF CEMENT IN THE UNITED STATES 1/

(Per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement 2/	All classes of cement
1994	60.28	177.04	61.07	79.40	61.88
1995	66.89	174.66	67.67	85.64	68.46

1/ Includes Puerto Rico. Mill value is the actual value of sales to customers, f.o.b. plant, less all discounts and allowances, less all freight charges from producing plant to distribution terminal if any, less total cost of operating terminal, if any, less cost of paper bags and pallets.

2/ Masonry cement made at cement plants only.

TABLE 14
PORTLAND CEMENT SHIPMENTS IN 1995, BY DISTRICT OF ORIGIN AND TYPE OF CUSTOMER 1/ 2/

(Thousand metric tons)

District of origin	Ready mixed concrete	Concrete product manufacturers 3/	Contractors 4/	Building material dealers	Oil well, mining, waste 5/	Government and miscellaneous 6/	Total 7/
New York and Maine	1,732	322	48	119	--	696	2,916
Pennsylvania, eastern	1,594	644	135	216	25	1,284	3,899
Pennsylvania, western	911	175	140	75	16	168	1,486
Illinois	1,296	229	65	16	15	30	1,651
Indiana	1,990	372	45	80	11	13	2,510
Michigan	2,102	595	208	248	14	1,932	5,098
Ohio	698	187	49	34	6	13	985
Iowa, Nebraska, South Dakota	2,722	497	342	82	34	112	3,790
Kansas	1,167	119	175	35	20	187	1,703
Missouri	2,799	351	461	112	--	1,054	4,778
Florida and Puerto Rico	2,168	583	206	632	--	2,013	5,604
Georgia and South Carolina	2,344	606	181	119	2	44	3,296
Maryland, Virginia, West Virginia	2,279	615	227	112	7	22	3,262
Alabama	1,643	419	210	245	--	1,393	3,910
Kentucky, Mississippi, Tennessee	1,863	279	110	67	3	24	2,346
Arkansas and Oklahoma	1,343	91	358	37	40	636	2,506
Texas, northern	1,932	215	494	106	389	419	3,556
Texas, southern	3,121	266	316	123	139	944	4,908
Arizona and New Mexico	1,721	252	168	50	30	89	2,309
Colorado and Wyoming	1,481	150	127	67	16	--	1,841
Idaho, Montana, Nevada, Utah	1,849	220	212	25	52	75	2,432
Alaska, Hawaii, Oregon, Washington	919	98	148	79	--	274	1,520
California, northern	1,584	243	103	46	45	12	2,032
California, southern	4,306	920	225	160	117	485	6,212
Total 7/	46,772	8,762	4,758	3,198	978	11,946	76,414

1/ Includes imports shipped by independent importers.

2/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

3/ Concrete product manufacturers in thousand metric tons include: brick/ block-1,519; precast-1,063; pipe-711; and others-5,317. Remainder includes unspecified amounts of brick/ block, precast, and pipe.

4/ Contractors in thousand metric tons include: road paving-1,740; soil cement-577 and other-2,237. Remainder includes unspecified amounts of road paving, and soil cement.

5/ Oil well, mining, and waste included in thousand metric tons: oil well drilling-713; mining-81; and waste stabilization-184.

6/ Includes shipments designated as going to "unspecified" customers.

7/ Data may not add to totals shown because of independent rounding.

TABLE 15
PORTLAND CEMENT SHIPPED FROM PLANTS
IN THE UNITED STATES, 1/ 2/ BY TYPE

Type	1994 Quantity (thousand metric tons)	1995 Quantity (thousand metric tons)
General use and moderate heat (Types I and II), (Gray)	69,810	69,247
High early strength (Type III)	2,618	2,658
Sulfate resisting (Type V)	1,763	1,694
Block	463	493
Oil well	937	750
White	519	549
Blended:		
Portland-slag and portland pozzolan	422	754
Other blended cement 3/	W	63
Expansive	W	W
Regulated fast setting	W	W
Miscellaneous 4/	304	155
Total 5/ 6/	76,903	76,414

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Includes Puerto Rico.
2/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.
3/ Includes blends with fly ash and silica fume.
4/ Includes waterproof and lowheat (Type IV).
5/ Data may not add to totals shown because of independent rounding.
6/ Does not include cement consumed at plant.

TABLE 16
U.S. EXPORTS OF HYDRAULIC CEMENT AND CEMENT CLINKER, 1/ BY COUNTRY

(Thousand metric tons and thousand dollars)

	1994		1995	
Country of destination	Quantity	Value 2/	Quantity	Value 2/
Bahamas, The	9	546	3	282
Canada	510	35,272	582	40,434
Ghana	(3/)	31	(3/)	6
Mexico	62	4,221	17	1,871
Netherlands	1	223	1	230
Other	52	4,896	156	10,153
Total 4/	633	45,189	759	52,975

1/ Includes portland and masonry cement.
2/ Free alongside ship (f.a.s.) value. The value of exports at the U.S. seaport, or border port of export, based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of exportation. The value excludes the cost of loading.
3/ Less than 1/2 unit.
4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 17

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, 1/ BY COUNTRY

(Thousand metric tons and thousand dollars)

	1994			1995		
		Value			Value	
Country of origin	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Canada	4,268	168,603	183,314	4,886	198,056	217,926
Colombia	709	24,830	31,351	804	30,993	38,026
France	474	27,088	32,538	508	24,639	30,905
Greece	914	31,919	44,060	1,245	44,326	61,549
Japan	14	668	891	(4/)	352	415
Mexico	640	25,573	31,097	850	31,938	39,491
Spain	1,342	54,585	64,771	1,501	56,336	71,906
Venezuela	803	32,735	42,090	1,435	56,965	71,317
Other	2,139	77,036	107,620	2,618	97,458	137,990
Total 5/	11,303	443,038	537,731	13,848	541,064	669,525

1/ Includes portland, masonry, and other hydraulic cements. Includes Puerto Rico.

2/ Customs value: price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ C.i.f. (Cost, insurance and freight): import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry. It is computed by adding "freight" to the "customs value."

4/ Less than 1/2 unit.

5/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 18

U.S. IMPORTS FOR CONSUMPTION OF CLINKER, 1/ BY COUNTRY

(Thousand metric tons and thousand dollars)

	1994			1995		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	103	3,675	5,414	114	4,534	6,177
Canada	913	31,674	32,261	1,375	46,658	50,560
Colombia	212	6,370	7,914	139	4,785	5,834
France	154	13,535	15,319	163	8,062	10,061
Greece	--	--	--	104	3,308	4,709
Mexico	(4/)	7	8	--	--	--
New Zealand	27	837	1,253	22	680	1,043
Spain	33	912	1,262	--	--	--
Other	766	22,773	31,540	940	30,646	41,356
Total 5/	2,208	79,783	94,970	2,858	98,674	119,742

1/ For all types of hydraulic cement.

2/ Customs value: price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ C.i.f. (Cost, insurance and freight): import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry. It is computed by adding "freight" to the "customs value."

4/ Less than 1/2 unit.

5/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1994			1995		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Anchorage:						
Canada	1	13	28	4	165	289
China	56	2,147	3,097	64	2,489	3,469
Japan	14	478	672	--	--	--
United Kingdom	--	--	--	(4/)	4	5
Total 3/	71	2,638	3,797	67	2,657	3,763
Baltimore:						
Brazil	(4/)	39	46	(4/)	36	41
Greece	9	289	410	112	4,064	5,272
Japan	(4/)	24	24	--	--	--
Netherlands	--	--	--	(4/)	25	29
Spain	53	1,618	3,094	42	1,482	1,482
United Kingdom	(4/)	68	92	(4/)	130	174
Venezuela	13	507	507	48	2,366	2,366
Total 3/	74	2,545	4,173	203	8,104	9,365
Boston:						
Canada	13	632	707	--	--	--
Germany	(4/)	16	22	--	--	--
Netherlands	--	--	--	(4/)	23	27
United Kingdom	(4/)	9	9	--	--	--
Total 3/	14	656	739	(4/)	23	27
Buffalo:						
Canada	532	27,683	30,046	651	32,703	35,358
United Kingdom	(4/)	1	1	--	--	--
Total	532	27,685	30,048	651	32,703	35,358
Charleston:						
Canada	43	1,451	2,147	--	--	--
Germany	(4/)	6	8	(4/)	13	17
Greece	23	627	1,020	--	--	--
United Kingdom	(4/)	58	78	(4/)	75	103
Venezuela	12	443	598	93	3,863	5,197
Total	78	2,585	3,852	93	3,951	5,317
Chicago:						
Japan	(4/)	47	56	(4/)	80	96
Netherlands	--	--	--	(4/)	6	24
Sweden	--	--	--	(4/)	4	6
Total 3/	(4/)	47	56	(4/)	90	126
Cleveland:						
Canada	522	18,032	19,145	504	17,496	18,237
Denmark	--	--	--	(4/)	2	3
Germany	--	--	--	(4/)	12	15
Netherlands	--	--	--	(4/)	76	91
Total 3/	522	18,032	19,145	504	17,587	18,346
Columbia Snake:						
China	243	9,241	11,660	273	10,682	14,654
Colombia	4	123	125	11	385	385
France	--	--	--	(4/)	1	2
Netherlands	(4/)	1	1	--	--	--
Total 3/	248	9,366	11,786	285	11,068	15,040
Detroit:						
Canada	1,171	45,712	47,525	1,518	60,156	65,627
Netherlands	(4/)	10	10	--	--	--
Taiwan	--	--	--	(4/)	3	3
Total 3/	1,171	45,721	47,535	1,518	60,159	65,629
Duluth: Canada	239	8,620	9,964	208	7,963	9,108
El Paso: Mexico	80	3,037	3,944	268	8,937	11,798
Great Falls:						
Canada	220	6,373	7,092	242	7,162	8,258
United Kingdom	(4/)	29	35	(4/)	15	19
Total 3/	220	6,402	7,127	242	7,178	8,277

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1994			1995		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Honolulu:						
Australia	103	3,675	5,414	114	4,534	6,177
France	--	--	--	(4/)	12	17
New Zealand	27	837	1,253	22	680	1,043
Venezuela	26	814	1,404	--	--	--
Total	157	5,326	8,071	137	5,227	7,237
Houston-Galveston:						
Colombia	7	324	438	24	884	1,380
Denmark	6	308	309	--	--	--
France	68	2,868	3,219	--	--	--
Japan	(4/)	70	82	(4/)	65	77
Spain	529	21,811	23,203	574	19,985	25,750
Switzerland	33	1,404	1,734	--	--	--
United Kingdom	(4/)	23	31	(4/)	50	63
Total	644	26,807	29,016	598	20,984	27,270
Laredo:						
China	--	--	--	(4/)	3	4
Mexico	48	3,978	4,560	51	4,755	5,211
Total	49	3,978	4,560	52	4,758	5,215
Los Angeles:						
Croatia	--	--	--	1	165	251
France	(4/)	22	26	--	--	--
Japan	(4/)	50	57	(4/)	70	79
Mexico	355	13,393	15,811	225	8,229	10,049
New Zealand	--	--	--	(4/)	265	332
Spain	24	828	1,103	--	--	--
United Kingdom	--	--	--	(4/)	5	8
Total 3/	380	14,293	16,996	227	8,734	10,719
Miami:						
Belgium	3	251	340	3	251	340
Brazil	--	--	--	(4/)	5	5
Colombia	306	11,523	14,636	224	9,221	11,509
Denmark	31	1,886	2,841	22	1,119	1,949
Germany	--	--	--	(4/)	9	12
Greece	35	1,275	1,647	--	--	--
Norway	64	2,275	2,892	--	--	--
Spain	288	13,331	15,364	350	15,732	19,364
Sweden	158	4,425	6,469	337	10,044	14,118
United Kingdom	(4/)	3	3	--	--	--
Venezuela	47	1,755	2,336	63	2,170	3,040
Total 3/	932	36,724	46,527	999	38,550	50,337
Milwaukee:						
Canada	179	6,056	6,226	188	6,361	6,561
Germany	(4/)	1	2	--	--	--
Total 3/	179	6,057	6,228	188	6,361	6,561
Minneapolis: Germany	(4/)	25	26	(4/)	11	13
Mobile:						
Bulgaria	56	1,407	2,201	162	4,315	6,811
France	54	1,491	1,843	63	1,936	2,064
Greece	--	--	--	69	2,086	2,947
Macao	24	619	850	--	--	--
Morocco	20	543	778	--	--	--
Tunisia	--	--	--	25	695	1,055
Venezuela	--	--	--	82	2,705	3,601
Total 3/	155	4,060	5,673	401	11,737	16,478
New Orleans:						
Bulgaria	24	599	917	35	874	1,338
Canada	--	--	--	145	4,293	5,745
Colombia	43	1,610	2,197	169	6,414	8,528
Croatia	--	--	--	5	605	885
Denmark	103	3,618	5,438	--	--	--

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

Customs district and country	1994 Quantity	1994 Value Customs 1/	1994 Value C.i.f. 2/	1995 Quantity	1995 Value Customs 1/	1995 Value C.i.f. 2/
New Orleans:--continued						
France	230	9,741	12,755	400	15,359	20,497
Greece	363	12,486	17,357	359	12,560	17,385
Italy	179	6,165	8,612	362	14,440	20,044
Netherlands	--	--	--	(4/)	6	8
Norway	--	--	--	103	3,548	5,180
Spain	99	3,613	4,726	37	1,360	1,771
Sweden	--	--	--	39	1,302	1,887
Tunisia	26	741	1,115	52	1,462	2,111
Turkey	474	14,162	20,311	213	6,530	9,702
Ukraine	34	900	1,247	--	--	--
Venezuela	34	1,351	1,826	6	278	369
Total 3/	1,612	54,988	76,500	1,928	69,033	95,448
New York:						
France	--	--	--	(4/)	5	6
Greece	300	11,102	15,300	182	6,652	8,952
Netherlands	(4/)	107	114	(4/)	79	83
Norway	78	2,522	3,496	245	9,348	12,684
Spain	208	8,157	10,614	218	8,246	10,472
United Kingdom	(4/)	10	11	(4/)	50	61
Total 3/	586	21,899	29,535	645	24,379	32,258
Nogales: Mexico	156	5,110	6,724	303	9,733	12,117
Norfolk:						
Croatia	--	--	--	(4/)	4	9
Denmark	117	5,865	7,198	236	9,366	12,245
France	84	11,740	12,998	45	7,294	8,282
Greece	183	6,140	8,325	492	17,908	25,466
Netherlands	(4/)	16	17	(4/)	144	161
Spain	(4/)	180	199	--	--	--
United Kingdom	--	--	--	(4/)	8	11
Venezuela	33	1,260	1,701	--	--	--
Total 3/	418	25,200	30,438	773	34,725	46,175
Ogdensburg:						
Canada	408	13,246	14,688	353	12,446	13,752
United Kingdom	--	--	--	(4/)	12	12
Total	408	13,246	14,688	354	12,458	13,764
Pembina: Canada	120	5,104	5,983	167	7,024	8,104
Philadelphia:						
Germany	(4/)	6	15	(4/)	76	89
Japan	--	--	--	(4/)	54	65
New Zealand	--	--	--	(4/)	66	85
Total	(4/)	6	15	(4/)	196	239
Portland:						
Bulgaria	28	733	1,028	--	--	--
Canada	10	469	622	8	410	526
Total	38	1,201	1,649	8	410	526
Providence: Spain	--	--	--	35	1,247	1,464
San Diego:						
Mexico	1	56	58	3	281	312
Spain	28	1,261	1,545	--	--	--
Total 3/	29	1,317	1,603	3	281	312
San Francisco:						
China	(4/)	2	2	--	--	--
France	(4/)	32	37	(4/)	30	34
Japan	--	--	--	(4/)	36	44
New Zealand	1	738	977	1	1,138	1,417
United Kingdom	--	--	--	(4/)	15	16
Total 3/	1	771	1,016	1	1,220	1,512
San Juan:						
Belgium	10	838	1,418	12	931	1,582
Canada	--	--	--	26	937	1,578

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1994			1995		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
San Juan:--continued						
Colombia	(4/)	22	29	42	1,720	1,872
Denmark	13	1,157	1,853	9	754	1,260
Germany	(4/)	5	5	--	--	--
Mexico	--	--	--	(4/)	3	4
Netherlands	--	--	--	(4/)	28	49
Spain	(4/)	7	8	(4/)	8	11
Turkey	(4/)	4	7	--	--	--
Venezuela	--	--	--	(4/)	2	2
Total 3/	23	2,033	3,319	90	4,383	6,358
Savannah:						
Bahamas, The	--	--	--	6	244	247
Bulgaria	--	--	--	24	643	1,049
Denmark	--	--	--	3	162	298
Greece	--	--	--	30	1,056	1,525
United Kingdom	--	--	--	30	749	1,246
Venezuela	--	--	--	91	3,274	3,691
Total 3/	--	--	--	184	6,127	8,057
Seattle:						
Canada	663	31,141	33,400	762	36,158	38,719
China	17	646	896	(4/)	9	11
Colombia	100	3,349	3,963	149	5,457	5,540
Japan	--	--	--	(4/)	46	54
Total 3/	780	35,136	38,259	911	41,671	44,323
St. Albans:						
Canada	78	2,699	3,543	110	4,780	6,065
Netherlands	(4/)	102	116	(4/)	117	136
Total 3/	79	2,801	3,660	110	4,897	6,201
Tampa:						
Canada	44	481	877	--	--	--
Colombia	241	7,531	9,427	184	6,911	8,812
Denmark	79	4,510	6,931	58	3,712	5,894
France	37	1,195	1,661	(4/)	3	3
Spain	113	3,779	4,915	244	8,275	11,591
Sweden	79	2,721	3,705	152	5,147	7,154
Turkey	38	1,248	1,616	--	--	--
Venezuela	450	17,578	22,406	883	34,960	43,529
Total 3/	1,081	39,043	51,538	1,522	59,008	76,983
U.S. Virgin Islands:						
Colombia	8	348	536	--	--	--
Martinique	4	28	30	--	--	--
Netherlands Antilles	--	--	--	2	64	67
Panama	--	--	--	4	73	98
Trinidad and Tobago	8	284	337	--	--	--
Venezuela	49	3,683	4,130	32	1,628	1,847
Total 3/	70	4,343	5,034	38	1,765	2,012
Washington: Netherlands	(4/)	3	4	--	--	--
Wilmington:						
Canada	25	893	1,321	--	--	--
Netherlands	--	--	--	(4/)	7	13
Venezuela	139	5,344	7,183	139	5,719	7,675
Total 3/	164	6,237	8,503	139	5,726	7,688
Grand total 3/	11,303	443,038	537,731	13,848	541,064	669,525

1/ Customs value: price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

2/ C.i.f. (Cost, insurance and freight): import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry. It is computed by adding "freight" to the "customs value."

3/ Data may not add to totals shown because of independent rounding.

4/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 20

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER 1/

(Thousand metric tons and thousand dollars)

	Gray hydraulic cement		White portland cement		Hydraulic cement clinker		Total 2/	
Year	Quantity	Value (customs)	Quantity	Value (customs)	Quantity	Value (customs)	Quantity	Value (customs)
1994	8,635	329,012	459	34,243	2,208	79,783	11,303	443,038
1995	10,554	407,537	436	34,854	2,858	98,674	13,848	541,064

1/ Includes Puerto Rico.

2/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 21

HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/

(Thousand metric tons)

Country	1991	1992	1993	1994	1995 e/
Afghanistan e/	112	115	115	115	115
Albania e/	600	200	200	200	200
Algeria	6,319	6,400	6,400 e/	6,060 r/	6,200
Angola e/	260	300	250	300	300
Argentina	3,399	5,051	5,647	6,306 r/	6,400
Armenia 2/	XX	400 r/	200	100 r/	200
Australia	6,108	5,412	5,500 e/	6,000 e/	6,000
Austria	5,016	5,031	4,941	5,000 e/	5,000
Azerbaijan 2/	XX	800 r/	600 r/	500 r/	200
Bahrain	150	220	225	225 e/	225
Bangladesh 3/	275	273	275	280 e/	280
Barbados	200 e/	175 e/	62 r/	78 r/	80
Belarus 2/	XX	2,300 r/	1,900 r/	1,488 r/	1,235 4/
Belgium	7,184	8,073	7,612 r/	8,000 e/	8,000
Benin e/	320	370	380	380	380
Bhutan	116	116	108	120 e/	140
Bolivia	592	600	654 r/	708 r/	700
Bosnia and Herzegovina e/ 5/	XX	150	150	150	150
Brazil	27,490	23,903 r/	24,843 r/	25,229 r/	25,500
Bulgaria	2,374	2,132 r/	2,007 r/	2,200 r/	2,100
Burma	443 r/	464 r/	400 r/	470 r/	517 4/
Cameroon	521 r/	519 r/	520 r/ e/	520 r/ e/	520
Canada	9,396	5,698	6,672	10,584 r/	10,722 4/
Chile	2,251	2,645	3,021 r/	2,995 r/	3,000
China	252,610	308,220	367,880	421,180 r/	445,610 4/
Colombia	6,302	6,807	7,930 r/	9,322 r/	9,624 4/
Congo	103	115	114 e/	114 e/	100
Costa Rica	700 e/	700 e/	860 r/	940 r/	990
Côte d'Ivoire e/	500	510	500	500	500
Croatia 5/	XX	1,768	1,683	1,700 e/	1,700
Cuba	2,000 e/	2,000 e/	1,049 r/	1,081 r/	1,200
Cyprus	1,134	1,131	1,089	1,053 r/	1,021 4/
Czech Republic 6/	XX	XX	5,393	5,303	4,825 4/
Czechoslovakia 7/	8,299	8,500	XX	XX	XX
Denmark (sales)	2,016	2,072	2,270	2,430 r/	2,000
Dominican Republic	1,235 r/	1,365 r/	1,271 r/	1,276 r/	1,453 4/
Ecuador	2,300 e/	2,250 e/	2,098 r/	2,164 r/	2,300
Egypt	16,427	17,000	16,000	16,000 e/	16,000
El Salvador	680	419	861	850	875
Eritrea e/	XX	XX	30	300 r/	350
Estonia e/ 2/	XX	600	500	402 r/ 4/	417 4/
Ethiopia	290	300	270 e/	260	611 4/
Fiji	79	84	80	94	78 4/
Finland	1,324	1,129	835	864 r/	900
France	26,507	21,165	20,464 r/	21,296 r/	21,000
Gabon	117	116	132	126 e/	130
Georgia 2/	XX	500 r/	300 r/	100 r/	100
Germany	34,396	37,529	36,649	40,380	40,000

See footnotes at end of table.

TABLE 21--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/

(Thousand metric tons)

Country	1991	1992	1993	1994	1995 e/
Ghana	750	1,024	1,203	1,346	1,400
Greece	11,808	10,668	12,618	12,636	12,000
Guadeloupe e/	240	235	230	230	230
Guatemala	1,440	1,400 e/	1,119 r/	1,480	1,560
Haiti e/	250	200	100	75	50
Honduras	693	650 e/	723 r/	615 r/	655
Hong Kong	1,677	1,643	1,712	1,927	1,913 4/
Hungary	2,529	2,236	2,533	2,813	3,000
Iceland	106	100	86	81 r/	82
India e/	51,000	50,000	53,812 4/	60,000 r/	70,000
Indonesia	16,153	17,280	18,934	19,000 e/	19,500
Iran e/	15,000	15,200 r/	16,000 r/	16,000 r/	16,300
Iraq e/	5,000	10,000	12,000	15,000 r/	18,000
Ireland e/	1,600	1,600	1,600	1,550	1,500
Israel e/	3,550	3,500	3,500	3,500	3,500
Italy	40,806	41,347	34,771 r/	33,192 r/	35,000
Jamaica	384 r/	475 r/	451	445 r/	523 4/
Japan	89,564	88,253	88,046	91,624 r/	90,474 4/
Jordan	1,363 r/	3,134 r/	3,514 r/	4,000 r/ e/	4,000
Kazakstan 2/	XX	6,400 r/	4,000 r/	2,000 r/	1,800
Kenya	1,423	1,508	1,417 r/	1,420 r/ e/	1,500
Korea, North e/	16,000	17,000	17,000	17,000	17,000
Korea, Republic of	34,999	44,444	47,313	50,730 r/	55,130 4/
Kuwait	98 r/	533 r/	500 e/	1,000 r/ e/	2,000
Kyrgyzstan 2/	XX	1,100 r/	700 r/	400 r/	300
Latvia e/ 2/	XX	400	300	244 r/ 4/	204 4/
Lebanon e/	900	1,500 r/	2,500 r/	2,800 r/	3,000
Liberia	2	8	8 e/	-- e/	--
Libya	2,369	2,300	2,300 e/	2,300 e/	2,300
Lithuania e/ 2/	XX	1,500 r/	1,000 r/	736 r/ 4/	649 4/
Luxembourg e/	688 4/	600	600	620	600
Macedonia 5/	XX	516 r/	499 r/	486 r/	500
Madagascar e/	60	60	60	60	60
Malawi	120	112	127	122 r/	139
Malaysia	7,451	8,366	8,797	9,928 r/	10,667 4/
Mali e/	20	20	20	20	20
Martinique e/	245	240	220	225	225
Mauritania	105	122	111	374	375
Mexico	25,100	26,880	27,120	29,700	23,971 4/
Moldova 2/	XX	700 r/	100 r/	39 r/	49 4/
Mongolia	227	133	82	86	109 4/
Morocco e/	5,770	6,340 4/	6,350 r/	6,500 r/	6,500
Mozambique e/	80	30	20	20	20
Nepal	136	196	190	190 e/	220
Netherlands e/	3,546 4/	3,300	3,400	3,400	3,400
New Caledonia	90	90	90 e/	90 e/	100
New Zealand	576	579	600 e/	700 r/ e/	700
Nicaragua	239 r/	277 r/	255 r/	309 r/	350
Niger	20	29	29 e/	30 e/	30
Nigeria e/	3,500	3,500	3,500	2,600 r/ 4/	2,600
Norway	1,147	1,266	1,344	1,444	1,400
Oman	995	970	1,000	1,200 r/	1,400
Pakistan	7,762	7,793	8,321	8,100 r/	8,586 4/
Panama	300 e/	250 e/	571 r/	615 r/	350
Paraguay	326 e/	326 e/	490 r/	570 r/	570
Peru e/	2,200	2,089 4/	2,089	2,100	2,100
Philippines	6,913	6,667 r/	7,962	9,600	9,800
Poland	12,012	11,908	12,228	13,834 r/	13,884 4/
Portugal e/	7,473	7,638	7,600	7,500	7,500
Qatar	527	544	544 e/	550 r/ e/	580
Romania	6,692	6,271	6,240	5,998 r/	6,000
Russia 2/	XX	61,700 r/	49,900 r/	37,200 r/	36,400
Rwanda e/	60	60	60	10	5
Saudi Arabia	11,371	15,324 r/	15,300 e/	16,000 e/	16,000

See footnotes at end of table.

TABLE 21--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/

(Thousand metric tons)

Country	1991	1992	1993	1994	1995 e/
Senegal	503	601	590	590 r/ e/	590
Serbia and Montenegro 5/	XX	2,036	1,088	1,612	1,696 4/
Singapore e/	2,000	1,900	1,900	1,900	1,900
Slovakia e/ 6/	XX	XX	2,500	2,500	2,500
Slovenia e/ 5/	XX	950	950	1,000	1,000
Somalia e/	10	25	25	25	25
South Africa	7,427	7,028	7,356	7,905	9,071 4/
Spain (including Canary Islands)	25,119 r/	24,615 r/	22,878 r/	25,150 r/	25,000
Sri Lanka	400 e/	817	676	925	900
Sudan e/	170	250	250	250	250
Suriname e/	50	50	50	50	50
Sweden	2,395	2,289	2,200 e/	2,100 e/	2,100
Switzerland	4,700	4,260	4,000 e/	4,000 e/	4,000
Syria	3,500	3,700	4,500 r/	5,000 r/ e/	6,000
Taiwan	19,399	21,644	23,971	22,722	22,478 4/
Tajikistan 2/	XX	400 r/	300 r/	200	100
Tanzania e/	540	540	540	490 r/	800
Thailand	18,054	21,832	26,870	28,000 e/	26,500
Togo	388	350	350 e/	350 e/	350
Trinidad and Tobago	485	482	527	583	600
Tunisia	4,009 r/	3,999 r/	4,269 r/	4,300 r/ e/	4,300
Turkmenistan 2/	XX	1,100 r/	1,100 r/	700 r/	400
Turkey	26,091	28,607	31,241 r/	29,493 r/	33,153 4/
Uganda e/	50	50	50 r/	125 r/	130
Ukraine 2/	XX	20,100 r/	15,000 r/	11,400 r/	11,000
U.S.S.R. 8/	127,000 e/	XX	XX	XX	XX
United Arab Emirates	3,473	3,800	4,000 r/ e/	5,000 r/ e/	6,000
United Kingdom	12,297 r/	11,006	11,039 r/	12,493 r/	12,500
United States (including Puerto Rico)	68,465 r/	70,883 r/	75,117	79,353 r/	78,320 4/
Uruguay e/	500	500	500	700 r/	600
Uzbekistan 2/	XX	5,900 r/	5,300 r/	4,800 r/	3,500
Venezuela	6,337	6,585	6,842	6,900 e/	6,900
Vietnam e/	3,000	5,000	6,500	7,200	7,500
Yemen	850	800	800 e/	800 e/	1,000
Yugoslavia 9/	7,500 e/	XX	XX	XX	XX
Zaire	250 e/	174	149	150 e/	100
Zambia	367	347 e/	350 e/	280 r/	300
Zimbabwe e/	865 4/	900	1,000	900	1,000
Total e/ 10/	1,181,793 r/	1,239,683 r/	1,301,527 r/	1,380,052 r/	1,421,342

e/ Estimated. r/ Revised. XX Not applicable.
1/ Table includes data available through Sept. 1996.
2/ Formerly part of the U.S.S.R.; data were not reported separately until 1992.
3/ Data are for the year ending June 30 of that stated.
4/ Reported figure.
5/ Formerly part of Yugoslavia; data were not reported separately until 1992.
6/ Formerly part of Czechoslovakia; data were not reported separately until 1993.
7/ Dissolved Dec. 31, 1992.
8/ Dissolved in Dec. 1991.
9/ Dissolved in Apr. 1992.
10/ Data may not add to totals shown because of independent rounding.

CEMENT

By Hendrik G. van Oss

Cement is a critical component and economic indicator of the construction industry because it is the binding agent in concrete and mortars. Total U.S. production of portland and masonry cement in 1996 increased by 3.1% to 79.3 million tons,[1] of which 96% was portland cement (see tables 1-3). This record performance reflected near practical capacity output levels of clinker (see table 4) and cement (grinding) facilities. The United States continued to be the world's third largest cement producer (second in terms of high-quality cement); total world output remained in the range of 1.4 billion to 1.5 billion tons.

Apparent U.S. consumption of cement increased by about 5% in 1996 to 90.4 million tons, with the excess demand being met by increased imports and the drawing down of stockpiles. Cement exports also increased but remained a small component of total U.S. cement commerce. Cement prices were higher during the year, and the total ex-plant value reported for shipments from mills and import terminals to final customers increased by about 13% to $6.0 billion. The comparable value for all shipments to final customers, including those from other distribution terminals, is estimated to be $6.6 billion. By using typical cement-in-concrete mixing ratios, the value (delivered) of concrete in the United States in 1996 was estimated to be at least $26 billion.

In this report, cement production refers to finished portland and masonry cements (only) and thus represents the output both of integrated facilities (producing clinker and cement), and dedicated clinker-grinding plants. Hydraulic cements, which are those that will set and harden under water, are overwhelmingly the dominant type of cement manufactured in the United States and worldwide. Portland and masonry cements are the most common forms of hydraulic cements. Other hydraulic varieties, such as pure pozzolan and aluminous cements, cumulatively make up only a tiny fraction of the U.S. cement market and are not covered in this report.

The term "portland cement" properly refers to an interground mixture of portland cement clinker and 3% to 5% gypsum. The clinker comprises mostly calcium silicates and is made by controlled, high-temperature burning of a measured blend of calcareous rocks (usually limestone) with lesser quantities of silicious, aluminous, and ferriferous materials as needed. The blend is adjusted according to the chemical composition of the raw materials and the type of portland cement desired. In the United States, five basic types (Types I through V) of portland cement are recognized, denoting such properties as high sulfate resistance and high early strength. Elsewhere in the world, other designations may be used for similar portland cements. Portland cement is almost always gray, but if care is taken to burn only iron-free raw materials, then a more valuable version, white cement, can be obtained.

Portland cement can be interground with pozzolans to produce a variety of so-called blended cements. Blended cements have similar properties to (true) portland cements and, in common with standard U.S. industry practice, this report includes blended cements within the portland designation. Pozzolans are siliceous materials, such as certain rocks (mainly tuffs) and industrial byproducts (e.g., granulated blast furnace slag, fly ash, silica fume), that exhibit hydraulic cementitious properties when finely ground and interacted with free lime. Blended cements commonly are a major component of cement consumption overseas, particularly in Europe and Asia. As yet, reported U.S. consumption of pozzolans is very small, although the data are incomplete. The largest consumer is the concrete industry, but data for this industry are crude and do not differentiate consumption of pozzolans from similar material used as aggregates. Concrete is a controlled mixture of cement, fine and coarse aggregates, and water that, through complex cement hydration reactions, hardens into a rocklike mass of specifiable properties. The concrete industry uses pozzolans as concrete admixtures. In terms of the resulting cement paste, the distinction between adding pozzolans to the concrete mix or having them introduced to the concrete within a blended cement would appear to be more semantic than real.

The term "masonry cement" is used broadly in this report and includes portland lime and plastic cements. It is the cementing agent in mortar (a mixture of cement, fine aggregate, and water) that is used to bind together building blocks, such as bricks and stones. Masonry cements can be made either from portland cement or directly from clinker; manufacture involves incorporating a high percentage (e.g., 50%) of admixtures—commonly ground limestone or lime. This need not require a high degree of sophistication; in particular, portland-lime cements commonly are mixed at the construction sites, using purchased portland cement and lime. Accordingly, the data in this report, which are for masonry cement produced and sold by cement manufacturers only, underreport the true production and consumption of this material, particularly for some regions of the country.

The bulk of this report, particularly tables 1 through 7, and 10 through 15, incorporates data compiled from U.S. Geological Survey (USGS)[2] annual surveys of individual cement and

[1]All tons are metric in this report unless otherwise stated.

[2]Data prior to 1995 were collected by the former U.S. Bureau of Mines.

clinker manufacturing plants and importers. In 1996, responses were received from 128 of the 134 facilities canvassed, including all but 1 producer; these facilities accounted for more than 99% of total U.S. cement production and shipments. In 1995, responses were received from 124 of the 130 facilities canvassed, recording 99% of production and shipments. Estimates were incorporated for the nonrespondents on the basis of monthly shipments data and/or past annual data. Tables 8 and 9, in contrast, are based on monthly shipments surveys of the cement-producing companies and importers, and for these, the response rate was 100% for both years. The several thousand U.S. concrete producers were not surveyed and, thus, the true production and consumption of pozzolans, and hence of "blended cement," are under represented.

For cases where annual questionnaires were returned incompletely filled out, followup inquiries were made, after which estimates were made and incorporated for any remaining missing data. Estimates for most information categories constituted only very small percentages of the aggregated totals and, thus, the introduced estimation errors are considered to be insignificant. Two important exceptions are the value data (tables 1 and 11-13), where a significant number of companies routinely withhold the information, and the data for portland cement shipments by customer type (table 14), where the cement producers readily admit to having incomplete knowledge.

As in previous years, there is a tonnage discrepancy between the annual shipments totals in tables 1-7 and 10-15 and the larger (monthly based) totals shown in tables 8 and 9. As a measure of cement consumption, the data in tables 8 and 9 are preferred because they are more complete; this will be discussed in more detail in the Consumption of Cement section. Integration of the data from tables 8 and 9 data with those from the other tables has not been done to avoid creating additional internal inconsistencies.

Tables 16 through 21 show nonproprietary trade data from the Bureau of the Census in lieu of the proprietary data collected through the USGS questionnaires. World production data shown in table 22 were derived by USGS country specialists from a variety of sources.

Some data are presented for State groupings or districts—generally corresponding to Census Districts or subsets thereof—where required to protect proprietary individual State data. Certain major cement-producing States have been subdivided along county lines to provide additional market information.[3]

Within the U.S. cement industry, very few significant changes were reported in plant or company ownership during the year. In June, Scancem Industries Inc., of Norway, sold Continental Cement Co.'s Hannibal, MO, plant, plus distribution terminals in St. Louis, Chicago, and Bettendorf, IA, to a group of private investors, mostly from the St. Louis, MO, area; the Chicago terminal was subsequently sold to Holnam, Inc. Scancem retained ownership of Continental Cement Co. of Florida, Inc., which operates two Florida import terminals (International Cement Review, 1996a). Also in June, Holnam purchased Koch Minerals Co., which has granulated blast furnace slag (pozzolan) grinding facilities at Weirton, WV, and Chicago, IL (Rock Products, 1996a). Essroc Corp. announced the acquisition of distribution terminals at Wilder, KY, and Pittsburgh, PA, from Lafarge Corp (Essroc, 1996). Southdown, Inc., announced the purchase of Mitsubishi Cement Corp.'s cement distribution terminal in Phoenix, AZ (Southdown, 1996).

Legislation and Government Programs

Economic Issues.—Federal and State annual proposals and appropriations for public sector construction are ever of concern to the cement industry. Similarly, the industry monitors Government policies that influence the cost of money and other aspects of the general economic climate because these affect private sector construction projects. Because of high transportation costs, cement markets tend to be fairly local. Competition within markets served by more than one cement company can be keen, but similarities of production methods and costs have constrained cement sales price variations among companies. This has led to periodic Government antitrust investigations of the industry, to date without findings against the cement companies. One such investigation was concluded in 1995; none was reported in 1996.

Probably the most significant Government economic actions of recent interest to the cement industry have been regarding trade and stem from the 1980's when various factors led to a flood of cheap cement imports coming onto the U.S. cement market. Subsequent determinations of cement dumping by Japanese, Mexican, and Venezuelan cement companies led to the imposition of antidumping tariffs on imports from Japan and

[3]State subdivisions are as follows:

California, northern.—Counties north of San Luis Obispo and Kern Counties and west of Inyo and Mono Counties.

California, southern.—Inyo, Kern, Mono, San Luis Obispo, and all counties further south.

Chicago, metropolitan.—Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.

Illinois.—All other counties in the State.

New York, eastern.—All counties east of Broome, Chenango, Lewis, Madison, Oneida, and St. Lawrence Counties, but excluding counties within Metropolitan New York.

New York, western.—Broome, Chenango, Lewis, Madison, Oneida, and St. Lawrence Counties, and all those further west.

New York, metropolitan.—The five counties of New York City (Bronx, Kings, New York, Queens, and Richmond) plus Nassau, Rockland, Suffolk, and Westchester Counties.

Pennsylvania, eastern.—All counties east of Centre, Clinton, Franklin, Huntingdon, and Potter Counties.

Pennsylvania, western.—Centre, Clinton, Franklin, Huntingdon, and Potter Counties, and all those further west.

Texas, northern.—All counties north of Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, and Williamson Counties.

Texas, southern.—The named counties above and all those further south.

Mexico and to a voluntary restraint agreement with Venezuela. The tariffs have dramatically reduced imports of Japanese cement and clinker into the United States, from 2.1 million tons in 1990 to less than 500 tons in 1996. Anticipation and eventual imposition of tariffs on Mexican imports similarly led to a decline from a peak of 4.5 million tons in 1988 to 0.6 million tons in 1994. The tariffs were under appeal by the main Mexican company involved, and in the meantime, imports from Mexico began growing, totaling 0.85 million tons in 1995 and almost 1.3 million tons in 1996. Administrative reviews of the tariffs conducted by the U.S. Department of Commerce (DOC) on a periodic (12 months beginning August 1) basis for the years 1990 through 1995 have so far confirmed the tariff dumping margins. The latest reviews, covering the fourth and fifth periods (ending September 1995), were released by the DOC in April 1997 (Southern Tier Cement Committee, 1997).

Environmental Issues.—Cement production involves both mining and manufacturing components. About 120 million to 125 million tons per year of nonfuel raw materials are mined, generally from quarries. Environmental issues impacting this activity are common to most surface mines and include problems with dust, increased sediment loads to local streams, chemical changes to local water supplies, and so forth. Of far greater concern are the environmental impacts of the manufacturing process, most of which stem from the manufacture of clinker. Clinker kilns burn large quantities of fossil and/or other organic fuels to thermochemically break down (calcine) calcareous rocks and to instigate other clinker-forming chemical reactions.

In the growing debate over climatic change, the impact of so-called greenhouse gases on atmospheric warming is a major issue. The most common greenhouse gas is carbon dioxide (CO_2), and in the clinker kiln, fuel combustion and carbonate calcination evolve large quantities of this gas. The precise determination of the CO_2 emissions of the U.S. cement industry is difficult because compilations of chemical analyses for the specific types and quantities of raw materials and fuels actually consumed are lacking. Instead, estimates are made separately for calcination and fuel combustion. For CO_2 from calcination, two estimation methods are in common use. The first assigns average carbonate (CO_3^{-2}) contents to the carbonate rock types (tonnages) consumed (see table 5). The main problem with this method is that the carbonate content of limestones and other carbonate rocks vary widely; seldom is a pure calcium carbonate limestone used to make cement. A lesser problem is the small carbonate component of other rocks consumed—particularly shales—that tends to be ignored. The second method uses clinker production data and typical calcium (oxide) analyses of clinker to back-calculate the (calcium) carbonate component of the kiln feed. A problem with this method is that the calcium content of clinker also varies, although not widely as with carbonate rocks. A minor problem is introduced if one assumes, for simplicity, that all the calcium in the clinker is derived from calcium carbonate; in fact, other components of the feed, such as calcium silicates, can contribute calcium. And both methods fail to account for a small component of carbonate escaping, uncalcined or incompletely calcined, as cement kiln dust (CKD). With the first method and the raw materials data in table 5, a rough estimate can be made of CO_2 emissions from calcination in 1996 amounting to about 40 million tons, or about 0.57 ton per ton of clinker. With the second method, assuming a CaO content of clinker of 64% and that all the CaO was derived from $CaCO_3$, the CO_2 emissions from calcination would amount to about 36 million tons (0.51 ton per ton of clinker).

Estimation of CO_2 emissions from the combustion of fuels generally involves assigning carbon contents to the fuels consumed either directly or after calculated conversion to a common fuel (e.g., tons of coal equivalent). The error in both methods is in the assignment of a carbon content to a specific fuel type, such as coal, when a range of carbon contents may be present. This error probably is not large for fossil fuels, but could be significant for waste fuels, given that all sorts of organic substances (generally unspecified), ranging from paper to paint thinners, may be burned as wastes. Another, probably minor, problem is that many carbonate rocks contain organic carbon (kerogen)—some to a significant degree—and this material behaves as a fuel in the kiln. Kerogen would reduce the consumption of exogenous fuels, but its emission of CO_2 is unquantified. The fuel consumption data in table 6 would yield an estimate of CO_2 emissions of about 34 million 35 million tons (0.48-0.50 ton per ton of clinker).

Combustion and calcination combined would, for 1996, yield total CO_2 emissions of about 70 million to 75 million tons. This estimate and its components are probably good to within 10%. The total emissions, as estimated, are equivalent to about 1 ton of CO_2 per ton of clinker produced. The ratio would not change significantly on a cement-produced basis, assuming the cement is "straight" portland (clinker plus 5% gypsum). It would not hold, however, for blended cements, masonry cements, or any cement made by grinding imported clinker (for which the CO_2 emissions would be credited to the clinker source country). The above estimates are in close accord with those presented elsewhere; for example, Cahn and others (1997).

The above estimates do not include the CO_2 equivalent of the electricity consumed by the cement industry. Such emissions are commonly credited to the power industry. For a given plant or region, an estimate, ideally, would require knowledge of the percentage of the electricity sourced from thermal power plants and from what fuels therein. A simple estimate for the U.S. cement industry overall can be made by assuming an average "mix" of power-generation sources. According to 1995 data from the Energy Information Administration (1996), the U.S. industrial sector electricity consumption-to-CO_2 ratio was about 1,700 kilowatt-hours per ton of CO_2. Applied to the 1996 electricity consumption of the cement industry (see table 7), this would yield a CO_2 equivalent of about 7 million tons.

The concern of the cement industry with CO_2 emissions stems mainly from worries that the Government will seek to reduce emissions through the imposition of carbon taxes or emissions quotas. For administrative reasons, carbon taxes would most likely be imposed on the fuels consumed rather than on the emissions themselves. The fear is that the carbon taxes, especially if high, would significantly raise clinker production costs and would, thus, reduce the price competitiveness of domestic cement against (presumed) cheaper imports. The imports would be cheaper because so-called developing countries, including Mexico, are expected to be exempted, at least for a time, from carbon emissions limits and could, thus, produce cement more cheaply. Many of these same developing countries also have very large and efficient modern plants.

In February, the U.S. Department of Energy (DOE) initiated a study into the economic impacts of carbon taxes on six industries, including cement. The completed study, summarized in Nisbet (1996), noted that energy currently accounts for 30% to 40% of current production costs, that affordable technological options to improve energy efficiencies of existing plants are limited, and that the unit CO_2 emissions from calcination cannot be reduced. In the study, carbon taxes were imposed under two incremental (year 2005 and 2010) price scenarios, wherein the initial tax (2005) doubled in 2010. The cheaper scenario imposed a tax in 2005 of 8.4 mils ($0.0084) per kilowatt-hour of electricity, $40.67 to $44.10 per ton of oil equivalent on fuel oil, $28.77 per ton of oil equivalent of natural gas, and $35.45 per ton of coal. The more-expensive scenario was approximately 50% higher and was projected to increase total energy costs by an average of 151% in 2010. The cost increases would cause domestic cement to become increasingly uncompetitive with foreign cement (sourced from nontax countries), with the result that the industry could lose about 15 million to 24 million tons of production capacity through plant closures, and imports would increase by as much as 100% or more to compensate. However, the study was constrained by boundary conditions set by DOE and, accordingly, did not fully account for the possibility of imposition of protective tariffs, the likelihood that developing countries ultimately would not be excluded from carbon taxes, or that certain parts of the country would remain insulated from imports because of high transportation costs (which also would increase), or the possibility that there would be a large increase in the consumption of nonclinker (i.e., pozzolan) extenders in cement manufacture. Given its widespread use in Europe and Asia, pozzolan (blended) cement consumption is likely to grow in the United States even without carbon taxes, although the market is constrained, to some degree, by cement specifications in existing construction codes.

Another major waste product of clinker manufacturing is CKD, made up of particles of clinker, incompletely reacted raw materials and solid fuels, and material eroded from the kiln's refractory brick lining. Almost all CKD is captured by either electrostatic precipitation or baghouse filtration, either for reuse as kiln feed or as a soil conditioner for farms, or for storage in a landfill. Nevertheless, worries remain regarding unacceptable levels in some CKD of hazardous trace-element or organic contaminants, such as chromium compounds from refractory bricks, and nickel and vanadium from fossil fuels. Objections have been raised by environmental groups and commercial waste-incineration companies to perceived risks of contaminant emissions arising from the increasing use of waste fuels by the cement industry.

Under amendments to the Resource Conservation and Recovery Act (RCRA) in 1980, the U.S. Environmental Protection Agency (EPA) was instructed to study so-called Bevill (amendment) wastes, including CKD, to see if such were to be regulated under the hazardous waste provisions of RCRA. The EPA completed its Report to Congress on CKD late in 1993; in this, CKD was described as posing little environmental or health risk, but some ground-water contamination problems owing to CKD mismanagement were identified (U.S. Environmental Protection Agency, 1993 a,b). The EPA issued an associated regulatory determination in early 1995 that reaffirmed the risk conclusions of the 1993 Report, and proposed, under the authority of RCRA Subtitle C (hazardous wastes), drafting in consultation with interested stakeholders a tailored set of management standards for CKD (U.S. Environmental Protection Agency, 1995). Importantly, the 1995 determination ruled that the standards need not be the stringent ones in Subtitle C; that is, CKD was not ruled to be a hazardous waste. In March 1995, the cement industry, responding to a perceived lack of rigor in the determinations language, presented to the EPA a so-called enforceable agreement that laid out standards for CKD management (American Portland Cement Alliance, 1995). The EPA reviewed the industry proposal but, in November 1995, professed itself uncertain of its authority under RCRA to sign such an agreement (American Portland Cement Alliance, oral commun., 1996). Instead, the EPA began a regulatory development program in April 1996, with a target date for release of a proposed rule in early 1998 (U.S. Environmental Protection Agency, 1996).

Increasingly stringent Government restrictions on fuel-derived emissions of so-called NO_x and SO_x, dioxins and furans, and other contaminants, are of concern to the industry, particularly to the degree that changing emission limits necessitates changes in testing procedures, equipment, and operating practices. These limits also affect the ability of plants to utilize waste fuels cheaply. The Government was moving towards regulating kiln emissions within the regulatory Maximum Achievable Control Technology (MACT) framework and issued an extensive document setting out proposed MACT standards in April 1996. After receiving complaints from the industry that the original review period was too short, the EPA agreed, in December, to an extension, and reevaluated standards are expected to be released late in 1997. Under a MACT framework, the standards adopted for each contaminant are the average emissions levels of the least polluting plants; current proposals involve the least polluting 12% of the plants.

Production

Cement was produced in 1996 in 37 States and in Puerto Rico by 43 companies (other totals are possible depending on ownership splitouts), including 1 that was State owned. All but 7 of the 118 plants that were in operation were integrated facilities producing both clinker and cement. Production and related data are shown in tables 2 through 4. About 65% of

U.S. cement production and capacity was foreign-owned.

Several cement companies were upgrading their plants to reduce operating costs and/or to increase capacity. Some of the projects announced during the year were major. Ash Grove Cement Co. completed a 0.15-million-ton-per-year capacity expansion project at the Leamington, UT, plant at midyear (Grover, 1997). Blue Circle America Inc. announced that it would start work in May to expand capacity at its Harleyville, SC, plant by more than 0.3 million tons per year; the work was expected to be completed by yearend 1997 (Portland Cement Association, 1996a). Holnam Inc. was converting its Devils Slide, UT, plant to dry process technology; the conversion was expected to be completed in late 1997 (International Cement Review, 1996b). Lafarge Corp. was planning to upgrade the kiln line at the Sugar Creek, MO, plant (Rock Products, 1996b). Lehigh Portland Cement Co announced that it was planning a modernization and 50% expansion (to 1.36 millio tons per year) program at its Union Bridge, MD, plant (Portland Cement Association, 1995); a tire-burning system for the kiln was installed as part of this project (U.S. Geological Survey, 1996a). Mountain Cement Co. brought a second dry kiln on line in January 1996 (U.S. Geological Survey, 1996b). North Texas Cement Co. completed construction of a large cement import terminal at Houston, TX, and received its first shipment in December (Wood and Olaveson, 1997). Rinker Materials Corp. announced that it would convert its Miami, FL, plant to dry process technology, thereby increasing capacity to 1 million tons per year (International Cement Review, 1996c); the work was due to be completed in 1999. Roanoke Cement Co. installed a single-string preheater/precalciner on its No. 5 kiln line (U.S. Geological Survey, 1996c). Southdown Inc. was expanding capacity at its Fairborn, OH, plant by 0.1 million tons per year and at Victorville, CA, by 0.3 million tons (Portland Cement Association, 1996c); a new finish mill was completed at Fairborn during the year (U.S. Geological Survey, 1996d).

The only permanent closure during the year was at Hawaiian Cement, which shut its kiln down at the end of August. The facility continued to operate as a grinding plant for imported clinker (Hawaiian Cement, oral commun., 1996).

Portland Cement.**—**In the United States and Puerto Rico, portland cement was manufactured at 118 plants, including 7 dedicated clinker-grinding facilities. The regional distribution of these plants, cement production and capacities, and yearend cement stockpiles are given in table 2.

Portland cement production rose by 3.4% in 1996 to about 75.8 million tons, a new record. As shown in table 2, increases were noted in all but a few States. The top five portland cement producer States continued to be, in descending order, California, Texas, Pennsylvania, Michigan, and Missouri. Nationwide, calculated cement (grinding) capacity utilization levels were at very high levels—almost 84% for the country. This statistic, however, is misleading in that it compares only the portland cement output with the reported grinding capacity. In reality, the masonry cement tonnage (table 3) should be incorporated, which would increase the overall grinding capacity utilization for the country to almost 88%. Given the fact that the reported capacities exclude downtime for unexpected maintenance, the utilization levels shown are likely very close to practical limits. Whether the 1995-96 changes in capacity utilization or in the capacities themselves are statistically significant for all regions remains unclear. Although a number of plants were involved with capacity improvement projects to one degree or another, some of the changes shown could simply reflect a difference in reporting personnel or in their data rounding from one year to the next.

Yearend portland cement stockpiles were down 0.4 million tons compared with those in 1995, but remained almost 0.7 million tons higher than those at yearend 1994. Although a reduction in 1996 stockpiles is in line with high levels of demand for cement, an analysis of the contribution of cement stockpiles to true consumption is precluded because of the absence of data on stocks of clinker, the intermediate product. As noted in the "Clinker" section, clinker output was inadequate to account for the portland cement production.

Data are not collected on the production of portland cement, by type, but production was probably proportional to the reported shipments, by type, shown in table 15. As in previous years, portland cement Types I and II presumably accounted for about 90% of total output.

Cement producers in the United States ranged from companies having a single plant of less than 0.5% of total U.S. capacity to large multiplant corporations. The largest of these had 13% of total U.S. cement production capacity. The top 10 companies in 1996, combined, accounted for 59.4% and 59.9% of total U.S. portland cement production and capacity, respectively. Their combined grinding capacity utilization averaged 83%. The top 10 companies were, in descending order of production, Holnam, Inc.; Lafarge Corp.; Southdown, Inc.; Ash Grove Cement Co.; Blue Circle Inc.; Essroc Materials, Inc.; Lone Star Industries, Inc.; California Portland Cement Co.; Medusa Corp.; and Lehigh Portland Cement Co.

Masonry Cement.**—**Reported production of masonry cement, as shown in table 3, declined modestly in 1996 to about 3.5 million tons (about 4% of total U.S. cement output). This was in contrast to increased demand, as evidenced by the shipments data in tables 8 and 12. At least some of the excess demand appears to have been met by drawing down masonry stockpiles; imports, however, may not account for the remainder. The amount of masonry shipments reported as of foreign origin (imports) in table 8 was substantially unchanged in 1996, and the trade data in tables 17 through 21 do not split out this cement type. Masonry cement continued to be produced by 32 companies at 84 plants, all but 1 of which also produced portland cement. Although not shown in table 3, of the masonry cement produced, 89% was made directly from clinker (vs. from portland cement) in 1996 and 93% was so derived in 1995.

Clinker.**—**Table 4 provides district-level information on clinker production and capacity. Including the facilities in Puerto Rico, clinker was produced by 111 integrated cement plants, operating 207 kilns. Almost two-thirds of the kilns used dry-process technology. Clinker production increased in 1996 by

0.5% to about 70.4 million tons, and calculated capacity utilization increased slightly to almost 95%. After excluding the clinker needed to make masonry cement (not reported, but estimated to be about 2.1 million tons), the remaining clinker (about 68.3 million tons) would be adequate to account for about 71.9 million tons of portland cement—about 3.9 million tons less than that actually produced. The clinker deficit (estimated to be about 3.7 million tons) was only partially compensated for by clinker imports [2.1 million tons (table 5) or 2.5 million tons (table 21)], leaving a 0.6 million to 1.6 million ton deficit that implies a significant drawdown of clinker stockpiles during the year. Although quantitative data were lacking, a number of cement companies orally reported a decline in their yearend clinker stockpiles. Ultimately, evaluation of the significance of a yearend decline would be difficult, as clinker stockpiles commonly show significant seasonal variations, especially with respect to planned kiln maintenance periods.

The increase in the total U.S. capacity utilization rate could be artificial as it is dependent on reported daily and calculated annual capacities, both of which declined about 2% in 1996. The capacity declines were unexpected as the 1996 data include a small plant in Nevada that was not incorporated in the 1995 data, as well as a new dry kiln in Wyoming. Further, the 1996 capacity data include Hawaiian Cement, despite the fact that it permanently shut its kiln in August; its inclusion, however, does not significantly affect the U.S. declines shown. There were no permanent shutdowns in 1995 that could have decreased the 1996 capacity basis. Past surveys have revealed inconsistencies for some plants in the reporting of scheduled vs. unscheduled downtime; only the scheduled downtime influences the calculated annual capacities. Accordingly, the total capacity declines for 1996 may include a measure of reporting or definitional errors. Notwithstanding these problems, the data indicate that U.S. cement kilns clearly operated at essentially full practicable capacity, as in 1995. The average operational plant capacity was about 0.36 million tons, slightly below that reported in 1995 but subject to the uncertainties given above. As shown in table 6, (entirely) dry-process plants accounted for 71.5% of total clinker production; wet plants for 25.8%; and combination plants for the remainder.

The top five clinker-producing States continued to be, in descending order, California, Texas, Pennsylvania, Missouri, and Michigan. The top 5 companies had about 38% of total U.S. clinker production and capacity, and the top 10 companies had about 59% of both. The top 10 companies were, in declining order of clinker output, Holnam, Inc.; Lafarge Corp.; Southdown, Inc.; Ash Grove Cement Co.; Blue Circle Inc.; Lone Star Industries, Inc.; Essroc Materials, Inc.; Medusa Corp.; California Portland Cement Co.; and Lehigh Portland Cement Co.

Consumption of Raw Materials and Energy.—The nonfuel raw materials used to produce cement, most of which were consumed in clinker manufacturing, are shown in table 5. As normal, about 85% of the raw materials mix was limestone and other calcareous rocks. The small decline in limestone consumption appeared to have been balanced, in terms of CaO credits, by the large increase in the consumption of cement rock (impure limestone). The cement rock also would have added significant silica credits that, together with the higher consumption of clay, could have more than offset the reduced consumption of shale, sand, and sandstone. Similarly, any iron and aluminum deficits from reduced shale consumption appeared to have been more than offset by the cement rock and increased consumption of clay, iron ore, and similar materials.

The increase in gypsum consumption shown is almost exactly proportional to that in cement production. Likewise, the modest increase in slag consumption is proportional to that in blended (with slag) cement sales shown in Table 15, assuming that the sales mirror the production and that, as seems likely, the slag was all used as a cement extender. In contrast, the fly ash consumption shown in table 5 clearly exceeds that used in fly ash blended cements (per sales in table 15) and indicates that most of the fly ash was being used as kiln feed.

Consumption of fuels, by kiln process, is shown in table 6. The table differs from that in previous editions of this report in that coke and petroleum coke are now listed separately from coal. Overall, coal consumption increased modestly, although part of this increase was offset by a decline in petroleum coke use. The burning of waste tires and other solid waste fuels increased. Most of the solid fuel consumption increases were at dry-process plants. Fuel oil consumption increased 52%, especially by wet-process plants (up 121%). Liquid waste fuel consumption also increased, also mostly by wet plants. In contrast, natural gas consumption fell by about one-third at both types of plants, indicating that coal and oil were being substituted for gas, probably because of the more than 50% average unit price increase for gas during the year (Oil & Gas Journal, 1997a). Although not shown in table 6, estimates may be made of the energy content of the fuels consumed by using standard heat conversions. For the waste fuels (undifferentiated), however, the energy content assignment error may be significant. The analysis further assumes the same heat content for the same fuel type in both years. On this basis, it was estimated that wet kilns used about 4% less total energy in 1996 than in 1995 and that dry kilns showed no significant change. Given that clinker output by wet kilns fell by 1.5% in 1996, and output by dry kilns increased by 1.4%, the estimated reduction in energy consumption suggests that most of the kilns, especially the wet-process lines, showed improved fuel consumption efficiencies in 1996.

Table 7 shows electricity consumption by integrated cement plants, by kiln-process type. The table differs from previous versions in that the unit consumption is now calculated for total finished cement (including masonry) instead of just for portland; for 1995, this revision has caused the average consumption to drop by 4 kilowatt hours per ton. Electricity consumption at integrated plants is dominated by the raw meal and finished cement comminution circuits. In modern dry lines, significant amounts of electricity also are used to operate various fans and blowers in preheater and precalciner equipment. Thus, dry-process kiln lines—at least those equipped with preheaters and/or precalciners—consume more electricity than equivalent capacity wet-process lines. For 1996, unlike the fuel consumption decreases noted above, per-ton (cement) electricity consumption showed no change for wet-process lines and increased by 1% and 2% for the dry- and the combined-process lines, respectively. The average cement-to-clinker production tonnage ratio increased by 2.9% to 1.08. This suggests that the higher unit electricity consumption in 1996 reflects increased electricity use by the finished cement grinding circuits. Raw materials crushing, or the kiln lines, may also have used proportionately more electricity in 1996. Unfortunately, data to evaluate this are not available.

Consumption of Cement

Data for cement shipments to final customers are accepted as being a proxy for true consumption levels in the United States. In contrast, shipments by one cement producer to another, whether or not of the same company, are not counted until, ultimately, the cement is sold to a final customer. The determination of what is and is not a "final customer" is left to the reporting cement producer. "Final customer" is understood to include concrete manufacturers, building supply dealers, construction contractors, and the like. The designation ignores the possibility that a customer might put some cement into stockpiles extending beyond yearend (to be "consumed" the following year) or might resell cement to other users. There are no data on such storage or transfers, but they are believed to be small—probably no more than 5% of any 1-month's shipments—and would likely balance out over a period of months.

Cement shipments data and derivations therefrom are given in tables 8 through 15. These tables reflect two data-collection methodologies. Tables 8 and 9 contain the annualized shipments data that are collected monthly from the cement-producing companies and from the cement importers. The monthly surveys commonly are returned on a consolidated basis—one form representing a company's entire cement shipment activities. Importantly, these surveys capture the activities of a company's importation and distribution terminals. Tables 10 through 15, in contrast, are based on annual surveys sent to all of the cement-producing plants and certain independently-owned import terminals. The annual forms are not returned on a consolidated-operations basis. A plant may report the shipment (to final customers) activities of a distribution terminal only to the extent that activities of the terminal are known to the plant. If the terminal acts partly or totally independently of the reporting plant, then some of the shipments from the terminal may remain unreported to the USGS.

Not surprisingly over the years, differences in the totals from the two survey types have been significant. For example, table 8 (monthly surveys) shows portland cement shipments to final customers (excluding exports) of about 82.9 million tons in 1995 and 87.6 million tons in 1996. Table 11 (annual surveys) shows shipments of 75.0 million tons in 1995 and 81.5 million tons in 1996. Both surveys include cement made from imported clinker and imported cement shipped out by the reporting entity. The difference in shipments—7.9 million tons in 1995 and 6.1 million tons in 1996—most likely reflects the cement importing activities of terminals not captured in the annual surveys (e.g., table 11). Accordingly, the preferred consumption data are those based on the complete monthly data; that is, tables 8 and 9.

Comparison of tables 8 and 9 with tables 11 and 12 also reveal differences on a State or district level. Tables 11 and 12 show a mix of State and district data where needed to conceal proprietary data. The mix is necessary because the annual surveys collect data from producers, and the regions shown are the originating districts, not the destinations, of the shipments. Except for masonry cement shipments for a small number of States, this precaution is not necessary for the shipments by destination data in table 8. The distinction between "origins" and "destinations" of shipments also explains why State data in table 8 differ from individual State data (where shown) in table 11. For example, table 8 shows Alabama as being the destination (consumer) of 1.47 million tons of portland cement in 1996, but table 11 shows Alabama as being the origin of 4.14 million tons of portland sold to final customers. Clearly, Alabama cement producers sold material to final customers outside of Alabama. Table 8 shows North Texas as having consumed 4.37 million tons of portland cement in 1996, but table 11 shows North Texas plants as shipping only 3.56 million tons. Clearly, North Texas consumers brought in cement from outside the region.

Although the monthly-based data in tables 8 and 9 are the preferred consumption data, no attempt has been made to reconcile these data with the annual data on shipments by type of cement, by mode of transportation, or by value, or the like. To maintain internal consistency, the annual shipment totals (e.g., tables 11 and 12) are used wherever these other annual data are presented.

National Consumption.—Table 8 shows that overall U.S. portland cement consumption increased by 5.6% in 1996 to about 87.6 million tons. Of the total shipments, those representing imports decreased slightly, but the change is partly administrative. A change was made in the reporting methodology for shipments in 1996 wherein all cement ground from imported clinker was to now be credited as having originated in the United States. For 1995 and prior years, some companies had reported this cement as being of foreign origin. It was, however, impractical to adjust the pre-1996 data. Imports of finished cement (all years) were unaffected by the reporting change. Consumption reflected a largely countrywide increase in construction. According to Bureau of Census data quoted by the Portland Cement Association (1996b), total construction spending grew by 1.9% in 1996 to $495.8 billion (1992-basis dollars). Within this, the largest gains were seen in residential construction: single-family housing construction spending grew by 6.6% to $135.5 billion, and multiple-family housing grew by 10.2% to $17.3 billion. In 1995, this interest-rate-sensitive sector had declined in line with modest increases in mortgage rates. The mortgage rates continued to increase, although remaining at modest levels, until the fourth quarter of

1996, when they declined somewhat. The residential construction increase in 1996 thus appears to reflect an overall stronger economy and pent-up demand. These factors also appeared to have helped private nonresidential construction, which grew by 3.0% to $123.4 billion. Public sector spending was, overall, stagnant at $123.9 billion. Within this, public building construction grew by 4.1% to $55.6 billion, but the important highway/street construction sector fell by 1.4% to $34.4 billion.

As shown in tables 8 and 9, most States and all regions showed consumption increases for the year, although there were some monthly regional declines (not shown) due to poor weather conditions. The largest growth regions were the Midwest and the West, notwithstanding the fact that the Mountain district within the West also had the majority of the (few) States nationwide that showed declines for the year. The declines were more than offset by strong increases in Arizona, Colorado, and Nevada, all of which were experiencing high population growth. Nevada also continued to see growth in consumption by the mining industry. For the country, the five largest portland-cement-consuming States continued to be, in declining order, Texas, California, Florida, Ohio, and Georgia. The South was again the largest cement-consuming region.

Reported masonry cement consumption increased by 6.7% overall, although, as noted in the definitions section of the introduction, the data likely underrepresent the true consumption of this type of cement. The increase largely reflects that in the residential construction sector.

Table 10 shows portland cement shipments to final customers in terms of transportation method. As in 1995, most shipments were directly from the plant to the customer and were mainly of bulk cement. Truck transport dominated deliveries to final customers, but not of deliveries from plant to distribution terminals.

Prices.—The price or value data shown in tables 11 through 13 represent ex-plant valuations by the mill of cement shipments to final customers. Although the plants are asked to provide annual portland cement shipment data, by tonnage and type (table 15), they are not asked for details concerning the value of the sales, by type, in recognition of some companies' misgivings about providing any value data at all. Instead, the values are queried only as totals for all shipments—one total for gray portland cement (all types), another for white portland cement, and another for masonry cement. Even with this accommodation, about one-fourth of the respondents did not provide value data for the 1996 survey, about the same as in previous years. In such cases, the values supplied by other plants in the same market area were averaged and applied; the number of plants so averaged varied regionally. The unit values shown are calculated averages for the whole year and do not reveal temporal variations. Further, the values represent the combined total or average of bulk and container (bag) shipments. In reality, the unit price difference between the two forms of shipments (bulk being cheaper) is significant. These and other variables preclude detailed error analysis of the results. The reader is cautioned that the value data are merely estimates, despite the fact that, to preserve a time series with previous editions of this report, they are presented unrounded. The data should be viewed solely as regional price indicators, suitable only for crude comparisons among districts and years. Although the data are thus not actual prices for specific type(s) of cement, the values shown for portland cement in tables 11 and 13 may be assumed to be dominated by the Types I and II varieties.

The ex-plant value of portland cement shipments to final domestic customers is shown in table 11. The total value rose almost by 14% in 1996 to about $5.7 billion, reflecting increased sales volume and, within the aforementioned data constraints, an ex-plant unit price (indicator) increase of almost 5%. If the average price shown is applied to the shipments data in table 8, then the total rises to almost $6.2 billion. Ignoring price-indicator changes of less than $0.50 per ton (which are almost certainly of no statistical significance), district unit price increases were seen in all except a few districts. The largest decreases (Maine-New York and Alaska-Hawaii-Oregon-Washington) appear to be, at least in part, aberrations reflecting incomplete reporting in one or both years. Average price (including freight) data for regional imports of hydraulic cement plus clinker (see table 18) suggest that some of the decreases shown (Oregon, Hawaii, Maine, New York, and possibly Florida) could partly reflect import price decreases. However, although far less detailed, the gray portland import data in table 19 suggest that the decreases seen in table 18 may be due more to clinker than to cement. Although not shown in the tables, the change in these districts in the consumption of expensive portland cements (such as white cement) was insufficient to account for the value decreases shown.

In table 12, masonry cement values show a total increase of more than 14% to almost $323 million and an average 6.0% price increase. In contrast to portland cement, if the average masonry unit value shown is applied to the consumption data in table 8, then the total value decreases to about $312 million. This decrease reflects the lower tonnage in table 8; a similar relation was seen for 1995 relative to 1994. A possible explanation for this tonnage difference, which is the reverse of that expected from the data-collection methodologies, is that the table 12 tonnages may include late-year shipments from plants that were destined for final customers, but that were not invoiced until the following year, or shipments that wound up in stockpiles at terminals. A summary of average cement ex-plant values, by major type, is given in table 13.

The only data for domestic delivered prices for cement are those for Type I portland (per short ton) and masonry cement (per 70-pound bag) published monthly by the journal *Engineering News Record*. The data represent a survey of customers (likely to be ready mixed concrete producers for portland cement and building supply depots for masonry) in 20 cities in the United States. The 20-city average delivered price in 1996 for Type I portland converts to $80.35 per metric ton, up by 6% from the 1995 price, with a range over the year of only $2.54 per ton. Prices showed a general increase from January to December ($81.32). The city data show a number of regional price differences, some of which differ significantly from those shown in table 11. The variations could reflect regional differences in shipping methods and costs. The prices for some cities covered, however, did not vary at all over the year, making their validity and that of the national average questionable. The 20-city average masonry cement price for the year was $4.47 per bag (literally converts to $140.78 per ton) and ranged only $0.11 per bag over the year.

Cement Customer Types.—Table 14 presents data on portland cement shipments to final customers broken out by customer type. Although presented in unrounded form, these data are less reliable than any of the other data collected in the annual survey, with the exception of the value data, as explained earlier. Unlike the value data, however, the main problem with the customer-type data is not a lack of survey responses, but the fact that the questionnaire asks for more details on customer types than many cement companies are able to provide. Even for companies tracking their customers' usages in detail, the assignment of cement sales tonnages to the 15 use(r) categories on the questionnaire can still be a problem. For example, a company may know that a certain ready-mixed concrete customer used X tons of cement (in ready-mixed concrete) for road paving contracts. The dilemma, then, is whether to register those tons under the ready-mixed category or the road paving category. Another example would be the "Government agencies" use category on the questionnaire—Government use could include ready-mixed concrete, or road paving, or other duplicative use(s). The "Other" category on the questionnaire, which is intended to mean "miscellaneous," is used by some cement plants use as a catch-all. Further, although generally listed as exact tonnages, some company responses calculate to simple (broad) percentages of the total shipments—the breakdown being the "best guess" of that cement plant. In a few instances, the apportioning appears to have been guided by past published breakdowns. Ultimately, then, the problem is partly interpretational: "type of customer" is not exactly the same thing as "type of use."

Notwithstanding these limitations, the data in table 14 clearly indicate that the dominant customer type for portland cement in 1996 continued to be ready-mixed concrete producers. As listed, cement for ready-mixed concrete (customers) accounted for about 60% of total cement shipments (61% in 1995). Of the total shipments listed under "Government and miscellaneous," however, 50% to 60% likely were used for ready-mixed concrete, which would have then accounted for about 70%. Similarly, the (footnoted) breakout of the "Contractors" category probably understates true consumption for road paving—some cement for this purpose no doubt resides under the "Government and miscellaneous" and the "Ready-mixed concrete" categories. In contrast, the data for concrete products manufacturers, buildings materials dealers, and oil well cement uses are probably fairly accurate. Overall, the relative usage breakdowns are very similar to those of 1995. The largest relative (tonnage) change was in "Oilwell, mining, waste," which increased by almost 24%. The category includes a 43% increase in cement purchases by oil-well drillers (the tonnage is slightly less than that shown for oil-well cement sales in table 15). The "oil well" increase is in accord with heightened drilling activity during the year, as evidenced by a much higher drill rig count (Oil & Gas Journal, 1997b) and the increased consumption of barite by the petroleum exploration industry (Searls, 1997). Although the cement customer types are shown in table 14 on a District basis, the data reflect the origins of the cement, not the locations of the customers, and are thus only an indirect regional indicator of portland cement usage.

Types of Portland Cement Consumed.—As shown in table 15, portland cement consumption in the United States remained dominated by general-use Types I and II. Within the broad use of the portland term, Types I through V accounted for more than 96% of total shipments. Of these main varieties, Type V cement, which is resistant to so-called sulfate attack, showed the largest relative increase during the year. Of the less common varieties, oil-well cement showed a large relative increase in shipments owing to an increase in drilling activity during the year, as discussed above. White cement (all varieties) showed a large relative increase in sales during the year, owing to a strong residential construction market but remained less than 1% of total U.S. cement consumption. After increasing significantly in 1995, blended cement consumption was surprisingly stagnant in 1996. An increase had been expected, given the common industry perception of a growing market for blended cements. Unfortunately, regional consumption data for blended cements are unavailable; market growth is perhaps present but geographically restricted. As noted above, the true level of "blended" cement consumption is unknown because concrete manufacturers can independently add pozzolans to their concrete mixes to yield, in effect, a blended product. Within the two blended cement categories in table 15, that which includes portland-slag cements can completely accommodate the blast furnace slag consumption noted in table 5. However, the second category, which includes portland-fly ash blends, cannot begin to accommodate the fly ash indicated in table 5. Thus, most of that fly ash must be consumed as kiln feed.

Foreign Trade

Trade data from the Bureau of the Census are shown in tables 16 through 21; tables have been added to the present report to show the splitout of imports of gray portland and white cements. As shown in table 16, total exports of hydraulic cement (all types) and clinker rose almost by 6% in tonnage and almost by 10% in value in 1996; nevertheless, these exports remained but a tiny fraction of total U.S. cement commerce. An estimate of the cement component of the exports can be calculated from those of portland and masonry cement in table 8; such exports amounted to 0.486 million tons in 1995 and 0.461 million tons in 1996. Assuming that exports of other forms of hydraulic cement were substantially nil, the table 8 (portland plus masonry cement) exports are equivalent to 64% and 57% of the total table 16 exports for 1995 and 1996, respectively. Accordingly, clinker (a cheaper product than cement) exports showed a decline in 1996, and thus, the higher overall export value in

1996 must reflect higher cement prices. As in previous years, the bulk of the exports went to Canada.

Table 17 shows total imports of hydraulic cement and clinker for 1995 and 1996. Total imports increased by only 2% in 1996, compared with a 1995-over-1994 increase of almost 23%. On a monthly basis, imports in 1996 were below 1995-levels through November, although there was a surge from September onwards (U.S. Geological Survey, 1996e). Despite steadily rising monthly demand, high domestic cement production levels throughout 1996 and the ability to draw from stockpiles of cement and clinker, appear to have been the main constraints on imports during the year.

The cement component of imports (data in table 17 minus the clinker imports in table 21) was 11.6 million tons, up by 5.6% over that of 1995. The import component of total cement sales shown in table 8 amounts to 11.9 million tons—the higher figure in table 11 probably includes imported material sold from stockpiles. Gray portland cement imports increased by 6.3% in 1996 to 10.1 million tons. As shown in table 19, the landed value (including freight) of gray portland imports averaged $53.82 per ton, up by 3.2%, and substantially below the average value for U.S. sales shown in table 13. Canada continued to be the largest source of portland imports, which increased by 10.9% (tonnage). Imports from Mexico increased by 50.4% from the depressed levels of 1995, notwithstanding high antidumping tariffs (which were under appeal) imposed on imports from that country. White cement imports (see table 20) declined by 10.6% in 1996, although the value rose by 15.4% to $120.65 per ton—well below the domestic sales value indicated in table 13. The imports were equivalent to almost 58% of the white cement sales shown in table 15; imports were equivalent to 72% of white cement sales in 1995. The decline in the apparent import component of sales in 1996 could represent either an increase in domestic production of white cement or greater sourcing of cement from stockpiles during the year.

Clinker import tonnage fell by almost 11%, but increased by 15.5% in value to $48.40 per ton (table 21). Canada remained by far the largest source, although imports declined almost 9%.

World Review

World hydraulic cement production is shown in table 22. Informal, but credible, commentary on past editions of this table suggests the strong possibility that the production numbers reported by some countries may, in fact, include exports of clinker. The countries involved and the degree to which this may be true are not known, but the clinker export component could be significant for some countries. Such a regrettable reporting practice would necessarily lead to overcounting (estimated to be less than 5%) within the world totals because the entire production of some countries, and the partial production of many others, includes cement ground in-country from imported clinker. Given this uncertainty, (unrelated) revisions to past data, and the inclusion within the unrounded world totals of production estimates for a number of countries, the 2.8% increase for 1996 world cement output probably has no statistical significance.

Within the world cement output of about 1.4 billion tons, China remained, by far, the largest producer, with about one-third of the total. The remaining top 10 producers were, in descending order, Japan, the United States, India, the Republic of Korea, Germany, Thailand, Italy, Turkey, and Russia. Comparison of production levels among some countries can be misleading, however, unless they are made for output of similar-quality cements. For example, throughout the world, portland and related cements from clinkers manufactured in large rotary kilns are considered to be generally of high quality. Cements from clinker made in small vertical (shaft) kilns, in contrast, may be of lesser quality; unsuitable for modern highways, bridges, large dams, tall buildings, and the like, or for exports, but perhaps entirely adequate for local demand for small, single-family residences and similar buildings and other low-strength applications. Shaft kilns for cement have been replaced almost entirely by rotary kilns in the so-called developed world but remain common in a number of less-developed countries. Thus, according to recent reviews (e.g., Hargreaves, 1997; Rong and others, 1997), China's cement production would be better viewed as comprising about 50 million tons of high- or export-quality cement from a relatively small number of medium and large rotary kilns and about 440 million tons of cement of uncertain quality from several thousand small shaft kilns (many of which are being phased out).

Even a cursory review of the 1996 cement trade literature (e.g., *International Cement Review*, *Rock Products Cement Edition*, *World Cement*) reveals the fact that new cement plant projects abound in most parts of the developing world; by comparison, the cement industries many of the major western industrial countries seem almost stagnant. The new cement plants being constructed or planned in the developing countries commonly are large and state of the art. Many are owned by the same giant European cement companies that dominate production in Europe and North America; likewise, most of the plant equipment and engineering services were being supplied by European and North American manufacturers.

As in 1995, much of the growth in the international cement market and in production in 1996 was in Asia, particularly in Southeast Asia and China. China is experiencing rapid growth in infrastructural spending and is seeking to replace its multitude of small, village-scale cement plants with large, modern facilities serving larger regions. In some countries in Asia, particularly Indonesia, planned capacity increases appear to be well in excess of anticipated domestic demand and would argue for growth in cement and/or clinker exports. A number of new projects were underway in various countries of the Middle East, and some of these, too, appeared to be geared towards export opportunities. Although activity in Western Europe was largely confined to modest upgrades of existing plants, major upgrade investments (by Western European companies) were underway at recently privatized existing plants in Eastern Europe. New plants and/or plant upgrades were underway in a number of Latin American countries, particularly Brazil. Africa, in contrast, had fewer major projects underway, most of which were in Egypt.

Outlook

World cement demand and production is anticipated to grow steadily at about 2% per year during the next decade, with the developing world generating and absorbing much of the increase. This is in line with predictions of continued high rates of general economic growth but assumes continued availability of venture capital for such high-cost projects as new cement plants.

Data through the third quarter of 1997 yield a projection of U.S. cement consumption for the year 4-5% higher than 1996 levels—somewhat higher than had been expected. Consumption in the medium term was expected to grow more modestly. Cement production in 1997 is predicted to increase only by about 2%, largely owing to the majority of plants already being operated at full practical capacity. Although several million tons of additional domestic production capacity was expected to be available by the year 2000, imports were anticipated to continue to play a major role in the U.S. cement market, at least in the short term. Indeed, cumulative imports, as of midyear 1997, were more than 25% higher than for the same period in 1996. As always, market growth could be constrained by higher interest rates, which especially affect the residential construction market. And public sector construction funding levels will continue to be important.

An important constraint on future domestic cement production increases will be any imposition of restrictive environmental legislation, particularly that requiring a majority of plants to reduce emissions to match that of their larger and more-modern competitors, and to restrict the ability of the industry to cheaply use waste fuels. If restrictions or taxes on CO_2 emissions are imposed, then the U.S. industry would find itself at a competitive disadvantage to imports from countries exempted from similar restrictions or taxes; absent protective tariffs, some shutdowns of domestic capacity could take place. Environmental cost increases could partly be mitigated by increasing the utilization of nonclinker components of cement, such as pozzolan or inert extenders.

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TABLE 1
SALIENT CEMENT STATISTICS 1/ 2/

(Thousand metric tons unless otherwise specified)

		1992	1993	1994	1995	1996
United States: 3/						
Production 3/ 4/		69,585	73,807	77,948	76,906	79,266
Shipments from mills 3/ 5/		69,203	72,770 r/	79,087 r/	78,518 r/	84,955
Value 3/ 5/	thousands	$3,779,286	$4,174,819 r/	$4,844,869 r/	$5,329,187 r/	$6,044,944
Average value per ton 3/ 6/		$54.61	$55.65 r/	$61.26 r/	$67.87 r/	$71.15
Stocks at mills, 3/ Dec. 31		5,272	4,788	4,701 r/	5,886 r/	5,488
Exports 7/		746	625	633	759	803
Imports for consumption:						
Cement 8/		4,582	5,532	9,074 r/	10,969	11,565
Clinker		1,532	1,507	2,206 r/	2,789	2,401
Total		6,114 r/	7,040 r/	11,280 r/	13,758 r/	13,967
Consumption, apparent 9/		74,158 r/	79,198 r/	86,476 r/	85,931 r/	90,426
World: Production e/ 10/		1,123,143 r/	1,292,379 r/	1,372,427 r/	1,443,689 r/	1,484,564

e/ Estimated. r/ Revised.
1/ Portland and masonry cement only, unless otherwise indicated.
2/ Excludes Puerto Rico.
3/ Includes cement made from imported clinker.
4/ Shipments are to final customers. Includes imported cement. Data are based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated monthly shipments data from companies.
5/ Plant valuation (f.o.b.) of portland (all types, including white) and masonry cement shipments from mills to final customers. Although presented unrounded, the data contain estimates for some plants.
6/ Total plant valuation (f.o.b.) of cement shipments to final customers divided by total tonnage of same. Although presented unrounded, the data contain estimates for some plants.
7/ Hydraulic cement (all types) plus clinker.
8/ Hydraulic cement, all types.
9/ Production (including that from imported clinker) of hydraulic cement plus imports of cement minus exports of cement minus change in stocks.
10/ Total hydraulic cement. May incorporate clinker exports for some countries. Includes estimates for some countries.

TABLE 2
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

	1995 2/					1996 3/				
			Capacity 4/		Stocks 5/			Capacity 4/		Stocks 5/
District	Plants active	Produc- tion 6/	Finish grinding	Percent utilized	at mills, Dec. 31	Plants active	Produc- tion 6/	Finish grinding	Percent utilized	at mills, Dec. 31
Maine, New York	4	2,937	3,937	74.6	317	4	2,966	3,348	88.6	234
Pennsylvania, eastern	8	4,045	5,019	80.6	355	7	4,057	5,152	78.7	243
Pennsylvania, western	4	1,565	2,009	77.9	146	4	1,615	2,009	80.4	105
Illinois	4	2,559	3,379	75.7	210	4	2,619	2,871	91.2	149
Indiana	4	2,328	2,597	89.6	253	4	2,347	2,731	85.9	185
Michigan	5	5,399	6,999	77.1	336	5	5,387	6,999	77.0	295
Ohio	3	1,049	1,588	66.1	94	3	1,054	1,588	66.4	62
Iowa, Nebraska, South Dakota	5	3,724	5,576	66.8	364	5	3,931	5,489	71.6	322
Kansas	4	1,725	1,774	97.2	185	4	1,725	1,783	96.7	149
Missouri	5	4,362	5,059	86.2	395	5	4,531	5,150	88.0	410
Florida	6	3,166	4,382	72.3	195	6	3,445	4,667	73.8	280
Georgia, Virginia, West Virginia	5	2,426	3,700	65.6	243	5	2,473	3,700	66.8	219
Maryland	3	1,670	1,837	90.9	192	3	1,609	1,837	87.6	105
South Carolina	3	2,210	3,067	72.1	111	3	2,368	3,075	77.0	85
Alabama	5	4,091	4,755	86.0	261	5	4,326	4,804	90.0	271
Kentucky, Mississippi, Tennessee	4	2,107	2,474	85.2	216	4	2,216	2,474	89.6	187
Arkansas, Oklahoma	4	2,544	2,717	93.6	202	4	2,553	2,889	88.4	191
Texas, northern	6	3,807	4,512	84.4	229	6	3,906	4,712	82.9	270
Texas, southern	5 7/	4,285	4,717	90.8	227	5	4,332	4,726	91.7	218
Arizona, New Mexico	3	2,061	2,333	88.3	47	3	2,217	2,140	103.6	63
Colorado, Wyoming	4	1,851	2,377	77.9	90	4	2,031	2,377	85.4	125

See footnotes at end of table.

TABLE 2
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

	1995 2/					1996 3/				
			Capacity 4/		Stocks 5/			Capacity 4/		Stocks 5/
District	Plants active	Produc- tion 6/	Finish grinding	Percent utilized	at mills, Dec. 31	Plants active	Produc- tion 6/	Finish grinding	Percent utilized	at mills, Dec. 31
Idaho, Montana, Nevada, Utah	7 r/	2,206	2,445	90.2	155	7	2,216	2,696	82.2	209
Alaska, Hawaii	1	357	499	71.5	56	1	312	499	62.5	45
California, northern	3	2,554	2,867	89.1	107	3	2,610	2,880	90.6	125
California, southern	8	6,808	7,899	86.2	250	8	7,297	7,943	91.9	279
Oregon, Washington	3	1,467	1,796	81.7	124	4	1,655	1,960	84.4	133
Total or average 8/	116 r/	73,303	90,316	81.2	5,359	116	75,797	90,497	83.8	4,959
Puerto Rico	2	1,414	2,004	70.6	40	2	1,552	2,004	77.4	37

r/ Revised.
1/ Includes Puerto Rico.
2/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas. Includes data for grinding plants as follows: California, Florida (2), Iowa, Michigan, Ohio, Pennsylvania, and Texas.
3/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas. Includes data for grinding plants as follows: Florida (2) Michigan (2), Ohio, Virginia, and Washington.
4/ Grinding capacity based on fineness necessary to grind Types I and II cement, making allowance for downtime required for routine maintenance.
5/ Includes imported cement.
6/ Includes cement produced from imported clinker.
7/ Excludes one additional plant that was operational January through April.
8/ Data may not add to totals shown because of independent rounding.

TABLE 3
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

	1995			1996		
District	Plants active	Production 2/	Stocks 3/ at mills, Dec. 31	Plants active	Production 2/	Stocks 3/ at mills, Dec. 31
Maine, New York	4	100	18	4	102	16
Pennsylvania, eastern	6	186	38	6	170	31
Pennsylvania, western	4	81	13	4	105	16
Illinois	1	--	--	1	--	--
Indiana	4	W	W	4	W	W
Michigan	5	229	26	5	232	28
Ohio	2	W	W	2	W	W
Iowa, Nebraska, South Dakota	4	51	17	4	W	6
Kansas	3	31	10	3	24	9
Missouri	1	W	W	1	W	W
Florida	4	383	31	4	422	26
Georgia, Virginia, West Virginia	4	319	34	4	376	32
Maryland	2	W	W	2	W	W
South Carolina	2	W	W	2	286	W
Alabama	5	306	45	5	309	37
Kentucky, Mississippi, Tennessee	3	108	15	3	W	W
Arkansas, Oklahoma	4	110	19	4	117	21
Texas, northern	4	W	8	4	W	8
Texas, southern	5	98	7	5	100	7
Arizona, New Mexico	3	W	W	3	W	W
Colorado, Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	4	W	W	4	W	W
Alaska, Hawaii	1	5	1	1	5	1
California, northern	1	W	W	1	W	W
California, southern	3	149	W	3	160	W
Oregon, Washington	3	W	W	3	W	W
Total or average 4/	84	3,603	455	84	3,469	380

W Withheld to avoid disclosing company proprietary data; included in "Total or average."
1/ Excludes Puerto Rico (did not produce any masonry cement).
2/ Includes cement made from imported clinker.
3/ Includes imported cement.
4/ Data may not add to totals shown because of independent rounding.

TABLE 4
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 1996, BY DISTRICT

District	Active plants 1/ Process used Wet	Dry	Both	Total	Number of kilns	Daily capacity (thousand metric tons)	Average number of days routine mainte-nance	Apparent annual capacity 2/ (thousand metric tons)	Produc-tion 3/ (thousand metric tons)	Percent utilized
Maine, New York	3	1	--	4	5	9	60	2,911	2,741	94.2
Pennsylvania, eastern	2	5	--	7	14	13	37	4,360	3,869	88.7
Pennsylvania, western	3	1	--	4	8	6	44	1,823	1,669	91.6
Illinois	--	4	--	4	8	8	33	2,655	2,557	96.3
Indiana	2	2	--	4	8	8	29	2,865	2,355	82.2
Michigan	1	2	--	3	8	13	29	4,434	4,116	92.8
Ohio	1	1	--	2	3	3	W	W	W	88.4
Iowa, Nebraska, South Dakota	--	4	1	5	9	13	48	4,195	3,635	86.7
Kansas	2	2	--	4	11	4	34	1,364	1,619	118.7
Missouri	2	3	--	5	7	14	32	4,410	4,195	95.1
Florida	2	2	--	4	7	9	35	2,961	2,957	99.9
Georgia, Virginia, West Virginia	1	2	1	4	12	9	46	3,019	2,432	80.6
Maryland	1	2	--	3	7	5	55	1,692	1,562	92.3
South Carolina	2	1	--	3	7	7	25	2,507	2,175	86.8
Alabama	--	5	--	5	6	12	33	3,892	3,886	99.8
Kentucky, Mississippi, Tennessee	2	2	--	4	5	6	27	2,153	2,054	95.4
Arkansas, Oklahoma	2	2	--	4	10	8	20	2,756	2,506	90.9
Texas, northern	3	3	--	6	14	13	43	4,015	3,834	95.5
Texas, southern	--	4	1	5	6	13	31	4,286	4,208	98.2
Arizona, New Mexico	--	3	--	3	9	6	25	2,256	2,110	93.5
Colorado, Wyoming	1	3	--	4	7	6	45	2,066	1,828	88.5
Idaho, Montana, Nevada, Utah	4	3	--	7	10	7	34	2,093	2,079	99.3
Alaska, Hawaii	--	1	--	1	1	1	15	260	124	47.7
California, northern	--	3	--	3	3	9	56	2,637	2,509	95.1
California, southern	--	8	--	8	17	20	32	6,429	7,034	109.4
Oregon, Washington	1	2	--	3	3	4	W	W	W	127.2
Total or average 4/	35	71	3	109	205	228	36	74,155	70,361	94.9
Puerto Rico	--	2	--	2	2	5	6	1,797	1,345	74.8

W Withheld to avoid disclosing company proprietary data; included in "Total or average."
1/ Includes white cement plants.
2/ Calculated on the basis of individual company data using 365 days minus reported days for routine maintenance multiplied by the reported unrounded daily capacity.
3/ Includes production reported for plants that shut down during the year.
4/ Data may not add to totals shown because of independent rounding.

TABLE 5
RAW MATERIALS USED IN PRODUCING CEMENT
IN THE UNITED STATES 1/ 2/ 3/

(Thousand metric tons)

Raw materials	1995	1996
Calcareous:		
Limestone (includes aragonite, marble, chalk)	80,142	80,016
Cement rock (includes marl)	24,164	25,746
Coral	680	682
Aluminous:		
Clay	4,294	4,747
Shale	4,378	4,202
Other (includes staurolite, bauxite, aluminum dross, alumina, volcanic material, other)	967	1,127
Siliceous:		
Sand and calcium silicate	2,210	2,153
Sandstone, quartzite, other	741	640
Ferrous: Iron ore, pyrites, millscale, other	1,523	1,691
Other:		
Gypsum and anhydrite	3,997	4,126
Clinker, imported 4/	2,635	2,133
Blast furnace slag	130	133
Fly ash	1,396	1,261
Other, n.e.c.	82	56
Total 5/	127,339	128,713

1/ Includes Puerto Rico.
2/ Nonfuel materials only.
3/ Includes portland and masonry cement.
4/ Outside purchases by producing plants; excludes purchases of domestic clinker.
5/ Data may not add to totals shown because of independent rounding.

TABLE 6
CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY 1/
IN THE UNITED STATES, 2/ BY PROCESS

	Clinker produced			Fuel consumed					Waste fuel		
Kiln process	Plants active	Quantity (thousand metric tons)	Percentage of total	Coal (thousand metric tons)	Coke (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
1995:											
Wet	35	18,775	26.3	2,351 3/	110	503	13,624	327,798	31	62	626,436
Dry	72	50,529	70.9	5,664 3/	346	943	28,190	635,786	122	6	258,150
Both	3	1,953	2.7	225 3/	--	28	--	105,459	5	--	--
Total 4/	110	71,257	100.0	8,241 3/	455	1,475	41,814	1,069,044	158	68	884,586
1996:											
Wet	35	18,502	25.8	2,343	101	492	30,158	223,986	42	54	649,978
Dry	73	51,240	71.5	6,140	357	776	33,558	411,323	142	18	260,175
Both	3	1,964	2.7	281	--	28	--	74,343	7	--	--
Total 4/	111	71,706	100.0	8,764	458	1,295	63,716	709,652	191	72	910,153

1/ Includes portland and masonry cement. Excludes grinding plants.
2/ Includes Puerto Rico.
3/ Revised to exclude coke and petroleum coke.
4/ Data may not add to totals shown because of independent rounding.

TABLE 7
ELECTRIC ENERGY USED AT CEMENT PLANTS
IN THE UNITED STATES, 1/ BY PROCESS

	Electric energy used							
	Generated by cement plants		Purchased		Total			
Kiln process	Number of plants	Quantity (million kilowatt-hours)	Number of plants	Quantity (million kilowatt-hours)	Quantity (million kilowatt-hours)	Percentage	Finished cement 2/ produced (thousand metric tons)	Average consumption (kilowatt-hours per ton of cement produced)
1995:								
Wet	--	--	34	2,682	2,682	24.6	19,595 r/	137 r/
Dry	5	574	70	7,355	7,930	72.7	53,389 r/	149 r/
Both	--	--	3	298	298	2.7	2,014 r/	148 r/
Total 3/	5	574	107	10,335 r/	10,909 r/	100.0	74,998 r/	145 r/
Percent of total electric energy used	--	5	--	95	--	--	--	--
Adjustments 4/	--	--	2 r/	--	--	--	1,094 r/	--
1996:								
Wet	--	--	34	2,700	2,700	24.0	19,778	137
Dry	4	500	72	7,847	8,347	68.3	55,610	150
Both	--	--	3	320	320	2.6	2,123	151
Total 3/	4	500	109	10,867	11,368	100.0	77,512	147
Percent of total electric energy used	--	4	--	96	--	--	--	--
Adjustments 4/	--	--	2	--	--	--	1,059	--

r/ Revised.
1/ Includes Puerto Rico. Excludes grinding plants.
2/ Includes portland and masonry cement.
3/ Data may not add to totals shown because of independent rounding.
4/ Tonnage of cement by two plants that did not report any electricity consumption.

TABLE 8
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

	Portland cement		Masonry cement	
Destination and origin	1995	1996	1995	1996
Destination:				
Alabama	1,389	1,474	121	133
Alaska	108	100	W	W
Arizona	2,266	2,516	W	W
Arkansas	937	905	54	56
California, northern	2,984	3,226	2	4
California, southern	5,118	5,239	W	W
Colorado	1,634	1,891	21	21
Connecticut 3/	607	654	13	12
Delaware 3/	223	240	9	9

See footnotes at end of table.

TABLE 8-Continued
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1995	Portland cement 1996	Masonry cement 1995	Masonry cement 1996
District of Columbia 3/	107	115	(4/)	1
Florida	5,769	6,082	465	538
Georgia	3,045	3,179	214	233
Hawaii	358	313	5	5
Idaho	463	449	1	1
Illinois, excluding Chicago	1,439	1,538	31	35
Chicago, metropolitan 3/	1,864	1,943	45	43
Indiana	1,859	1,947	92	93
Iowa	1,429	1,601	12	12
Kansas	1,339	1,527	15	16
Kentucky	1,195	1,258	91	93
Louisiana 3/	1,747	1,751	50	53
Maine	210	212	5	5
Maryland	1,092	1,179	79	73
Massachusetts 3/	1,036	1,074	26	24
Michigan	2,712	2,992	126	143
Minnesota 3/	1,579	1,605	32	32
Mississippi	865	931	52	56
Missouri	2,234	2,269	44	41
Montana	274	273	1	1
Nebraska	982	994	9	10
Nevada	1,483	1,803	(4/)	1
New Hampshire 3/	256	275	7	7
New Jersey 3/	1,410	1,471	57	61
New Mexico	708	747	7	8
New York, eastern	491	484	29	21
New York, western	754	759	31	31
New York, metropolitan 3/	1,078	1,203	39	42
North Carolina 3/	2,218	2,259	263	273
North Dakota 3/	310	300	3	4
Ohio	3,533	3,725	181	190
Oklahoma	1,105	1,145	38	41
Oregon	1,027	1,165	(4/)	(4/)
Pennsylvania, eastern	1,806	1,840	57	60
Pennsylvania, western	1,002	1,035	66	68
Rhode Island 3/	117	111	3	3
South Carolina	1,035	1,160	106	116
South Dakota	302	333	4	4
Tennessee	1,805	1,965	193	211
Texas, northern	4,115	4,373	146	162
Texas, southern	4,225	4,413	91	90
Utah	1,286	1,267	2	3
Vermont 3/	105	111	3	3
Virginia	1,757	1,794	138	149
Washington	1,669	1,722	6	6
West Virginia	412	443	30	29
Wisconsin	1,838	2,013	35	38
Wyoming	215	196	1	1
U.S. total 5/	82,925	87,588	3,150	3,361
Foreign countries 6/	393	355	93	106
Puerto Rico	1,405	1,555	--	--
Total shipments 5/	84,724	89,498	3,243	3,467
Origin:				
United States 7/	71,750	75,995	3,185	3,416
Puerto Rico	1,405	1,555	--	--
Foreign 8/	11,568	11,948	57	51
Total shipment 5/	84,724	89,498	3,243	3,467

W Withheld to avoid disclosing company proprietary data; included with "Foreign countries."
1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers, Canadian cement manufacturers, and other importers.
2/ Data are developed from monthly consolidated surveys of shipments by company and may differ from data in tables in 1, 10, 11, 12, 14, and 15, which are from annual surveys of individual plants.
3/ Has no cement plants.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.
6/ Includes shipments to U.S. possessions and territories. Includes States indicated by the symbol W.
7/ Includes cement produced by domestic producers from imported clinker.
8/ Imported cement distributed in the United States by domestic producers, Canadian cement manufacturers, and other importers.

TABLE 9

CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT) 1/ 2/

Region and Census District	Portland cement: Thousand metric tons 1995	Portland cement: Thousand metric tons 1996	Portland cement: Percentage of grand total 1995	Portland cement: Percentage of grand total 1996	Masonry cement: Thousand metric tons 1995	Masonry cement: Thousand metric tons 1996	Masonry cement: Percentage of grand total 1995	Masonry cement: Percentage of grand total 1996
Northeast:								
New England 3/	2,330	2,438	3	3	56	54	2	2
Middle Atlantic 4/	6,540	6,792	8	8	278	282	9	8
Total 5/	8,870	9,230	11	11	334	336	11	10
South:								
South Atlantic 6/	15,658	16,452	19	19	1,303	1,421	41	42
East South Central 7/	5,255	5,627	6	6	457	493	15	14
West South Central 8/	12,129	12,587	15	14	379	402	12	12
Total 5/	33,042	34,666	40	39	2,139	2,316	68	68
Midwest:								
East North Central 9/	13,245	14,159	16	16	511	541	16	16
West North Central 10/	8,174	8,628	10	10	120	118	4	4
Total 5/	21,419	22,787	26	26	631	659	20	20
West:								
Mountain 11/	8,330	9,140	10	10	32	35	1	1
Pacific 12/	11,264	11,765	14	13	12	14	(13/)	(13/)
Total 5/	19,594	20,905	24	23	44	49	1	1
Grand total 5/	82,925	87,588	100	100	3,150	3,361	100	100

1/ Includes imported cement shipped by importers. Excludes Puerto Rico and exported cement.

2/ Data are developed from monthly consolidated surveys of shipments by company and may differ from data in tables 1, 10, 11, 12, 14, and 15, which are from annual surveys of individual plants.

3/ New England includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

4/ Middle Atlantic includes New Jersey, New York, and Pennsylvania.

5/ Data may not add to totals shown because of independent rounding.

6/ South Atlantic includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.

7/ East South Central includes Alabama, Kentucky, Mississippi, and Tennessee.

8/ West South Central includes Arkansas, Louisiana, Oklahoma, and Texas.

9/ East North Central includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.

10/ West North Central includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.

11/ Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

12/ Pacific includes Alaska, California, Hawaii, Oregon, and Washington.

13/ Less than 1/2 unit.

TABLE 10

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, 1/ IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER

(Thousand metric tons)

	Shipments from plant to terminal: In bulk	Shipments from plant to terminal: In containers 2/	Shipments to final domestic consumer: From plant to consumer: In bulk	From plant to consumer: In containers 2/	From terminal to consumer: In bulk	From terminal to consumer: In containers 2/	Total shipments to consumer 3/ 4/
1995:							
Railroad	10,388	64	2,396	377	951	78	3,803
Truck	2,763	222	43,917	1,922	25,964	645	72,449
Barge and boat	7,898	--	105	26	32	--	162
Other 5/	1,853	--	--	--	--	--	--
Total 3/	22,902	286	46,418	2,325	26,947	723	76,414
1996:							
Railroad	10,527	54	5,036	433	520	53	6,042
Truck	3,143	147	43,990	1,708	29,027	870	75,594
Barge and boat	7,021	--	565	3	810	--	1,378
Other 5/	1,811	--	--	--	14	2	16
Total 3/	22,502	201	49,592	2,144	30,370	927	83,033

1/ Includes Puerto Rico. Includes imported cement and cement made from foreign clinker.

2/ Includes bags and jumbo bags.

3/ Data may not add to totals shown because of independent rounding.

4/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

5/ Includes cement used at plant.

TABLE 11
PORTLAND CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/

District	1995 3/ Quantity (thousand metric tons) 6/	1995 3/ Value 5/ Total (thousands)	1995 3/ Value 5/ Average per ton	1996 4/ Quantity (thousand metric tons) 6/	1996 4/ Value 5/ Total (thousands)	1996 4/ Value 5/ Average per ton
Maine, New York	2,916	$230,337	$78.99	3,118	$189,942	$60.92
Pennsylvania, eastern	3,899	241,352	61.90	4,095	307,830	75.17
Pennsylvania, western	1,486	99,139	66.72	1,612	112,747	69.94
Illinois	1,651	109,030	66.04	2,653	183,736	69.26
Indiana	2,510	154,462	61.54	2,570	168,032	65.38
Michigan	5,098	340,461	66.78	5,470	403,465	73.76
Ohio	985	68,237	69.28	1,013	74,100	73.15
Iowa, Nebraska, South Dakota	3,790	262,662	69.30	3,966	302,254	76.21
Kansas	1,703	107,345	63.03	1,859	128,848	69.31
Missouri	4,778	295,352	61.81	5,141	332,715	64.72
Florida	4,199	309,231	73.64	4,575	325,302	71.10
Georgia, Virginia, West Virginia	2,471	181,915	73.62	2,644	193,907	73.34
Maryland	1,796	108,230	60.26	1,924	118,832	61.76
South Carolina	2,291	161,390	70.45	2,463	193,115	78.41
Alabama	3,910	272,509	69.70	4,138	311,819	75.36
Kentucky, Mississippi, Tennessee	2,346	156,550	66.73	2,712	197,788	72.93
Arkansas, Oklahoma	2,506	158,566	63.27	2,545	170,721	67.08
Texas, northern	3,556	228,525	64.26	3,562	242,030	67.95
Texas, southern	4,908	293,380	59.78	5,152	320,441	62.20
Arizona, New Mexico	2,309	160,069	69.32	2,238	172,938	77.27
Colorado, Wyoming	1,841	149,462	81.19	2,001	160,521	80.22
Idaho, Montana, Nevada, Utah	2,432	185,221	76.16	2,398	190,588	79.48
Alaska, Hawaii, Oregon, Washington	1,520	136,986	90.09	1,493	125,137	83.79
California, northern	2,032	139,534	68.67	2,151	147,089	68.38
California, southern	6,212	357,611	57.57	6,897	415,781	60.28
Total 7/ 8/ 9/ or average	75,009	5,028,616	67.04	81,478	5,722,113	70.23
Puerto Rico	1,405	W	W	1,555	W	W

W Withheld to avoid disclosing company proprietary data.

1/ Includes cement produced from imported clinker.

2/ Includes imported cement shipped by producers.

3/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas. Includes data for grinding plants as follows: California, Florida (2), Iowa, Michigan, Ohio, Pennsylvania, and Texas.

4/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas. Includes data for grinding plants as follows: Florida (2) Michigan (2), Ohio, Virginia, and Washington.

5/ Values represent ex-plant (f.o.b - plant) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators.

6/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

7/ Data may not add to totals shown because of independent rounding.

8/ Does not include cement consumed at plant.

9/ Total includes imports shipped by independent importers.

TABLE 12
MASONRY CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/

District	1995 2/ Quantity (thousand metric tons) 5/	1995 2/ Value 4/ Total (thousands)	1995 2/ Value 4/ Average per ton	1996 3/ Quantity (thousand metric tons) 5/	1996 3/ Value 4/ Total (thousands)	1996 3/ Value 4/ Average per ton
Maine, New York	87	$6,986	$80.30	102	$8,440	$82.75
Pennsylvania, eastern	180	13,211	73.39	181	17,783	98.25
Pennsylvania, western	80	7,394	92.43	99	10,861	109.71
Illinois, Indiana, Ohio	500	42,857	85.67	498	42,756	85.93
Michigan	224	16,369	73.08	254	22,271	87.68
Iowa, Nebraska, South Dakota	45	4,116	91.47	46	5,075	110.33
Kansas, Missouri	159	8,562	53.95	155	8,691	56.03
Florida	415	38,023	91.62	418	34,901	83.50
Georgia, Virginia, West Virginia	303	30,073	99.25	366	40,174	109.77
Maryland, South Carolina	341	28,909	84.89	400	34,901	87.19
Alabama	302	30,277	100.25	311	32,240	103.67
Kentucky, Mississippi, Tennessee	117	9,476	80.99	113	10,391	91.96
Arkansas, Oklahoma	102	7,945	77.89	110	9,487	86.25
Texas	207	16,423	87.26	215	18,289	93.89
Arizona, Colorado, Idaho, Montana New Mexico, Nevada, Utah, Wyoming	122	9,099	74.30	135	11,186	83.08
Alaska, Hawaii	5	495	99.00	4	454	113.50
California, Oregon, Washington	177	11,793	66.78	219	14,729	67.40
Total 6/ 7/ or average	3,229 r/	282,805 r/	87.58 r/	3,477	322,832	92.85

r/ Revised.

1/ Excludes Puerto Rico (did not produce any masonry cement).

2/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas. Includes data for grinding plants as follows: California, Florida (2), Iowa, Michigan, Ohio, Pennsylvania, and Texas.

3/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas. Includes data for grinding plants as follows: Florida (2) Michigan (2), Ohio, Virginia, and Washington.

4/ Values represent ex-plant (f.o.b - plant) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimated for some plants. Accordingly, the data should be viewed as cement-value indicators.

5/ Shipments calculated on the basis of annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

6/ Data may not add to totals shown because of independent rounding.

7/ Total includes imports shipped by independent importers.

TABLE 13
AVERAGE MILL VALUE OF CEMENT IN THE UNITED STATES 1/

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
1995	66.25 r/	174.66	67.04 r/	85.64	67.84
1996	69.37	183.08	70.23	92.84	71.15

r/ Revised.

1/ Excludes Puerto Rico. Mill value is the actual value of sales to customers, f.o.b. plant, less all discounts and allowances, less all freight charges from producing plant to distribution terminal if any.

TABLE 14
PORTLAND CEMENT SHIPMENTS IN 1996, BY DISTRICT OF ORIGIN AND TYPE OF CUSTOMER

(Thousand metric tons)

District of origin	Ready mixed concrete	Concrete product manufacturers 1/	Contractors 2/	Building material dealers	Oil well, mining, waste 3/	Government and miscellaneous 4/	Total 5/ 6/
Maine, New York	602	206	--	70	1	2,239	3,118
Pennsylvania, eastern	1,682	620	132	206	21	1,435	4,095
Pennsylvania, western	973	183	162	78	17	199	1,612
Illinois	2,035	256	163	13	187	--	2,653
Indiana	2,080	330	41	101	10	10	2,570
Michigan	2,246	660	230	277	16	2,041	5,470
Ohio	352	109	22	62	6	460	1,013
Iowa, Nebraska, South Dakota	2,824	530	372	89	57	96	3,966
Kansas	1,154	174	252	28	23	227	1,859
Missouri	3,332	448	565	140	--	657	5,141
Florida	2,737	643	276	267	--	650	4,575
Georgia, Virginia, West Virginia	1,761	456	236	183	8	--	2,644
Maryland	1,046	243	120	11	--	503	1,924
South Carolina	1,856	417	82	59	--	48	2,463
Alabama	1,765	443	222	268	--	1,440	4,138
Kentucky, Mississippi, Tennessee	1,656	252	59	29	2	715	2,712
Arkansas, Oklahoma	1,450	72	256	22	70	675	2,545
Texas, northern	1,800	351	503	101	370	437	3,562
Texas, southern	2,974	275	505	177	221	1,000	5,152
Arizona, New Mexico	1,453	316	261	66	33	107	2,238
Colorado, Wyoming	1,596	203	116	64	22	--	2,001
Idaho, Montana, Nevada, Utah	1,934	197	107	19	58	83	2,398
Alaska, Hawaii	264	21	63	21	--	--	369
California, northern	1,605	335	141	38	2	31	2,151
California, southern	4,964	1,025	149	162	82	515	6,897
Oregon, Washington	655	91	87	52	--	238	1,124
Total 5/ 6/ 7/	49,137	9,217	5,177	2,735	1,212	14,001	81,478
Puerto Rico	803	140	29	580	--	3	1,555

1/ Concrete product manufacturers include, in thousand metric tons, brick/ block,--1,655; precast,--1,138; pipe,--750; and others,--5,814. Remainder includes unspecified amounts of brick/ block, precast, and pipe.

2/ Contractors in thousand metric tons include road paving,--1,827; soil cement,--763 and other,--2,389. Remainder includes unspecified amounts of road paving, and soil cement.

3/ Oil well, mining, and waste included in thousand metric tons oil well drilling,--1,022; mining,--89; and waste stabilization,--101.

4/ Includes shipments designated as going to "unspecified" customers.

5/ Shipments calculated on the basis of annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

6/ Data may not add to totals shown because of independent rounding.

7/ Includes imports shipped by independent importers.

TABLE 15
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE
UNITED STATES TO DOMESTIC CUSTOMERS, 1/ 2/ BY TYPE

Type	1995 Quantity (thousand metric tons)	1996 Quantity (thousand metric tons)
General use and moderate heat (Types I and II), (Gray)	69,247	75,014
High early strength (Type III)	2,658	2,942
Sulfate resisting (Type V)	1,694	2,000
Block	493	416
Oil well	750	1,041
White	549	615
Blended:		
Portland-slag and portland pozzolan	754	770
Other blended cement 3/	63	63
Expansive and regulated fast setting	60	81
Miscellaneous 4/	147	89
Total 5/ 6/	76,414	83,033

1/ Includes Puerto Rico. Includes imported cement.

2/ Shipments calculated based on annual survey of plants; may differ from tables 8 and 9, which are based on consolidated company monthly data.

3/ Includes blends with fly ash and silica fume.

4/ Includes waterproof and low heat (Type IV).

5/ Data may not add to totals shown because of independent rounding.

6/ Does not include cement consumed at plant.

TABLE 16

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, 1/ BY COUNTRY

(Thousand metric tons and thousand dollars)

Country of destination	1995 Quantity	1995 Value 2/	1996 Quantity	1996 Value 2/
Canada	582	40,434	611	42,193
China	2	348	17	816
Germany	15	593	22	1,814
Hong Kong	26	1,290	20	1,042
Korea, Republic of	1	89	10	536
Marshall Islands	--	6	9	400
Mexico	17	1,871	30	4,805
United Kingdom	8	513	10	539
Other	108 r/	7,831 r/	74	6,007
Total 3/	759	52,975	803	58,152

r/ Revised

1/ Includes portland and masonry cement.

2/ Free alongside ship (f.a.s.) value. The value of exports at the U.S. seaport or border port of export based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of exportation. The value excludes the cost of loading.

3/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 17

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, 1/ BY COUNTRY

(Thousand metric tons and thousand dollars)

	1995			1996		
		Value			Value	
Country of origin	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Bulgaria	222	5,831	9,198	148	4,433	6,274
Canada	4,886	198,056	217,926	5,351	246,694	270,198
China	337	13,183	18,138	394	15,771	19,714
Colombia	804	30,993	38,026	924	36,520	46,872
Denmark	327	15,116	21,649	399	17,593	26,393
Greece	1,245	44,326	61,549	1,098	40,803	52,046
Italy	362	14,440	20,044	209	8,432	11,751
Mexico	850	31,938	39,491	1,272	47,736	59,390
Norway	347	12,896	17,863	226	8,181	11,032
Spain	1,501	56,336	71,906	1,595	63,274	83,739
Sweden	529	16,495	23,165	765	24,337	33,495
Venezuela	1,435	56,965	71,317	1,517	58,424	73,536
Other	1,002 r/	44,489 r/	59,253 r/	257	20,051	24,116
Total 4/	13,848	541,064	669,525	14,154	592,249	718,556

r/ Revised.

1/ Includes portland, masonry, and other hydraulic cements. Includes Puerto Rico.

2/ Customs value--price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ C.i.f. (Cost, insurance, and freight)--import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1995			1996		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Anchorage:						
Canada	4	165	289	5	138	309
China	64	2,489	3,469	59	2,413	3,443
United Kingdom	(4/)	4	5	--	--	--
Total 3/	67	2,657	3,763	64	2,551	3,752
Baltimore:						
Brazil	(4/)	36	41	--	--	--
Greece	112	4,064	5,272	38	1,447	1,643
Netherlands	(4/)	25	29	--	--	--
Spain	42	1,482	1,482	15	551	551
United Kingdom	(4/)	130	174	(4/)	18	27
Venezuela	48	2,366	2,366	131	5,421	5,421
Total 3/	203	8,104	9,365	184	7,437	7,642
Boston: Netherlands	(4/)	23	27	--	--	--
Buffalo: Canada	651	32,703	35,358	740	37,270	39,996
Charleston:						
Germany	(4/)	13	17	--	--	--
Netherlands	--	--	--	(4/)	19	20
Spain	--	--	--	(4/)	36	39
United Kingdom	(4/)	75	103	(4/)	91	126
Venezuela	93	3,863	5,197	66	2,689	3,639
Total	93	3,951	5,317	67	2,835	3,824
Chicago:						
Japan	(4/)	80	96	(4/)	59	69
Netherlands	(4/)	6	24	--	--	--
Sweden	(4/)	4	6	--	--	--
Total 3/	(4/)	90	126	(4/)	59	69
Cleveland:						
Canada	504	17,496	18,237	497	25,320	26,051
Denmark	(4/)	2	3	--	--	--
Germany	(4/)	12	15	--	--	--
Netherlands	(4/)	76	91	(4/)	12	15
United Kingdom	--	--	--	(4/)	13	16
Total 3/	504	17,587	18,346	497	25,345	26,081
Columbia Snake:						
China	273	10,682	14,654	335	13,330	16,238
Colombia	11	385	385	18	685	867
France	(4/)	1	2	--	--	--
Total 3/	285	11,068	15,040	353	14,015	17,105
Dallas-Fort Worth: United Kingdom	--	--	--	(4/)	6	7
Detroit:						
Canada	1,518	60,156	65,627	1,647	79,423	84,419
Netherlands	--	--	--	(4/)	135	162
Taiwan	(4/)	3	3	--	--	--
Total 3/	1,518	60,159	65,629	1,647	79,559	84,581
Duluth: Canada	208	7,963	9,108	332	13,559	15,562
El Paso: Mexico	268	8,937	11,798	467	14,980	20,287
Great Falls:						
Canada	242	7,162	8,258	274	11,548	13,435
Japan	--	--	--	(4/)	2	6
United Kingdom	(4/)	15	19	(4/)	16	25
Total 3/	242	7,178	8,277	275	11,566	13,465
Honolulu:						
Australia	114	4,534	6,177	42	1,499	2,141
Belgium	--	--	--	(4/)	15	19
France	(4/)	12	17	(4/)	21	26
New Zealand	22	680	1,043	--	--	--
Venezuela	--	--	--	115	3,491	5,792
Total	137	5,227	7,237	157	5,027	7,977

See footnotes at end of table.

TABLE 18--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1995			1996		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Houston-Galveston:						
Colombia	24	884	1,380	46	1,739	2,729
Denmark	--	--	--	30	1,067	1,438
France	--	--	--	(4/)	83	99
Japan	(4/)	65	77	(4/)	46	55
Spain	574	19,985	25,750	675	24,872	32,188
United Kingdom	(4/)	50	63	(4/)	41	55
Venezuela	--	--	--	27	899	1,120
Total	598	20,984	27,270	780	28,748	37,684
Laredo:						
China	(4/)	3	4	--	--	--
Mexico	51	4,755	5,211	69	7,121	7,590
Total	52	4,758	5,215	70	7,121	7,590
Los Angeles:						
Croatia	1	165	251	--	--	--
Denmark	--	--	--	(4/)	3	5
Japan	(4/)	70	79	--	--	--
Mexico	225	8,229	10,049	382	13,945	17,027
New Zealand	(4/)	265	332	--	--	--
United Kingdom	(4/)	5	8	--	--	--
Total 3/	227	8,734	10,719	382	13,948	17,031
Miami:						
Belgium	3	251	340	2	251	340
Brazil	(4/)	5	5	--	--	--
Canada	--	--	--	24	871	1,153
Colombia	224	9,221	11,509	--	--	--
Denmark	22	1,119	1,949	44	1,942	3,290
Germany	(4/)	9	12	--	--	--
Portugal	--	--	--	(4/)	23	24
Spain	350	15,732	19,364	435	19,166	27,430
Sweden	337	10,044	14,118	441	13,529	18,471
United Kingdom	--	--	--	(4/)	1	1
Venezuela	63	2,170	3,040	189	7,439	9,913
Total 3/	999	38,550	50,337	1,136	43,223	60,622
Milwaukee: Canada	188	6,361	6,561	219	9,069	10,279
Minneapolis: Germany	(4/)	11	13	(4/)	12	13
Mobile:						
Bulgaria	162	4,315	6,811	122	3,368	4,863
Canada	--	--	--	163	5,087	6,948
France	63	1,936	2,064	--	--	--
Greece	69	2,086	2,947	73	2,446	3,317
Tunisia	25	695	1,055	--	--	--
Venezuela	82	2,705	3,601	25	819	1,007
Total 3/	401	11,737	16,478	383	11,721	16,135
New Orleans:						
Austria	--	--	--	(4/)	6	8
Bulgaria	35	874	1,338	--	--	--
Canada	145	4,293	5,745	88	3,065	4,047
China	--	--	--	(4/)	28	33
Colombia	169	6,414	8,528	120	5,131	6,768
Croatia	5	605	885	5	605	873
France	400	15,359	20,497	10	1,576	1,906
Greece	359	12,560	17,385	282	10,601	13,993
Italy	362	14,440	20,044	208	8,431	11,745
Netherlands	(4/)	6	8	--	--	--
Norway	103	3,548	5,180	--	--	--
Spain	37	1,360	1,771	9	340	438
Sweden	39	1,302	1,887	236	7,837	10,906
Tunisia	52	1,462	2,111	--	--	--
Turkey	213	6,530	9,702	34	1,271	1,592

See footnotes at end of table.

TABLE 18--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1995			1996		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
New Orleans--Continued:						
Venezuela	6	278	369	--	--	--
Total 3/	1,928	69,033	95,448	993	38,889	52,309
New York:						
France	(4/)	5	6	--	--	--
Greece	182	6,652	8,952	206	7,455	8,215
Italy	--	--	--	(4/)	1	6
Japan	--	--	--	(4/)	7	7
Netherlands	(4/)	79	83	(4/)	226	241
Norway	245	9,348	12,684	226	8,181	11,032
Spain	218	8,246	10,472	236	10,465	13,136
United Kingdom	(4/)	50	61	--	--	--
Total 3/	645	24,379	32,258	668	26,335	32,637
Nogales: Mexico	303	9,733	12,117	351	11,189	13,944
Norfolk:						
Croatia	(4/)	4	9	--	--	--
Denmark	236	9,366	12,245	214	8,460	11,079
France	45	7,294	8,282	45	8,103	8,914
Greece	492	17,908	25,466	438	16,756	22,029
Netherlands	(4/)	144	161	(4/)	87	97
United Kingdom	(4/)	8	11	(4/)	124	173
Venezuela	--	--	--	5	208	213
Total 3/	773	34,725	46,175	703	33,737	42,504
Ogdensburg:						
Canada	353	12,446	13,752	260	8,789	9,679
Netherlands	--	--	--	(4/)	56	69
United Kingdom	(4/)	12	12	--	--	--
Total	354	12,458	13,764	261	8,845	9,748
Pembina: Canada	167	7,024	8,104	143	6,812	7,724
Philadelphia:						
Germany	(4/)	76	89	(4/)	23	23
Japan	(4/)	54	65	(4/)	12	15
New Zealand	(4/)	66	85	--	--	--
United Kingdom	--	--	--	(4/)	10	22
Total	(4/)	196	239	(4/)	44	60
Portland: Canada	8	410	526	10	478	581
Providence: Spain	35	1,247	1,464	--	--	--
San Diego: Mexico	3	281	312	4	501	542
San Francisco:						
France	(4/)	30	34	--	--	--
Germany	--	--	--	(4/)	11	15
Japan	(4/)	36	44	(4/)	49	63
New Zealand	1	1,138	1,417	1	703	852
United Kingdom	(4/)	15	16	--	--	--
Total 3/	1	1,220	1,512	1	764	929
San Juan:						
Belgium	12	931	1,582	4	341	583
Canada	26	937	1,578	--	--	--
Colombia	42	1,720	1,872	--	--	--
Denmark	9	754	1,260	16	1,314	2,293
Luxembourg	--	--	--	5	439	764
Mexico	(4/)	3	4	--	--	--
Netherlands	(4/)	28	49	--	--	--
Spain	(4/)	8	11	119	4,044	4,863
Venezuela	(4/)	2	2	43	1,890	2,332
Total 3/	90	4,383	6,358	188	8,029	10,836
Savannah:						
Bahamas, The	6	244	247	--	--	--
Bulgaria	24	643	1,049	26	1,064	1,410
Canada	--	--	--	78	2,389	3,335
Colombia	--	--	--	19	1,027	1,181

See footnotes at end of table.

TABLE 18--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1995			1996		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Savannah--Continued:						
Denmark	3	162	298	13	852	1,420
Greece	30	1,056	1,525	--	--	--
Ukraine	--	--	--	--	--	--
United Kingdom	30	749	1,246	64	2,310	2,460
Venezuela	91	3,274	3,691	106	3,801	5,134
Total 3/	184	6,127	8,057	307	11,443	14,939
Seattle:						
Canada	762	36,158	38,719	744	36,518	38,962
China	(4/)	9	11	--	--	--
Colombia	149	5,457	5,540	198	7,769	11,244
Japan	(4/)	46	54	(4/)	20	24
Total 3/	911	41,671	44,323	942	44,307	50,230
St. Albans:						
Canada	110	4,780	6,065	99	5,327	6,271
Netherlands	(4/)	117	136	(4/)	123	143
Total 3/	110	4,897	6,201	100	5,450	6,413
Tampa:						
Canada	--	--	--	27	1,032	1,445
Colombia	184	6,911	8,812	520	20,019	23,916
Denmark	58	3,712	5,894	83	3,955	6,870
France	(4/)	3	3	--	--	--
Greece	--	--	--	61	2,099	2,849
Spain	244	8,275	11,591	105	3,800	5,095
Sweden	152	5,147	7,154	88	2,970	4,118
Turkey	--	--	--	34	1,201	1,595
Venezuela	883	34,960	43,529	751	29,388	36,197
Total 3/	1,522	59,008	76,983	1,669	64,463	82,086
U.S. Virgin Islands:						
British Virgin Islands	--	--	--	1	98	118
Colombia	--	--	--	3	150	167
Netherlands Antilles	2	64	67	5	167	183
Panama	4	73	98	--	--	--
Trinidad and Tobago	--	--	--	3	114	119
Venezuela	32	1,628	1,847	59	2,378	2,769
Total 3/	38	1,765	2,012	70	2,907	3,356
Wilmington:						
Netherlands	(4/)	7	13	(4/)	6	12
Venezuela	139	5,719	7,675	--	--	--
Total 3/	139	5,726	7,688	(4/)	6	12
Grand total 3/	13,848	541,064	669,525	14,154	592,249	718,556

1/ Customs value- price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

2/ C.i.f. (Cost, insurance, and freight)--import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry. It is computed by adding "freight" to the "customs value."

3/ Data may not add to totals shown because of independent rounding.

4/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT 1/, BY COUNTRY

(Thousand metric tons and thousand dollars)

	1995			1996		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Canada	3,342	136,923	152,131	3,953	182,457	198,857
China	337	13,170	18,123	393	15,743	19,682
Colombia	645	25,404	31,358	685	27,734	35,737
Denmark	238	9,529	12,543	303	11,803	16,000
Greece	1,140	41,018	56,839	983	36,949	46,822
Italy	362	14,440	20,044	208	8,432	11,751
Mexico	784	25,527	32,414	1,178	37,470	48,367
Norway	315	11,349	15,851	218	7,410	10,176
Spain	1,426	49,986	64,756	1,428	53,769	72,737
Sweden	529	16,492	23,159	765	24,337	33,495
Turkey	138	4,443	6,560	68	2,471	3,187
Venezuela	924	37,833	48,002	944	38,556	46,530
Other	327	11,571	15,281	41	1,816	1,999
Total 4/	10,507	397,685	497,061	11,167	448,947	545,340

1/ Includes imports into Puerto Rico.

2/ Customs value--price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ C.i.f. (Cost, insurance, and freight)--import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT 1/, BY COUNTRY

(Thousand metric tons and thousand dollars)

	1995			1996		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Belgium	14	1,176	1,915	6	591	923
Canada	167	13,888	14,603	135	12,170	12,700
Colombia	20	805	834	--	--	--
Denmark	89	5,585	9,103	96	5,787	10,389
Luxembourg	--	--	--	6	439	764
Mexico	63	6,095	6,721	91	9,995	10,732
Norway	7	707	794	8	771	856
Spain	76	6,342	7,139	48	5,425	6,101
Other	(4/)	256	298	(4/)	228	244
Total 5/	436	34,854	41,407	390	35,406	42,709

1/ Includes imports into Puerto Rico.

2/ Customs value--price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ C.i.f. (Cost, insurance, and freight)--import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Less than 1/2 unit.

5/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 21
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, 1/ BY COUNTRY

(Thousand metric tons and thousand dollars)

Country	1995 Quantity	1995 Value Customs 2/	1995 Value C.i.f. 3/	1996 Quantity	1996 Value Customs 2/	1996 Value C.i.f. 3/
Australia	114	4,534	6,177	42	1,499	2,141
Bulgaria	222	5,831	9,198	148	4,433	6,274
Canada	1,375	46,658	50,560	1,253	50,345	56,695
Colombia	139	4,785	5,834	239	8,785	11,135
France	163	8,062	10,061	53	8,065	9,039
Greece	104	3,308	4,709	115	3,854	5,224
Spain	--	--	--	119	4,044	4,863
Tunisia	78	2,157	3,166	--	--	--
Turkey	75	2,087	3,142	--	--	--
Venezuela	503	18,377	22,501	572	19,861	26,996
Other	83 r/	2,875 r/	4,394 r/	6	635	906
Total 4/	2,858	98,674	119,742	2,547	101,521	123,273

r/ Revised.

1/ For all types of hydraulic cement. Includes imports into Puerto Rico.

2/ Customs value-- price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ C.i.f. (Cost, insurance, and freight)-- import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 22
HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/

(Thousand metric tons)

Country	1992	1993	1994	1995	1996 e/
Afghanistan e/	115	115	115	115	116
Albania e/	200	200	200	200	200
Algeria	6,400	6,400 e/	6,060	6,822 r/	7,000
Angola e/	300	250	300	300	300
Argentina	5,051	5,647	6,306	5,447 r/	5,117 2/
Armenia	400	200	100	228 r/	282 2/
Australia e/	5,412 2/	5,500	6,500 r/	6,500 r/	6,500
Austria	5,031	4,941	4,828 r/	3,843 r/	4,000
Azerbaijan	800	600	500	200	200 2/
Bahrain	220	225	225 e/	197 r/	193 2/
Bangladesh 3/	273	275	280 e/	280 e/	285
Barbados	175 e/	62	78	80 e/	80
Belarus	2,300	1,900	1,488	1,235	1,467 2/
Belgium	8,073	7,612	8,000 e/	8,000 e/	8,000
Benin e/	370	380	380	380	380
Bhutan	116	108	120 e/	140 e/	160
Bolivia	600	654	768 r/	869 r/	934 2/
Bosnia and Herzegovina e/	150	150	150	150	200
Brazil	23,903	24,843	25,330 r/	28,256 r/	34,597
Brunei	--	--	--	--	100
Bulgaria	2,132	2,007	2,200	2,070 r/	2,100
Burma	464	400	470	517	505 2/
Cameroon e/	620 r/	620 r/	620 r/	620 r/	600
Canada	5,698	6,672	10,584	10,440 r/	11,050 p/
Chile	2,645	3,021	2,995	3,275 r/	3,634 2/
China	308,220	367,880	421,180	475,910 r/	490,000 2/
Colombia	6,807	7,930	9,322	9,624	8,346 2/
Congo e/	115 2/	114	114	100	100
Costa Rica	700 e/	860	940	990 e/	990
Côte d'Ivoire e/	510	500	500	500	500
Croatia	1,768	1,683	2,055 r/	1,708 r/	1,842 2/
Cuba	2,000 e/	1,049	1,081	1,524 r/	1,453 2/

See footnotes at end of table.

TABLE 22--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/

(Thousand metric tons)

Country	1992	1993	1994	1995	1996 e/
Cyprus	1,131	1,089	1,053	1,021	1,025
Czech Republic 4/	XX	5,393	5,303	4,825	5,011 2/
Czechoslovakia 5/	8,500	XX	XX	XX	XX
Denmark (sales)	2,072	2,270	2,430	2,584 r/	2,629 2/
Dominican Republic	1,365	1,271	1,276	1,453	1,500
Ecuador	2,250 e/	2,098	2,164	2,300 e/	2,677 2/
Egypt	17,000	16,000	16,000 e/	17,665 r/	18,000
El Salvador	419	861	850	875 e/	948 2/
Eritrea e/ 6/	XX	30	30 r/	50 r/ 2/	41 2/
Estonia	600 e/	500 e/	402	417	400
Ethiopia	300	270 e/	260	611	600
Fiji	84	80	94	91 r/	92
Finland	1,129	835	864	907 r/	947 2/
France	21,165	20,464	21,296	19,692	20,000
Gabon	116	132	126 e/	130 e/	130
Georgia	500	300	100	100 e/	100
Germany	37,529	36,649	40,380	40,000 e/	40,000
Ghana	1,024	1,203	1,346	1,400 e/	1,400
Greece	10,668	12,618	12,636	12,000 e/	12,000
Guadeloupe e/	235	230	230	230	230
Guatemala	1,400 e/	1,119	1,200 r/	1,200 r/ e/	1,090 2/
Haiti e/	200	100	75	50	50
Honduras	650 e/	723	1,100 r/ e/	1,140 r/	960
Hong Kong	1,643	1,712	1,927	1,913	2,027 2/
Hungary	2,236	2,533	2,813	2,875 r/	2,776 2/
Iceland	100	86	81	82	80
India e/	50,000	53,812 2/	57,000 r/	62,000 r/	76,220 2/
Indonesia	17,280	18,934	21,907 r/	23,129 r/	25,000
Iran e/	15,200	16,000	16,000	16,300	16,500
Iraq e/	2,000 r/	2,000 r/	2,000 r/	2,108 r/ 2/	2,100
Ireland e/	1,600	1,600	1,550	1,500	1,500
Israel	3,960 r/	4,536 r/	4,800 r/	4,800 r/ e/	4,800
Italy	41,347	34,771	33,192	33,715 r/	34,000
Jamaica	475	451	445	523	555
Japan	88,253	88,046	91,624	90,474	94,492 2/
Jordan	3,134	3,514	4,000 e/	3,508 r/	3,500
Kazakstan	6,400	4,000	2,000	2,616 r/	2,500
Kenya	1,508	1,417	1,420 e/	1,500 e/	1,500
Korea, North e/	17,000	17,000	17,000	17,000	17,000
Korea, Republic of	44,444	47,313	50,730	55,130	57,334 2/
Kuwait	533	500 e/	1,000 e/	1,950 r/	2,000
Kyrgyzstan	1,100	700	400	300	500 2/
Laos e/	7	7	10	10	10
Latvia	400 e/	300 e/	244	203 r/	270 2/
Lebanon e/	1,500	3,000 r/	3,450 r/	3,538 r/ 2/	3,500
Liberia e/	8 2/	8	--	--	--
Libya	2,300	2,300 e/	2,700 r/ e/	3,210 r/	3,550 2/
Lithuania	1,500 e/	1,000 e/	736	649	600
Luxembourg e/	600	600	620	600	600
Macedonia	516	499	486	524 r/	550
Madagascar e/	60	60	60	60	60
Malawi	112	127	122	139	140
Malaysia	8,366	8,797	9,928	10,713 r/	12,335 2/
Mali e/	20	20	20	20	20
Martinique e/	240	220	225	225	225
Mauritania	122	111	374	120 r/	120
Mexico	26,880	27,120	29,700	23,366 r/	22,829 2/
Moldova	700	100	39	49	70 2/
Mongolia	133	82	86	109	106 2/
Morocco	6,340	6,350 e/	6,500 e/	6,401 r/	6,400
Mozambique e/	30	20	20	20	30
Nepal	238 r/	274 r/	316 r/	327 r/	343 2/
Netherlands e/	3,300 2/	3,400	3,400	3,400	3,300
New Caledonia e/	90 2/	90	90	100	100

See footnotes at end of table.

TABLE 22--Continued

HYDRAULIC CEMENT: WORLD PRODUCTION BY COUNTRY 1/

(Thousand metric tons)

Country	1992	1993	1994	1995	1996 e/
New Zealand e/	579 2/	800 r/	1,000 r/	1,000 r/	1,000
Nicaragua	277	255	309	350 e/	350
Niger e/	29 2/	29	30	30	30
Nigeria e/	3,500	3,500	2,600 2/	3,000 r/ e/	3,000
Norway	1,266	1,344	1,444	1,613 r/	1,600
Oman	970	1,000 e/	1,200 e/	1,177 r/	1,200
Pakistan	7,793	8,321	8,100	8,586	8,900
Panama	250 e/	571	615	350 e/	350
Paraguay	325 r/ e/	490	570	635 r/	620 2/
Peru e/	2,090 r/	2,500 r/	3,000 r/	3,000 r/	3,848 2/
Philippines	6,667	7,962	10,400 r/ e/	10,600 r/	12,000
Poland	11,908	12,228	13,834	13,884	13,879 2/
Portugal	7,638	7,570 r/	7,780 r/	7,770 r/	8,300
Qatar	544	550 r/ e/	600 r/ e/	667 r/	690 2/
Romania	6,271	6,240	5,998	6,842 r/	6,858 2/
Russia	61,700	49,900	37,200	36,500 r/	27,800 2/
Rwanda e/	60	60	10	5 2/	10
Saudi Arabia	15,324	15,300 e/	15,000 r/ e/	15,773 r/	16,437 2/
Senegal	601	590	590 e/	590 e/	590
Serbia and Montenegro	2,036	1,088	1,612	1,696	2,205 2/
Singapore e/	1,900	2,980 r/	3,100 r/	3,200 r/	3,300
Slovakia e/ 4/	XX	2,500	2,500	2,500	2,500
Slovenia	801 r/	707 r/	898 r/	991 r/	1,000
Somalia e/	25	25	25	25	30
South Africa	7,028	7,356	7,905	9,071	9,400
Spain (including Canary Islands)	24,615	22,878	25,150	26,423 r/	25,157 2/
Sri Lanka	817	676	925	900 e/	905
Sudan e/	250	250	250	391 r/ 2/	380
Suriname e/	50	50	50	50	50
Sweden	2,289	2,200	2,100 e/	2,539 r/	2,447 2/
Switzerland e/	4,260 2/	4,000	4,300 r/	4,400 r/	4,400
Syria	3,700	4,500	4,500 r/ e/	4,463 r/	4,100
Taiwan	21,644	23,971	22,722	22,478	21,537 2/
Tajikistan	400	300	200	100	50 2/
Tanzania e/	540	540	490	800	800
Thailand	21,832	26,870	29,900 r/ e/	34,900 r/ e/	35,000
Togo e/	350	350	350	350	350
Trinidad and Tobago	482	528 r/	583	559 r/	617 2/
Tunisia	3,999	4,269	4,606 r/	4,938 r/	4,567 2/
Turkmenistan	1,100	1,100	700	437 r/	451 2/
Turkey	28,607	31,241	29,493	33,143 r/	32,500
Uganda e/	50	50	125	90 r/	100
Ukraine	20,100	15,000	11,400	7,600 r/	5,000 2/
United Arab Emirates	3,800	4,000 e/	5,000 e/	5,918 r/	6,000
United Kingdom	11,006	11,039	12,493	11,805 r/	11,600
United States (including Puerto Rico) 7/	70,883	75,117	79,353	78,320	80,818 2/
Uruguay e/	500	500	700	600 2/	685 2/
Uzbekistan	5,900	5,300	4,800	3,400 r/	5,000 2/
Venezuela	6,585	6,842	7,100 r/ e/	7,200 r/ e/	7,300
Vietnam e/	4,000 r/	4,200 r/	4,700 r/	5,200 r/	5,700
Yemen	800	800 e/	800 e/	1,088 r/	1,040 2/
Zaire	174	149	50 r/ e/	25 r/ e/	10
Zambia	347	350 e/	280	250 r/ e/	350
Zimbabwe e/	900	1,000	1,070 r/ 2/	1,000	1,150 2/
Total e/ 8/	1,231,143 r/	1,292,379 r/	1,372,427 r/	1,443,689 r/	1,484,564

e/ Estimated. p/ Preliminary. r/ Revised. XX Not applicable.

1/ Table includes data available through Aug. 4, 1997. Data may include clinker exports for some countries.

2/ Reported figure.

3/ Data are for the year ending June 30 of that stated.

4/ Formerly part of Czechoslovakia; data were not reported separately until 1993.

5/ Dissolved Dec. 31, 1992.

6/ Eritrea became an independent country in May 1993.

7/ Portland and masonry cement only.

8/ Data may not add to totals shown because of independent rounding.

CEMENT

By Hendrik G. van Oss

Cement is the binding agent in concrete and mortar and its production and consumption are fundamental economic indicators for a country's construction industry. Total U.S. production of portland and masonry cement increased in 1997 by 4.2% to a new record level of 82.6 million (metric) tons; 96% of this was portland cement.*(See tables 1-3.)* Clinker production *(see table 4)* also set a new record of72.7 million tons. Clinker and cement output were at or near full practical capacity levels. The United States ranked third in the world in terms of cement production; world output *(see table 22)* was about 1.5 billion tons.

Calculated U.S. apparent consumption of cement increased 6.3% to 96.0 million tons in 1997, and consumption as measured by sales to final customers increased 5.8% to about 96.5 million tons.The substantial excess demand was met by increased imports.Exports remained a very small component of total U.S. cement trade and declined slightly during the year. Cement prices increased, although to a lesser degree than in 1996.The total ex-plant value reported for annual cement shipments from mills and terminals to final customers increased 11% to about $6.6 billion.The same component unit values applied to reported monthly sales to final customers—a larger tonnage—yield a total value for 1997 that increased 9% to about $7.1 billion. By using typical cement-in-concrete mix ratios, the value (delivered) of concrete(excluding mortar) in the United States in 1997 was estimated to be at least $27 billion.

Hydraulic cements are those that will set and harden under water and are overwhelmingly the dominant form of cement produced in the United States and the rest of the world. In turn, the production of hydraulic cements is dominated by that of portland (broadly defined) and related masonry cement. Except for certain trade and international production data, this report is concerned only with portland and masonry cements. Thus excluded are certain other hydraulic varieties, such as pure pozzolan and aluminous cements; these cumulatively make up only a small fraction of the U.S. cement market.

The term "portland cement" refers to the finished product which, in the strictest sense, is a finely interground mixture of portland cement clinker and 3% to 5% gypsum. Thus, portland cement can be produced either by integrated cement plants, which manufacture clinker and grind it to make cement, or by stand-alone facilities that grind clinker obtained elsewhere. Clinker comprises mostly calcium silicates and is made by controlled high-temperature burning in a kiln of a measured blend of calcareous rocks (usually limestone) and lesser quantities of siliceous, aluminous, and ferrous materials as needed. The kiln feed blend (also called raw meal or raw mix) is adjusted depending on the chemical composition of the raw materials and the type of portland cement desired. In the United States, five basic types (Types I through V) of portland cement are recognized, denoting such properties as high sulfate resistance and high early strength. Other designations may be used in other countries for similar portland cements. Portland cement is almost always gray, but a more valuable version—white cement—can be obtained if care is taken to burn only iron-free raw materials.

Although technically restricted to Types I through V, it is common U.S. industry practice, and that of this report, to include as portland cement almost all nonmasonry varieties of cement that contain portland cement clinker, notably the so-called blended cements. Blended cements are interground mixtures of (finished) portland cement (or ground clinker plus gypsum) and pozzolans. The proportion of pozzolans is quite variable, but is commonly in the range of 15% to 50% by weight. Pozzolans are siliceous materials, such as certain rocks (mainly tuffs, diatomaceous earths, and burned clays or shales) and industrial byproducts (mainly granulated blast furnace slag, fly ash, and silica fume), that exhibit hydraulic cementitious properties when finely ground and interacted with free lime and water. Blended cements are of similar strength as (straight) portland cements and commonly offer improved resistance to certain types of chemical attack and reduced environmental impact of manufacture.

On the basis of available data, blended cements appear to be only a small component of the U.S. cement market at present, in contrast to their greater popularity in many countries overseas. Blended cements can be purchased, but some concrete manufacturers do their own mixing of pozzolans with purchased (straight) portland cement. In terms of the resulting cement paste, the distinction between adding pozzolans to the concrete mix and having them introduced to the concrete within a purchased blended cement would appear to be more semantic than real.

Concrete is a controlled mixture of cement, fine and coarse aggregates, and water that, through complex hydration reactions, hardens into a rocklike mass of specifiable properties. Apart from doing their own mixing of pozzolans into the mix, there is substantial consumption by concrete manufacturers of nonpozzolanic, or slightly pozzolanic, varieties of slag, fly ash, and the like, for use as aggregates. Concrete manufacturers are not surveyed and hence the true extent of consumption of blended cements by the concrete industry in the United States is not known. Further, there is some consumption of "pure" pozzolan cements that do not involve the addition of portland cement. In such cases, the pozzolan activator generally is added lime. Data from pozzolans suppliers tend to lump together sales to the cement and concrete manufacturers, and commonly do not differentiate sales of pozzolans from similar, but nonreactive, material used as aggregates. Accordingly, the data in this report, which are supplied by the cement manufacturers as to consumption of pozzolans and subsequent sales of blended cement, under represent the true market for these materials, likely by as much as a factor of two or three.

As with portland cement, the term "masonry cement" is used broadly in this report and includes portland lime and plastic (portland cement mixed with plasticizing agents) cements. However, this combination is not the universal practice of the industry and it remains possible, particularly with monthly sales data *(see tables 8 and 9)*, that some portland lime and plastic cement data for some regions have been reported within the portland cement designation. Overall, the tonnages misassigned likely are small. Masonry-type cements are used in mortar, which is a mixture of cement, fine aggregate, and water used to bind together building blocks, such as bricks and stones. Masonry cements can be made either from portland cement or directly from clinker. The manufacture of masonry cement involves incorporating a high percentage (e.g., 50%) of admixtures—commonly ground limestone or lime. In some cases, particularly with portland lime cements, the purchased components can be mixed at the construction site. Accordingly, the data in this report, which are for masonry cement produced and sold by cement manufacturers only, under report the true production and consumption of this material, particularly for some regions of the country.

The bulk of this report, particularly tables 1 through 7 and 10 through 15, incorporates data compiled from U.S. Geological Survey (USGS)[1] annual surveys of individual cement and clinker manufacturing plants and certain terminals and importers. In 1997, responses were received from 135 of the 136 facilities canvassed, including all producers; these facilities accounted for 100% of total U.S. cement production and more than 99% of shipments. In 1996, responses were received from 124 of the 134 facilities canvassed, recording more than 99% of production and shipments. Tables 8 and 9, in contrast, are based on monthly shipments surveys of the cement-producing companies and importers, and for these, the response rate was 100% for both years.

For cases where annual questionnaires were returned incompletely or improperly filled out, followup inquiries were made, after which estimates were made and incorporated for any remaining missing data. Estimates for most information categories constituted only very small percentages of the aggregated totals and, thus, the introduced estimation errors are considered to be insignificant. Two important exceptions are the data for values *(see tables 1 and 11-13)*, where a significant number of facilities routinely omit or incorrectly report the information, and the data for portland cement shipments by customer (user) type *(see table 14)*, where the cement producers readily admit to having incomplete knowledge.

As in previous years, there is a significant tonnage discrepancy between the annual shipments totals in tables 1 and 10-15 for portland cement and the larger (monthly based) totals shown in tables 8 and 9.The difference for masonry cement is small. Because they are more complete, the data in tables 8 and 9 are the preferred measure of true U.S. consumption (see Consumption section); these data (actually the component monthly data) are used by U.S. cement companies to estimate their market shares and to perform many other economic analyses. Integration of the data from tables 8 and 9 data with those from the other tables has not been done to avoid creating additional internal inconsistencies.

There were two significant changes in cement company ownership in the United States during the year and one other that was announced, but which would take effect early in 1998.In April 1997, Blue Circle Industries of the United Kingdom completed the purchase, announced in January, of St. Marys Cement Corp. of Canada (Blue Circle, 1997).Blue Circle, one of the largest cement producers in the United States, gained through this purchase St. Marys' large grinding plant in Detroit, MI, several U.S. distribution terminals, and two integrated plants and associated terminals in Canada. Early in the year, Australian company Adelaide Brighton Ltd. sold its 50% ownership in Hawaiian Cement Co. to the co-owner, Knife River Corp. of North Dakota (International Cement Review, 1997a).In September, Texas-based producer TXI Inc. reached an agreement to purchase Riverside Cement Co., a major California producer, from the Korean company Ssangyong Cement Industrial Co., Ltd (International Cement Review, 1997c).The purchase was to take effect January 1, 1998.The purchases of Hawaiian Cement and Riverside Cement were departures from the trend, begun in the 1980's, of foreign companies buying U.S. cement plants.

State data in a number of tables are presented within State groupings or districts, generally corresponding to Census Districts or subsets thereof, where required to protect proprietary information. Certain major cement-producing States have been subdivided along county lines to provide additional market information.[2]

Tables 16 through 21 show nonproprietary trade data from the U.S. Bureau of the Census in lieu of the proprietary data collected through the USGS monthly questionnaires. World production data shown in table 22 were derived by USGS country specialists, from a variety of sources. These production data are for hydraulic cement (all types) and the entries for a few countries may include clinker exports.

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[1]Data prior to 1995 were collected by the former U.S. Bureau of Mines.

[2]State subdivisions are as follows:

California, northern.—Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, and Tuolumne Counties, and all those further north.

California, southern.—Inyo, Kern, Mono, and San Luis Obispo Counties, and all those further south.

Chicago, metropolitan.—Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.

Illinois.—All counties other than those included within Metropolitan Chicago.

New York, eastern.—Delaware, Franklin, Hamilton, Herkimer, and Otsego Counties, and all those further east and south, excepting those within Metropolitan New York.

New York, western.—Broome, Chenango, Lewis, Madison, Oneida, and St. Lawrence Counties, and all those further west.

New York, metropolitan.—The five counties of New York City (Bronx, Kings, New York, Queens, and Richmond) plus Nassau, Rockland, Suffolk, and Westchester Counties.

Pennsylvania, eastern.—Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union County, and all those further east.

Pennsylvania, western.—Centre, Clinton, Franklin, Huntingdon, and Potter Counties, and all those further west.

Texas, northern.—Angelina, Bell, Concho, Crane, Falls, Houston, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, and Ward Counties, and all those further north.

Texas, southern.—Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, and Williamson Counties, and all those further south.

Legislation and Government Programs

Economic Issues.—The cement industry is affected by a range of Government economic policies. Of particular interest are Government spending programs, or proposals therefore, related to public construction, and to any and all other policies—especially those concerning interest rates—that would affect private construction programs.

Probably the most important Government actions in recent years with respect to the cement industry concern imports. A number of factors led to large quantities of inexpensive cement being imported into the United States in the 1980's. These imports undercut prices at a time when the domestic cement industry was simultaneously having to contend with rapidly rising production costs and reduced overall demand. During this time, a number of plants closed, and many others were purchased by foreign companies. A number of cement companies complained that Japan, Mexico, and Venezuela were dumping cement and/or clinker onto the U.S. market. The U.S. Department of Commerce determined that the pricing was unfair and this led to the imposition of antidumping tariffs on imports from Japan and Mexico and to a voluntary restraint agreement with Venezuela. The tariffs dramatically reduced the imports of cement and clinker from Japan from 1.9 million tons in 1990 to 0.3 million tons in 1991, and thence to negligible levels from 1993 onwards. Anticipation and eventual imposition of tariffs on Mexican imports similarly led to a decline from a peak of 4.5 million tons in 1988 to 0.6 million tons in 1994.The main Mexican company involved has repeatedly appealed the tariffs, and imports from Mexico increased in 1995 and reached almost 1.3 million tons in 1996.The appeals to date have all been turned down, and the tariffs reaffirmed. In April 1997,the U.S. Department of Commerce released its determinations for the two review periods covering August 1993 through July 1994 and August 1994 through July 1995.The tariffs for these periods were set at 109.43% and 103.82%, respectively (Southern Tier Cement Committee, 1997).Imports from Mexico declined to about 1 million tons in 1997.Although cement and clinker imports from Venezuela fell dramatically from 1990 to 1992, they have grown steadily since, reaching almost 2 million tons in 1997. But, overall, rising imports of cement and clinker since the early 1990's have served to meet excess demand rather than undercut domestic production. Based on the data in tables 11, 12, and 18; the imports may have constrained, but appear not to have led to a lowering of, regional cement prices.

Because of high transportation costs, cement markets tend to be fairly local, especially where access must be by truck. Competition among cement plants serving a market tends to be keen, and this, coupled with the fact that most plants have broadly similar production technologies and costs, have tended to constrain cement price variations within a market. Uniform prices within cement markets have led to periodic Government antitrust investigations of the industry, to date without findings against the cement companies. No such investigations were reported ongoing in 1997.

Environmental Issues.—Cement production involves mining and manufacturing activities. About 120 million to 135 million tons per year of nonfuel raw materials are mined *(see table 5)* for cement manufacture, generally from open pit operations. Environmental issues affecting this activity are common to most surface mines and include problems with dust, increased sediment loads to local streams, chemical changes to local water supplies, etc. Of greater concern are the environmental impacts of the cement manufacturing process, most of which stem from the manufacture of clinker. Clinker kilns burn large quantities (12 to 13 million tons per year *(see table 6*) of fossil and/or other organic fuels to thermochemically break down (calcine) calcareous and other rocks to instigate clinker-mineral-forming chemical reactions.

In the debate over climatic change, the impact of so-called greenhouse gases on atmospheric warming is a major issue. The most common greenhouse gas is carbon dioxide (CO_2), and both fuel combustion and carbonate (limestone) calcination in the clinker kilns generate large quantities of this gas. As explained more thoroughly in the previous edition of this report (van Oss, 1996), precise determinations of the CO_2 emissions of the U.S. cement industry are not available, but the amount for the country may be estimated to within 5% to 10% based on various assumptions of the composition of the raw materials and fuels consumed or that of the clinker produced. The clinker manufacturing technology also plays a role—wet kilns consume more fuel on a unit (of clinker) output basis than do dry kilns. On average, it may be estimated that the calcination component of clinker production releases between 0.50 and 0.57 ton of CO_2 per ton of clinker produced and the fuel consumption component about 0.48 to 0.50 ton per ton of clinker, for a total release of about 1 ton of CO_2 per ton of clinker. This translates to about 0.95 ton of CO_2 per ton of "straight" portland cement. It is, however, better to calculate CO_2 based on the production of clinker, rather than of portland cement, because the cement tonnage may include material made from the grinding of imported clinker (in which case the CO_2 was generated elsewhere).Also, finished cement may include pozzolan, or even inert, components which replace an equivalent mass of clinker in the finished product, although this has yet to become a common practice for portland cement in the United States. Of course, most of the major synthetic pozzolans are themselves produced by CO_2-generating industries (e.g., blast furnace slag is a byproduct of the iron smelting industry, and fly ash is a byproduct of coal-fired powerplants), but the emissions are credited to those industries. Using the clinker data in table 4, it is estimated that the U.S. cement industry released about 74 million tons of CO_2 in 1997.In addition, U.S. cement plants consumed electricity *(see table 7)* equivalent to about 7 million tons ofCO_2, but this generally would be assigned to the electrical power industry.

The concern of the cement industry with CO_2 emissions stems mainly from the possibility that the Government will seek to reduce emissions through the imposition of carbon taxes or emissions quotas. At the United Nations Framework Convention on Climate Change, held in December in Kyoto, Japan, measures were agreed to that would have so-called developed countries reduce their emissions of greenhouse gases to levels below those in 1990; for the United States, the "Kyoto Protocol" reduction requirement was 7% below levels in 1990, to be achieved by the year 2012.With current U.S. emissions of greenhouse gases substantially higher than the 1990 levels, the Kyoto targeted reduction for the United States implies an actual reduction well in excess of 7%.At least initially, so-called developing countries would be encouraged, but not required, to reduce their emissions of greenhouse gases.

It is not clear how a large reduction in U.S. CO_2 emissions could be achieved without substantial increases in energy and production costs throughout the economy, or without having domestic manufacturers facing increased competition from imports originating in countries not encumbered by the Kyoto accords. Given the voiced concerns over the economic consequences of the accords, the U.S. Congress passed resolutions (House Resolution 4761 and Senate Resolution 98) requesting that the President not sign the Kyoto Protocol, nor submit it to Congress for ratification until it is amended to include the developing countries. However, even lacking ratification, it was expected that the Government would encourage the industry to find ways to begin to reduce CO_2 and other greenhouse gas emissions.

For the U.S. cement industry, meeting the Kyoto levels of reduction in CO_2 emissions could require the shutdown of a number of older plants (especially those operating less energy efficient wet kilns).However, a much larger contribution to reduction of CO_2 emissions would be achievable through a drastic change in the formulation of finished portland cement, specifically, a major reduction in the average clinker component (currently about 95%) of cement produced at integrated plants. In other words, the U.S. cement industry could change from a product line dominated by "straight" portland cement to one dominated by blended cements. Although blended cements can have satisfactory performance characteristics, a radical shift to their use would require changes in many building codes, namely changing the cement specifications from a compositional basis to a performance basis. Further, a major shift to blended cements could lead to regional shortages of suitable pozzolans. Barring a commensurate increase in overall cement consumption, a major shift to blended cements would necessarily leave some kiln capacity idle or underutilized.

Another major waste product of clinker manufacturing is cement kiln dust (CKD), made up of fine particles of clinker, incompletely reacted raw materials and solid fuels, and material eroded from the kiln's refractory brick lining. Almost all CKD is captured by either electrostatic precipitation or baghouse filtration. On average, about 70% of CKD is recycled to the kilns as part of the raw meal, and another 5% or so is used for other purposes, commonly as a soil conditioner (liming agent) or for road bases. The remaining CKD, amounting to about 3 million tons annually, is removed to landfills—this is required for CKD containing contaminants levels (e.g., of excessive alkalis, chromium, vanadium, and toxic organic compounds) that preclude recycling.

Government proposals to reduce cement industry emissions of nitrogen oxides (NO_x) and sulfur oxides (SO_x), dioxins and furans, and other contaminants, are of concern to the industry, particularly to the degree that changing emission limits necessitates changes in testing procedures, equipment, and operating practices. These limits also affect the ability of plants to utilize waste fuels cheaply because the emissions are largely a function of fuel type and combustion conditions within the kiln. The Government was moving towards regulating kiln emissions within the regulatory Maximum Achievable Control Technology (MACT) framework, under which the standards adopted for each contaminant would be the average emissions levels of the 12% least polluting plants. The U.S. Environmental Protection Agency issued preliminary MACT standards in 1996, but had not issued final standards as of yearend 1997.

Production

Cement was produced in 1997 at 118 plants, in 37 States and in Puerto Rico, by 42 companies (other company totals are possible depending on ownership breakdowns), of which 1 was State-owned. Production and related data are shown in tables 2 through 6.About 63% of U.S. cement production and capacity was foreign-owned.

Florida Rock Industries broke ground early in the year for a new integrated 0.75-million-ton-per-year cement plant at Newberry, FL—the first new greenfields plant in the United States in a decade. The plant was expected to come on-line around midyear 1999 (World Cement, 1997a).

A number of companies were engaged in, or planning, projects to upgrade their plants to one degree or another to reduce operating costs and/or to increase capacity. Among the major projects, Ash Grove Cement Co. was upgrading its Durkee, OR, plant to increase capacity by 80% to 0.9 million tons per year; the work was expected to be completed early in 1998 (International Cement Review, 1998a).Blue Circle America Inc. continued its work, begun in 1996, to expand the capacity of its Harleyville, SC, plant by 0.3 million tons per year. A new crusher was installed in the quarry, and the kiln's preheater capacity was enlarged. A new precalciner and a new roller mill were to be installed in early 1998 (U.S. Geological Survey, 1997a).Holnam, Inc. completed its conversion from wet to dry kiln technology at its Devils Slide facility at Morgan, UT. The new 0.7-million-ton-per-year kiln was fired up in November and replaced two wet lines having one-half as much (total) capacity. The new kiln burns an interesting mix of fuels, namely coal, natural gas, waste tires, and waste material from the manufacture of disposable diapers (U.S. Geological Survey, 1997b; International Cement Review, 1998b).Lafarge Corp. was installing a new kiln line at its Sugar Creek, MO, plant that will raise the output capacity by 70% to 0.9 million tons per year and is expected to be in production in the year 2000 (World Cement, 1997b).The Union Bridge, MD, plant of Lehigh Portland Cement Co. was being upgraded to a capacity of 1.5 million tons per year, a 50% increase (World Cement, 1997b).Lone Star Industries Inc. expanded the capacity of its granulated blast furnace slag grinding plant in New Orleans, LA, and was planning to mix some blended cements there in addition to its primary ground slag product (Rock Products, 1998a).Tarmac America Inc. announced that its was going to convert from wet to dry technology at its Pennsuco Cement subsidiary company's Miami, FL, plant, increasing the plant's capacity thereby by one-third to 1.2 million tons per year of cement plus 0.2 million tons per year of ground slag (Tarmac America Inc., 1997).In June, Southdown, Inc. started up its new finish mill (constructed in 1996) at its Fairborn, OH, plant, part of a project to expand capacity by 0.1 million tons per year (U.S. Geological Survey, 1997c).At its

Victorville, CA, plant, Southdown completed its 0.3-million-ton-per-year kiln upgrade project in August (U.S. Geological Survey, 1997d) and was planning to add a further 0.3 million tons per year to the pyroprocessing capacity of the plant in 1999 (International Cement Review, 1997b).

There were no permanent plant closures announced during the year.

Portland Cement.—In the United States and Puerto Rico, portland cement was manufactured at 118 plants, including 8 dedicated grinding facilities for clinker (some of these also ground slag).The regional distribution of these plants, cement production and capacities, and yearend cement stockpiles, are given in table 2.

Portland cement production rose by 4.2% in 1997 to a new record of almost 79 million tons. As shown in table 2, increases were noted in most States. The top five portland cement producer States continued to be, in descending order, California, Texas, Pennsylvania, Michigan, and Missouri. Nationwide, calculated cement (grinding) capacity utilization was at very high levels—almost 85% overall. This statistic, however, is misleading in that it compares the reported grinding capacity with (only) the portland cement output. In reality, the masonry cement tonnage *(see table 3)* should be incorporated for most plants, which would increase the overall grinding capacity utilization for the country to almost 89%.Given the fact that the reported capacities are supposed to exclude all but routine downtime, the utilization levels shown are likely at or very close to practical limits. Although a number of plants had capacity improvement projects underway, some of the 1996-97 district changes shown could simply reflect a difference in reporting personnel or in their data rounding from one year to the next. Reported grinding capacities are somewhat subjective and, thus, the minor increase shown for the U.S. total capacity and capacity utilization in 1997 may not be statistically significant. As in previous years, the grinding capacity shown substantially exceeds the clinker capacity given in table 4.The main reasons for this are that the grinding capacity includes that of dedicated grinding plants (but not all districts have such plants); the annual grinding capacities for plants are reported directly to the USGS, whereas those for clinker are calculated; some plants have extra capacity for grinding purchased clinker and/or inert or pozzolan extenders; and it is cheaper to construct grinding capacity than clinker capacity.

Yearend portland cement stockpiles were about 0.25 million tons higher than those in 1996.It is difficult to evaluate changes in yearend national inventories—particularly such small ones—for a number of reasons. An increase in stocks could represent buildup of material ahead of shutting down the kiln(s) for routine maintenance or other work to allow for continued normal sales deliveries of cement. Such buildups would normally follow a buildup of clinker stocks, for which data are unavailable. The timing of kiln shutdowns for maintenance is not consistent for a given plant or among plants. Buildups could represent the coming on-stream, or the reaching of full production levels, of new or upgraded production capacity. Changes in stockpiles could reflect changes in sales volumes towards yearend. They can reflect mass changes associated with conversion to other types of cement, such as a "straight" portland cement being converted to a blended or a masonry cement. Finally, stockpiles appear to be prone to accounting inconsistencies, as evidenced by the fact that yearend stocks for a given facility reported in one year commonly are significantly different from the beginning year stockpiles reported in the subsequent year's survey.

Data are not collected on the production of specific types ofportland cement (e.g., Type I vs. Type III), but it is likely that production by type, at least of the major varieties, was proportional to the reported shipments by type, which are shown in table 15.Assuming this to be true, it is evident that gray portland cement Types I and II again accounted for about 90% of total output.

Portland cement producers in the United States ranged from companies having a single plant of less than 0.5% of total U.S. capacity to large multiplant corporations. The largest of these had 13% of total U.S. cement production capacity. The top 10 companies were, in descending order of production, Holnam, Inc.; Lafarge Corp.; Southdown, Inc.; Blue Circle Inc. (including St. Marys Cement Co.); Essroc Materials, Inc. (including San Juan Cement); Ash Grove Cement Co.; Lone Star Industries, Inc.; Medusa Corp.; California Portland Cement Co.; and Lehigh Portland Cement Co. However, some individual company performances and their rankings are ownership-dependent; thus if Lehigh Portland Cement is combined with CBR Cement Corp. (CBR), based on their common major parent, Heidelberger Zement AG of Germany, Lehigh would rank 6th instead of 10th.Depending on the ownership combinations chosen, the top 10 companies in 1997, combined, accounted for 61% to 65% of U.S. portland cement production and capacity.

Masonry Cement.—Reported production of masonry cement (including portland lime and plastic cements), as shown in table 3, increased 4.8% to about 3.6 million tons in 1997, which was 4.4% of total U.S. cement output. Production was very close to consumption (slightly in excess of shipments shown in table 8 (preferred); slightly less than shipments shown in table 12).The significant increase shown in stockpiles may be largely due to imports but, because the trade data in tables 17 through 21 do not split out masonry cement, the slender evidence for this is the modest increase in 1997 in the amount of masonry shipments to final customers reported as being of foreign origin in table 8.However, this amount does not represent total imports.

Masonry cement was produced in 1997 by 35 companies at 83 plants, all but 2 of which also produced portland cement. Almost 94% of total masonry cement was produced directly from clinker in 1997, as opposed to being produced from portland cement. It is unclear if this proportion, up from the 89% in 1996, reflects increased activity by dedicated clinker grinding plants, or a change in the relative amounts produced of (true) masonry, portland lime, and plastic cements countrywide.

Clinker.—The production of clinker increased 3.3% in 1997 to a new record of72.7 million tons; output increased in all but a few districts. Including the facilities in Puerto Rico, clinker was produced by 110 integrated cement plants, operating 200 kilns. Two-thirds of the plants used dry-process kiln technology.

Table 4 provides district-level information on clinker production and capacity. Capacity utilization for the country was about 89%, and no district had a utilization level of less than 84%.As with clinker (cement) grinding capacities discussed earlier, these levels of performance represent full, or near full practical, output levels, as was the case in 1996.

It is important to note that the clinker capacity and capacity utilization data for 1997 show significant differences from those reported for 1996 (van Oss, 1996, table 4).Calculated annual capacity was about 81.3 million tons in 1997 and was shown as 74.2 million tons in 1996.Capacity utilization in 1996 was shown as 95%.Although it is likely that ongoing capacity expansion programs resulted in some actual capacity increases, the overall increase in 1997 almost certainly was not the 10% shown, nor is it likely that capacity utilization rates decreased (significantly or at all) in 1997.The problem lies within the calculation of annual capacity.

As the term is used in this report, annual clinker capacity is calculated from a reported 24-hour daily capacity for each kiln, times a period of 365 days minus "scheduled" downtime. Idle kilns that cannot be restarted, for whatever reason, in less than 6 months are not counted (one such kiln that was inadvertently retained in 1996 for eastern Pennsylvania was removed for the 1997 table).Scheduled downtime is supposed to mean only that for routine maintenance (mainly rebricking of the kiln(s); other maintenance, to the degree possible, would be scheduled concurrently).Typically, routine maintenance takes 15 to 30 days each year. Scheduled maintenance is not supposed to include plant upgrades, except to the degree that this work is carried out simultaneously with the routine kiln shutdowns. All downtime beyond that needed for routine maintenance is supposed to be reported as "unscheduled" downtime, which plays no role in the annual capacity calculation. However, many plants misreport downtime for plant upgrades under the "scheduled" category (because the work has been planned), even where that work extends beyond the routine maintenance period(s).The result of this extra scheduled downtime is a calculated annual capacity that is too low and a capacity utilization rate that is too high—commonly in excess of 95% or even 100%.For annual capacity as defined above, such a performance generally would be possible only for short periods, under circumstances of no unexpected mechanical problems and less time than normal taken for routine maintenance work. It is doubtful that such a performance for a cement plant or other large industrial facility, much less several in an entire District, could be maintained over the span of a year.

Because of seemingly excessive annual capacity utilization rates in recent years preceding 1997, great effort was made, for the 1997 survey,to recontact all of the plants that reported seemingly high (in excess of 30 days) totals for scheduled downtime to see if, in fact, the plants' reporting was in error. In virtually every case, the plants so contacted provided downward revisions of the scheduled downtime (but not the total downtime).These revisions increased the calculated annual capacities and reduced the utilization rates relative to the original data, and relative to the probably erroneous reporting of previous years. It was not practicable to similarly obtain corrections for the 1996 and earlier data. However, if the 1997 average of 26 days of downtime (for routine maintenance) is applied to the data for 1996 (instead of the 36 days actually reported), the 1996 annual capacity climbs to 77.3 million tons (91% capacity utilization), and the capacity increase for 1997 is then reduced to a more believable 5%.This is in line with the increase in the daily capacity (a reported, not calculated, statistic).The capacities for earlier years could be similarly recalculated, using an average for downtime within the range of 25 to 30 days. It should be noted that, although the 1997 annual capacity (as defined) data are more accurate than those of recent preceding years, the 1997 data may still incorporate errors for plants that reported realistic (30 days or less) scheduled downtime totals—these data were not questioned but some could still be wrong.

In 1997, the average plant operational capacity was 0.75 million tons per year; average annual capacity per kiln was0.41 million tons. As shown in table 6, (entirely) dry-process plants accounted for about 72% of total clinker production and wet plants for 26%; combination plants accounted for the remainder.

Excluding the clinker used directly in the manufacture of masonry cement (not broken out but estimated at about 2.3 million tons), the remaining clinker produced was sufficient to make approximately 76 million tons of "straight" portland cement, or 79 million tons if the imported clinker *(see table 5)* is included. Thus, unlike the case in 1996 where stockpiles were drawn down to meet an apparent clinker deficit of about 1 million tons, clinker production plus imports in 1997 were adequate for cement production needs, implying no significant net changes to clinker stockpiles for the year.

The top five clinker-producing States continued to be, in descending order, California, Texas, Pennsylvania, Missouri, and Michigan. Depending on the ownership combinations used, the top 5 companies had about 40% of total U.S. clinker production and capacity, and the top 10 companies had between about 60% and 64% of both. In terms of ranked clinker production, the order of the top 10 companies is ownership-dependent, and was (in declining order) Holnam, Inc.; Southdown, Inc.; Lafarge Corp.; Ash Grove Cement Co.; Essroc Materials, Inc. (including San Juan Cement); Blue Circle Inc.;Lone Star Industries, Inc.; Medusa Corp.; California Portland Cement Co.; and Lehigh Portland Cement Co. (excluding CBR).

Raw Materials and Energy Consumed in Cement Manufacture.—The nonfuel raw materials used to produce cement, most of which were consumed to manufacture clinker, are shown in table 5.As normal, about 83% of the raw materials mix was limestone and other calcareous rocks. Overall, the mass ratios among various major raw materials, and of these to clinker produced, are essentially the same for both 1997 and 1996.

Given increasing environmental interest in pozzolan consumption and data thereon, the substantial relative increase in consumption of blast furnace slag in 1997 is noteworthy because it is in contrast to the (surprising) decrease in sales of blended (with slag) portland cement shown in table 15.In 1996, the ratio of blast furnace slag consumed *(see table 5)* to the sales of blended (with slag) cement was about 17%, but in 1997 the ratio was 72% (the ratios assume a negligible volume of sales of blends containing natural pozzolans within the same table 15 category).Although there is no unique proportion of slag in blended cements, an amount of 15% to 40% would be common. Accordingly, the slag consumed in 1996 could easily "fit" into the tons of blended cement sold and, therefore, it was concluded for that year that essentially all of the blast furnace slag consumed was granulated slag used as a pozzolan. For 1997, however, although a proportion of70% slag or more in blended cement is certainly possible, this proportion (and the large "recipe" shift it would represent) is unlikely for the country overall. This suggests that there could be a disproportionality in 1997 between the tons of slag consumed and the tons of slag-containing blended cements sold. It is also possible that the slag consumption data for (especially) 1997 includes nongranulated (i.e., nonpozzolanic) varieties of blast furnace slag, or even misreported steel slag, both of which could be used as a kiln feed. Another possibility is that some of the slag reported as consumed in 1997 may be in excess of what was used to make portland cement—the excess having been for the manufacture of ground slag product or slag lime cements, which are not included in table 15.Limited proprietary data from slag processors, which in any case exclude the disposition of imported granulated slag, are inadequate to resolve this apparent slag consumption imbalance.

In contrast to blast furnace slag, the data for fly ash 1996-97 are in accord with the sales of blended cements that contain fly ash *(see table 15)* in terms of trend, but not in terms of proportionality. In any case, the amount consumed in both years remained well in excess of what could be accommodated by the cement sales. Accordingly, as in 1996, it is likely that the bulk of the fly ash consumed in 1997 was used as kiln feed; about 40% of the fly ash consumption increase shown was due to that of included bottom ash, which is only used for kiln feed.

Consumption of fuels, by kiln process, is shown in table 6.Overall, the consumption of coal (or coal plus coke) relative to clinker production were substantially unchanged in 1997.A significant increase in the burning of tires apparently offset modest declines in the burning of other solid wastes and of coke. The biggest change in 1997 was seen in the 37% increase in fuel oil consumption, apparently due to low oil prices during the year. The increase appeared to be at the expense of liquid wastes and, particularly at wet kilns, of natural gas.

Table 7 shows electricity consumption by the cement industry. For integrated plants, the consumption data are differentiated by kiln process type. Electricity consumption at integrated plants is dominated by the raw meal and finished cement comminution circuits. However, in modern dry lines significant amounts of electricity also are used to operate various fans and blowers in preheater and precalciner equipment. Thus, dry-process kiln lines—at least those equipped with preheaters and/or precalciners—consume more electricity than equivalent capacity wet-process lines. In 1997, overall per-ton (of cement) consumption of electricity decreased slightly compared to that in 1996; within this modest improvement was a significant decline in unit consumption by wet kilns. The improved wet kiln performance likely reflected various plant upgrade projects.

New to this edition of table 7 is the inclusion of electricity consumption by the dedicated grinding plants. The grinding plants reported an average consumption of 65 to 68 kilowatt hours per ton of cement produced, equivalent to 47% to 49% of the total unit consumption by integrated plants. Although the breakout data were unavailable, it is likely that the dedicated grinding plants consume more electricity on a unit basis than do the combined equivalent functional parts (finish milling, conveying, packaging, storage, and loading circuits) of the integrated plants. This is because the dedicated grinding plants have additional stand-alone functions (e.g., extra materials handling and storage) that might not be charged solely to the grinding and followup functions at integrated plants. Further, some of the clinker grinding plants also grind slag (in some cases, well in excess of blended cement needs) for sale either directly or within slag lime cement. It is likely that at least some of the electricity consumption for such (excess) grinding and handling was included in the data provided to the USGS. Alsop (1998) reports that, for a typical "world" integrated plant, the finish grinding and followup functions account for 41% of the plant's total electricity consumption. For his exemplar, this was 50 kilowatt hours per ton out of a total of 116 kilowatt hours per ton; accordingly, his reference appears to be to a more energy efficient facility than is represented by the U.S. average shown in table 7.

Consumption

Consumption of cement can be measured in more than one way. Table 1 shows the calculated apparent consumption for the country (excluding Puerto Rico).Apparent consumption is a commonly used statistic for commodities and is a mass balance among production, imports, exports, and changes in stockpiles. Although corrected for this report, values for apparent consumption of cement for earlier years prior to 1991 are somewhat too large because they contain a double counting of clinker imports, which should be deducted because the derived cement is already included within the production data. Also, apparent consumption data prior to 1991 are inconsistent in their inclusion or exclusion of trade and production data for Puerto Rico. For all years, the U.S. exports (may) include clinker, but any error introduced thereby is small. For consistency, the beginning year stockpiles data used in the calculation have been set as equal to the preceding yearend inventory, but this is not always in accord with the actual survey data for January 1st stocks. Also, the cement trade data used are for all types of hydraulic cement, not just the (dominant) portland and masonry varieties that compose production and stockpiles. Apart from these issues of data quality, the main problem with "apparent consumption" is that it includes cement moving as inter- and intracompany transfers (i.e.,material that has not yet been consumed) as well as material sold to final customers. On the other hand, the import data within "apparent consumption" are from the Department of Commerce, and may include material brought by spot importers—these imports would likely be missed by the USGS surveys of long-established terminals.

The best measure of true cement consumption levels in the United States is the amount of cement sold (shipped) to final domestic customers. In contrast, shipments by one cement producer to another, whether or not of the same company, are not counted until, ultimately, the cement is transferred to a final customer. The definition of who is and is not a "final customer" is left to the reporting cement producer, but is generally understood to include concrete manufacturers, building supply dealers, construction contractors, and the like. The designation ignores the possibility that a customer might put some cement into stockpiles extending beyond yearend (to be "consumed" the following year) or might resell cement to other users. There are no data on such storage or transfers, but they are believed to be small—probably no more than 5% of any 1-month's shipments—and would likely balance out over a period of months.

Cement shipments data and derivations therefrom are given in tables 8 through 15.Although some of the tables are superficially similar, it is important to note that these tables reflect two different data-collection methodologies, which yield some results that are not strictly comparable. The best consumption data are those of tables 8 and 9, which are annualized compilations of shipments data collected monthly from the cement-producing companies and from independent cement importers. The monthly surveys commonly are returned on a consolidated basis—one form representing a company's entire cement shipment activities (to final customers) including, importantly, those of its importation and distribution terminals. In contrast, tables 10 through 15 are based on the annual surveys sent to all of the cement-producing plants and certain import terminals. The annual forms are returned on an individual, not consolidated, operations basis. On the annual form, a cement manufacturing plant may report the shipments (to final customers) of distribution (including imports) terminals, but only to the extent that the activities of the terminals are known to the plant. Importantly, if a terminal acts partly or totally independently of the reporting plant, and did not itself return a survey form, then some or all of the shipments from the terminal may remain unreported to the USGS.

That all or part of the activities of some terminals are missing from the USGS cement surveys is strongly suggested by the fact that, over the years, the differences in the national shipment totals—especially for portland cement—from the two survey types have been significant. For example, total portland cement shipments to final customers in 1997 are given as 92.8 million tons in table 8 (monthly survey data) but only as 86.7 million tons in table 11 (annual survey data).For 1996, table 8 shows (revised) shipments of 87.5 millions tons, but table 11 shows 80.1 million tons. Both tables 8 and 11 include shipments of imported cement by mills and independent importers, and of cement made from imported clinker. The difference in total shipments—6.1 million tons in 1997 and 7.4 million tons in 1996—most likely reflects the activities of terminals not captured in the annual surveys (that is, on table 11).The monthly survey-based data (*table 8*) show the larger shipments of portland cement, are undoubtably more complete, and are thus preferred.

In a seeming logical contradiction, although the table 8 data for masonry cement are also the better measure of consumption, the table 8 national totals can for some years be slightly smaller than those in table 12.This is most likely explained by the fact that some companies' monthly surveys have some (generally small) shipments of portland lime and/or plastic cement misreported as being portland cement instead of masonry cement. This problem was identified in early 1998, and corrections to (identified) errors were sought only back through 1996.The 1997 data and the revisions for 1996 shown on table 8 reflect such corrected data as have been received by the USGS, but it is unclear if all misreporting companies have yet submitted corrected data, or if all of the errors have even been identified. The annual surveys appear to be substantially free of this problem.

Comparison of tables 8 with tables 11 and 12 reveals another important difference in the presentation of shipments data. Table 8 data are presented on an individual State basis, but some of the data in tables 11 and 12 (and others) are grouped on a multi-State basis where needed to conceal proprietary individual plant data. This (grouping) precaution is necessary because the data in tables 11 and 12 represent only the activities of plants and terminals within the given State. Except for cement imported (and subsequently shipped to customers) by these same facilities, the shipments shown all originated within the given State. However, the tonnages shown in tables 11 and 12 for a given State merely represent the total cement shipped by survey respondents in that State to final customers somewhere. The customers are not necessarily in the same State, and hence the data do not equate with consumption in that State. Thus, only the national totals in tables 11 and 12 represent a true "regional" consumption. In contrast, table 8 shows the individual State destinations of the shipments to final customers (i.e. consumption within that State), regardless of the State (or country) of origin of the cement. Because any number of companies or locations could ship to customers in a given State, with the exception of a few data for masonry cement, individual State data in table 8 do not require proprietary concealment.

As an example of the tonnage differences between the two data sets, Missouri is shown on table 8 as being the final customer destination (i.e., consumer) of 2.311 million tons of portland cement (that was produced somewhere), but table 11 shows Missouri (facilities) as having shipped 5.563 million tons of portland cement to final customers (somewhere).Clearly, Missouri was a net exporter of portland cement. In contrast, Florida is shown in table 8 as consuming 6.435 million tons of portland cement, but table 11 shows Florida facilities as having shipped only 4.750 million tons to final customers. Clearly, Florida was a net importer of portland cement.

Because they are from the same annual surveys, the data (national totals) in tables 10, 14, and 15, match those in tables 11 and 12, but not those in tables 8 and 9.

National Consumption.—Overall U.S. consumption of portland cement in 1997 increased 6.1% to 92.8 million tons, as shown in table 8.The component of shipments consumed that was imported cement grew 19.6% to 13.8 million tons. Masonry cement consumption increased by a modest 1.6%, but part of this increase was due to corrected monthly reporting (especially for 1997) by some companies for portland lime and/or plastic cement shipments that had hitherto been reported as being portland cement. As noted in the introduction to this report, the consumption of masonry cement shown likely under represents true consumption for the country because some such cement may be mixed at the job site, using purchased portland cement and various additives, rather than at the cement plant.

Construction spending overall increased 2.8% in 1997 from that in 1996 to $507.5 billion (1992 dollars), according to Bureau of the Census data quoted by the Portland Cement Association (1998).Within this total, residential construction grew 2.9% to $218.2 billion, as a result of a 9.8% growth to $19.1 billion in multifamily dwelling construction; that for single family units was stagnant at $136.5 billion. Compared to the 5.2% growth in overall residential spending in 1996, the 1997 performance was modest, but the 1996 performance was in comparison to a lackluster 1995.Growth in 1997 reflected continued, and generally slightly declining, low mortgage rates. Nonresidential building construction rose 4.6% in 1997 to $136.4 billion. Public sector construction rose 2.2% to $117.9 billion, led by a 5.4% increase in road construction to $35.1 billion. It is interesting to note that, as in 1996, the overall rate of increase of construction spending was less than the rate of increase, by tonnage, of cement consumption noted above. For 1997, this appears to be partly due to modest increases in cement prices (see Values section below), but also (for both years) appears to reflect a somewhat higher "penetration" rate of cement in overall construction—that is, more cement was consumed per dollar of construction than in years past. Unfortunately, the survey data are not adequate (see the Cement Customer Types section) to assess wherein what usage types this penetration (increase) might be occurring.

As shown in tables 8 and 9, most States and all regions showed consumption increases for the year. Of the few States that consumed less portland cement in 1997, almost all were small consumers. For some States, the annual tabulation masks some short-term (monthly) declines that were, generally, the result of adverse weather conditions. The largest relative growth region was the Pacific District, which was powered by a 13% increase in consumption by California, the largest consuming State. The Northeast region, led by Massachusetts (up 17.5%), New York (9.9%), and Pennsylvania (7.2%), also showed strong growth. Besides these States, major (consumer) States that showed strong growth were Arkansas (up 11.5%), Indiana (9.9%), Iowa (8.6%), New Jersey (15.6%), Texas (6.7%), and Washington (8.1%). For the country, the five largest portland-cement-consuming States were, in declining order, California, Texas, Florida, Ohio, and Georgia—the order unchanged from 1996 except for a reversal of the top two. Overall, the South continued to be the largest consuming region. The 1997 data for Georgia and South Carolina understate true consumption because of the startup of two import terminals acting as captive suppliers to their parent local ready-mixed concrete companies. The terminals were not part of the 1997 surveys but, based on the import data in table 18, their activity in 1997 was believed to be very small.

Table 10 shows portland cement shipments to final customers in terms of transportation method. As in 1996, most shipments were directly from the plant to the customer and were mainly of bulk cement. Truck transport continued to dominate deliveries to final customers, but railroads were the largest mode of delivery from plant to distribution terminals. The only significant changes in transportation modes in 1997 were that barged shipments from plants to terminals grew at the expense of rail transport, and barged shipments to final customers were virtually eliminated.

Values.—The value data shown in tables 11 through 13 represent ex-plant valuations provided by the plants and import terminals for their total shipments to domestic final customers of gray portland cement, white cement, and masonry cement. In recognition of the highly proprietary nature of value data and the misgivings of some companies about providing such data at all, values are not queried for shipments by individual types of portland cement (although the tonnages, by type, are reported and are shown in table 15), nor is there differentiation of bulk shipments from container (bag) shipments. Container shipments would be expected to have relatively high unit values. Except in table 13, the white cement data have been lumped in with those for gray portland cement. Notwithstanding these obscuring protections, almost one-fourth of the respondents did not provide value data for the 1997 survey, about the same as in previous years. In such cases, the values supplied by other plants in the same market area were averaged and applied as an estimate; the number of plants so averaged varied regionally.

Traditionally, the values sought have been "mill net," which can be defined as the (sales) value at ("free on board" or f.o.b.) the manufacturing plant, excluding any discounts, and excluding shipping charges to the final customers. For independent terminals, particularly import terminals, the equivalent statistic sought would be the f.o.b. terminal value. In the case of imports, this would essentially represent the c.i.f. (cost, insurance, freight) value of the imports plus unloading and storage costs plus the terminal's markup. However, it is evident that some facilities have provided value data that was calculated differently.

Given the entrained problems with the value data, the reader is cautioned that the values shown are merely estimates, despite the fact that, to preserve a time series with previous editions of this report, they are presented unrounded. The unit value data should be viewed solely as estimated regional indicators or indices, good (only) to perhaps the nearest $0.50 or $1.00 per ton, and suitable only for crude comparisons among districts and years. Most especially, the unit value data cannot be viewed as regional shopping prices for cement. It may be assumed that the data for portland cement are dominated by the values of the Types I and II varieties.

The total ex-plant value of portland cement shipments to final domestic customers, as shown in table 11, rose almost 12% to about $6.3 billion in 1997, reflecting both an 8% sales volume increase and, within the aforementioned data constraints, an average ex-plant unit value increase of 3.3%.If the average price shown is applied to the shipments (consumption) data in table 8, the 1997 total rises to $6.7 billion. This performance follows a 14% increase in total value, and about a 5% increase in unit value, in 1996.The substantially larger volume of imports in 1997, which averaged only a 2.4% increase in c.i.f. price (*see table 19*), may be partly responsible for the relatively moderate increase in the overall unit value of cement sales in 1997.

The regional breakouts in table 11 represent the location of the reporting facilities, not the location of consumption, for the cement sales shown, consequently, the data shown are only crude indicators of regional values. Within this constraint, and ignoring changes of $1.00 per ton or less (statistically probably indistinguishable), unit values increased modestly for most regions in 1997.The significant decline shown for eastern Pennsylvania probably reflects a too high value in 1996, although it is possible that the 1997 decline could reflect an influx of low cost imports (imports into the New York Customs District *(see table 18)* showed an 8.5% reduction in unit c.i.f. value in 1997.

Table 12 shows the distribution of masonry cement sales and the values thereof, in terms of the location of the reporting facilities. The average unit value of sales in 1997 increased only about 1% (this may not be statistically significant) to about $94 per ton, for a total of about $344 million. As noted above, table 12 shows a slightly higher total sales volume of masonry cement for the country than does table 8 because the latter may still exclude a small amount of portland lime or plastic cement mistakenly reported to the USGS as sales of portland cement. The unit value in table 12 applied to the total volume in table 8 would yield a total value of sales of $340 million.

The only data for domestic delivered prices for cement are those for Type I portland (per short ton) and masonry cement (per 70-pound bag) published monthly by the journal Engineering News Record (ENR).The data represent a survey of customers (likely to be ready mixed concrete producers for portland cement and building supply depots for masonry) in 20 cities in the United States. The 20-city average delivered price in 1997 for Type I portland converts to $83.04 per metric ton, up by 3.3% from the 1996 price, with a range over the year of only $2.55 per ton. The prices showed a general increase from January to December ($83.87).The $10.45 per ton difference between the average ENR price and the average unit value in table 11 is an indicator of the approximate delivery charge to final customers. The ENR specific city data show a number of regional price differences, some of which differ significantly from those shown in table 11.The variations could reflect regional differences in shipping methods and costs. The prices for some cities covered, however, did not vary at all over the year, making questionable the validity of the data, save for the fact that the overall percentage price increase for the ENR survey is consistent with that in table 11.The ENR 20-city average masonry cement price for the year was $4.58 per bag (literally converts to $144.25 per ton), up by 2.5%; the large difference in "price" between this and the average in table 12 is probably a combination of packaging, handling, and delivery charges.

Cement Customer Types.—Data for 1997 on portland cement shipments to final customers are shown in table 14, broken out by customer (user) type and region. Again, the regional splitouts represent the locations of reporting facilities, not necessarily the locations of the consumers. As with the value data, the user-type data must be viewed as crude estimates.

The problem with the user-type data lies in the fact that the survey requests more details (user categories) than many companies are able to provide. A few cement plants seem not to track their customers by user type at all, and many others track their sales only in terms of very broad user types, such as "Concrete product manufacturers."In the latter case, the shipments would be entered on the form either all under the broad classification header (Concrete products), or under its breakout subheading "other."Thus, the subheadings "other," intended to capture miscellaneous uses not otherwise broken out, instead misleadingly serve largely as a catch-all. Even for companies that track customer user types in detail, the user categories that they employ might not match those of the survey. And there are some categories that present assignment ambiguities. Perhaps the most important of these are cases where a cement plant knows how much of its cement gets used by a ready-mixed concrete manufacturer customer for the purpose of building or repairing roads. The dilemma, then, is whether to register those tons under the "Ready-mixed concrete" category or the "Contractors—road paving" category. Another example would be the "Government agencies" use category on the questionnaire, wherein the "Government" use could include ready-mixed concrete, or road paving, or other duplicative use(s).Further, although generally listed as exact tonnages, some company responses calculate to simple (broad) percentages of the total shipments—the breakdown being the "best guess" of that cement plant. In a few instances, the apportioning appears to have been guided by past published breakdowns.

To a significantly greater extent than in previous years, plants that initially provided inadequate details for user types on the 1997 survey were solicited on a followup basis for additional details, with, however, mixed success. Certainly, the major use categories are better represented than in past years, if only by companies' best guesses, but some of the minor use categories remain questionable (probably under represented).Importantly, table 14 for 1997 has far fewer tons lumped under the "other" and "Government and miscellaneous" categories. Although believed to be more accurate than in previous years, the data still contain a number of estimates and, although presented in unrounded form, probably should not be taken as being accurate to more than two significant figures.

Notwithstanding these limitations, the data in table 14 clearly indicate that the dominant customer type for portland cement in 1997 continued to be ready-mixed concrete producers, accounting for 72% of the total. This is in accord with data for recent past years, once allowance was taken for a share of ready-mixed concrete lumped under the past years' "Government and miscellaneous" and "Road paving" categories. Unfortunately, to a significant degree the improved subcategory assignations of the 1997 data within "Concrete product manufacturers" and "Contractors" preclude their direct comparison with data from preceding years, at least in terms of usage trends. Sales to oil well drilling consumers increased by 35%, but this may underestimate the true sales volume because, where estimates were included, they were only to assign reported sales of oil well cement. No "ordinary" (e.g., Types I and II) portland cements were assigned to this user category on an estimated basis, yet "ordinary" cements can be used in shallow drill holes. The increase shown reflects a higher level of drilling activity during the year, as evidenced by the 19% increase in the drill rig count (Oil & Gas Journal, 1998).Sales to mining customers, as shown, are an almost sixfold increase over those in 1996.However, although—particularly in the gold industry—there was greater reliance on underground mining (for which cement is used in backfill), the level of this activity almost certainly did not increase by the percentage indicated for the cement shipments, which suggests some under reporting of cement consumption for mining in 1996.Likewise, the doubling of sales for waste stabilization purposes may reflect incomplete data.

Types of Portland Cement Consumed.—As shown in table 15, portland cement consumption in the United States continued to be dominated by general-use Types I and II. Within the broad use of the portland term, Types I through V accounted for more than 96% of total shipments. Of these main varieties, Type V cement, which is resistant to so-called sulfate attack, showed the largest relative increase during the year. Of the less common varieties, oil-well cement showed an 18% relative increase in shipments, owing to a large increase in drilling activity during the year, as noted above. After having increased significantly in 1995, consumption of slag-blended cement was largely stagnant in 1996, and decreased significantly in 1997.This decline was unexpected given that, based on proprietary sales data for domestic granulated slag and the general paradigm that blended cements are more "environmentally friendly" than "straight" portland, the market was believed to have grown for slag-blended cements. The table 15 decline could reflect a greater reliance by the concrete manufacturers on purchases of domestic or imported granulated slag which they then mix themselves. Alternatively, the decline could reflect market substitution of other types of blended cement, especially of blends with fly ash. Table 15 shows a five-fold relative increase in sales in 1997 in the category that includes blends containing fly ash. Overall, blended cement consumption increased 14.4% during the year.

Foreign Trade

Trade data from the Bureau of the Census are shown in tables 16 through 21.Exports of hydraulic cement (all types) and clinker decreased slightly in volume and increased slightly in value, but the overall volume of exports is so small as to render such small shifts meaningless. The bulk of the exports continued to be to Canada.

Tables 17 and 18 show total imports of hydraulic cement and clinker for 1997 and 1996.Unlike the relatively stagnant level of imports in 1996 (which increased only 2.2% over those in 1995), imports in 1997 increased by 24.3% (compared with 1996 levels).The unit value of the imports, however, rose only 2.7%, which likely constrained price increases for domestic cement, at least in markets having access to imports.

The cement component of imports (data in table 17 minus the clinker imports in table 21) was 14.6 million tons, up 25.6% cement from imports in 1996.Gray portland cement imports represented 96% of total cement imports, and were up 25.4% (tons); the c.i.f. unit value was up only 2.5%, to $50.05 per ton. This continued to be substantially below the unit sales value of domestic shipments, but excluded markups by terminals. The cheapest cement was from Mexico (c.i.f. value of $39.22 per ton).

The Customs districts of entry for imports of hydraulic cement and clinker are shown in table 18.Large relative increases were seen particularly for West Coast and Gulf of Mexico import terminals. A significant contributor to the West Coast increase was the reopening early in the year of the MCC Lucky terminal, owned by Mitsubishi Cement Corp., in Long Beach, CA, which had been idle since its construction in 1991 (World Cement, 1997b).Canada continued to be the largest source of cement imports, but its sales to the United States in 1997 increased only modestly, reflecting in part, importation infrastructure constraints. Other than Canada, most major traditional sources showed substantial increases in sales to the United States in 1997, particularly Colombia and Greece. One notable exception was Mexico, imports of gray portland from which declined 25%, evidently the result of burdensome antidumping tariffs and failed appeals thereof. Of nontraditional sources, imports from China and Turkey increased dramatically. White cement imports *(see table 20)* were up by one-third compared with levels in 1996, although the latter had shown a decline of 10.6% compared with imports in 1995.The major sources continued to be Canada, Denmark, Mexico, and Spain. The average c.i.f. price declined 4% to $104.77—well below the domestic sales value (for which, however, the data are weak) shown in table 13.Imports of white cement, per table 20, were equivalent to 82% of the sales shown in table 15 in 1997, as opposed to 63% in 1996 and 79% in 1995.

Hydraulic cement clinker imports increased by 19%, as shown in table 21.The c.i.f. value increased 3.6% to $50.13 per ton, virtually identical with the unit value for gray portland cement; however, these amounts are inflated by their inclusion ofvery high unit value material (largely aluminous cement clinker) from France and some miscellaneous ("Other") countries. Removing these yields a remainder that is largely portland cement clinker and which amounted to about 2.72 million tons, up 9%, and worth about $47 per ton, up 4%.

Although Canada continued to be the dominant source of clinker imports, the tonnage taken in 1997 fell almost 19%.Based on Customs district of entry data for clinker imports in the monthly surveys, it appears that the decline was of waterborne deliveries to South Atlantic and Gulf ports where it was replaced, to a major degree, by a 36% increase in imports from Venezuela. After a hiatus in 1996, Turkey reemerged as a significant import source for clinker.

World Review

World hydraulic cement production is shown in table 22 and amounted to about 1.5 billion tons in 1997.The data incorporate estimates for a number of countries, and the production of cement for some countries may include their exports of clinker. Accordingly, the minor annual world total increases shown for the years 1995-97 are within the likely range of error for the summations and are thus probably of no statistical significance. Further, although the data are supposed to include all forms of hydraulic cement, for some countries (notably the United States), it is likely that the data are, in fact, not all-inclusive.

China continued to be, by far, the largest cement producer in the world, with about one-third of the total output. A strict ranking of the remaining top 15 producers cannot be fully fixed, but would appear to be, in descending order, Japan, the United States, India, the Republic of Korea, Brazil, Germany, Turkey, Thailand, Italy, Spain, Mexico, Russia, Indonesia, and Taiwan. The top 15 countries accounted for 74% of the world total in 1997, and among these countries are about 10 that have accounted for the majority of the growth in world production. China's growth, in particular, has been explosive for the years shown (except for 1997, where its output increased only slightly).For the period 1993-97, China has accounted for about 125 million tons, or 56% of the total world increase. Among the other major producers, India's output has increased about 26 million tons during this period, Brazil by more than 13 million tons, Korea by almost 13 million tons, and the United States and Thailand by about 9 million tons each. India's growth has been so rapid that it would appear destined to overtake the United States within 1 or 2 years. In contrast, Russia has experienced a 23-million-ton decline in output since 1993.

Comparison of production levels among some countries can be misleading, however, unless they are made for output of similar-quality cements. For example, portland and related cements from clinkers manufactured in large rotary kilns are generally considered to be of higher and more consistent quality than cements made in small ("village-scale") vertical shaft kilns. The vertical shaft kilns might produce cements suitable for the construction of small houses and similar edifices, but for modern highways, large bridges and dams, tall buildings, and the like, cements from modern rotary kilns are preferable. Unfortunately, there are few if any data on the world production split between vertical shaft kiln plants and modern rotary kiln plants; the former are almost universally found in so-called developing world countries, but the same countries may also have enormous, state-of-the-art rotary kilns. Where financing and demand permit, most countries having shaft kilns are replacing them with rotary kilns. The giant example of the difference in output between kiln types is, once again, China. Cement production in China, based on recent reviews (e.g., Hargreaves, 1997; Rong and others, 1997), comprised in 1997 about 60 million tons of high- or export-quality cement from a relatively small number of medium and large rotary kilns and about 430 million tons of cement of uncertain quality from several thousand small shaft kilns (many of which are being phased out).

On a regional basis, Asia (including Australasia) had the largest cement production in 1997, accounting for about 58% of the world total. Europe was the next largest producing region, with 15% (Western Europe alone was 12%) of the total; followed by North America (including Mexico), 8%; the Middle East (including Turkey), 7%; Central America and South America, 5%; Africa, 4%; and the former Soviet Union, 3%.Asia has accounted for 88% of the total world growth in cement production for the period 1993-97.

Were it practicable to produce an accurate list of all the ongoing or planned world projects to build new, or upgrade existing, cement plants, the compendium would be very lengthy. Given the production and production growth distributions noted above, it is no surprise to find that a majority of these projects are in Asia, particularly in Southeast Asia. As state-owned plants in Eastern Europe and elsewhere have been privatized, they have attracted investment interest by, in the main, the same major European and Mexican cement companies that dominate the production of cement in Western Europe, the former Soviet Union, and the Americas. Many of the Southeast Asian projects, on the other hand, have been more locally organized and financed. By comparison, new projects—particularly for greenfields plants—in Western Europe and in the United States and Canada have been relatively few. Except mainly for Egypt, there have been few significant cement projects in recent years in Africa.

The economic crisis that manifested itself late in 1997 in Southeast Asia and which has subsequently spread to many parts of the world appears already to be slowing the completion of some ongoing projects and the startup of new ones.

Outlook

Over the medium to long term, world cement consumption and production is anticipated to grow at about 2% per year. However, the Southeast Asian economic crisis mentioned above has necessitated a revision to cement forecasts and to most other world near-term economic forecasts. Although the economic downturn in Southeast Asia has subsequently spread elsewhere, it can be argued that it has yet to do so with the same degree of severity. Nevertheless, because Asia has been the locus of the majority of world production, of growth in cement consumption, and of new or planned capacity, any major economic downturn in this region would argue for, at the very least, a stagnation in both world cement consumption and production in the short term (e.g., for the period 1999-2003).A contraction of 1% to 2% per year would be equally possible, although data inconsistencies for many of these countries could make documentation of this difficult. The cement industries of Asia (especially Southeast Asia) appear to be particularly vulnerable to the current crisis, compared with their counterparts elsewhere, for a number of reasons. Much of the recent growth in Asian cement consumption and production capacity has been tied to high levels of public sector construction spending and many of the planned new capacity projects have been predicated on continued high levels of such. A large portion of this spending has now been put into abeyance or is in jeopardy. Many of the new plants and planned facilities have been projects of local companies or consortia rather than of large, multinational, cement corporations, and many of these projects have been financed by borrowing from local banks, at high debt to equity ratios (Roy, 1998).Financing of these projects (which each cost tens to hundreds of millions of dollars) has been made very difficult, particularly for the local companies, by the devaluations that have occurred to the local currencies and the fact that these companies, and many of the local banks, do not have significant hard currency reserves.

Cement industries in other regions of the world can also expect to be affected as the economic downturn spreads, but it appears likely that for many of these regions the decline could be mitigated to some degree by an overall lesser reliance on public sector spending. Further, in these regions, most of the companies involved are large, multinational concerns having the ability to spread their risks and draw on resources, worldwide, and which are not as vulnerable to local currency value fluctuations. Also, for the developed world, the more established and generally more diversified nature of the economies would argue for fewer sudden shifts in construction spending.

The U.S. economy has been relatively unaffected from the Asian economic crisis in 1998 and continued buoyant during the year, with the construction sector benefitting from continued very low interest rates. Data available through the third quarter of 1998 yield a projection of U.S. consumption of portland plus masonry cement for the year that could, for the first time, exceed 100 million tons. In the near term beyond 1998, some slow weakening of the U.S. construction market, particularly for buildings, could occur, particularly on the West Coast, where the economies are vulnerable to diminished levels of U.S. exports to Asia. Any decline would likely be mitigated by continued low interest rates and by increases in public sector construction spending resulting from the 1998 passage of a major highway spending bill. Overall, any demand growth in 1999-2003 is likely to be under 3% per year. In contrast, U.S. cement production is slated to rise in 1999 and in the succeeding few years, as several million tons of new capacity (largely at existing plants) is brought on-stream. Given a relatively stable U.S. cement market, the added production would augur for proportionally reduced levels of imports, although there could be short-term increases due to influxes of inexpensive cement from major producing countries experiencing severe economic downturns. In particular, several Asian countries now have significant excess production capacity and can be expected to seek to export their excess output. Because of local currency devaluations, this cement will likely be inexpensive. For some Asian companies, exports may be constrained by a lack of convenient access to shipping ports or to suitable cement tankers. The ability of these countries to export to the United States is further constrained by limited capacity at U.S. cement unloading port terminals, although this can be offset by the use of self-unloading or silo ships, or by bringing in packaged shipments that can be unloaded at general cargo ports.As of the third quarter in 1998, large increases (over full year 1997 levels) in cement (plus clinker) imports into the United States were being seen for material from China, the Republic of Korea, and Thailand. Any flood of inexpensive imports can be expected to be scrutinized for evidence of dumping.

In addition to standard market factors, a constraint on future domestic cement production will be any imposition of restrictive environmental legislation, particularly that requiring a majority of plants to reduce emissions, or that restricts the ability of the industry to cheaply use waste fuels. If restrictions or taxes on CO_2 emissions are imposed, then the U.S. industry could find itself at a competitive disadvantage to imports from countries exempted from similar restrictions or taxes. Without protective tariffs, or allowing the industry to engage in some sort of trading of emissions credits, some shutdowns of domestic capacity could take place. Any resulting declines in clinker production likely will be offset by increased domestic use of nonclinker components of cement, such as pozzolan or inert extenders.

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TABLE 1
SALIENT CEMENT STATISTICS 1/

(Thousand metric tons unless otherwise specified)

		1993	1994	1995	1996	1997
United States 2/						
Production 3/		73,807	77,948	76,906	79,266	82,582
Shipments from mills 3/ 4/		72,770	79,087	78,518	83,607 r/	90,359
Value 3/ 5/	thousands	$4,049,820 r/	$4,844,869	$5,329,187	$5,952,203 r/	$6,622,464
Average value per ton 3/ 6/		$55.65	$61.26	$67.87	$71.19 r/	$73.49
Stocks at mills, 3/ Dec. 31		4,788	4,701	5,814 r/	5,488	5,784
Exports 3/ 7/		625	633	759	803	791
Imports for consumption:						
Cement 8/		5,532	9,074	10,969	11,566 r/	14,523
Clinker		1,507	2,206	2,789	2,401	2,867
Total		7,040	11,280	13,758	13,967	17,389
Consumption, apparent 9/		79,198	86,476	86,003 r/	90,355 r/	96,018
World: Production 10/		1,290,905 r/	1,373,013 r/	1,443,328 r/	1,488,262 r/	1,515,442 e/

e/ Estimated. r/ Revised.

1/ Portland and masonry cement only, unless otherwise indicated.

2/ Excludes Puerto Rico.

3/ Includes cement made from imported clinker. Includes imported cement shipped by mills and import terminals.

4/ Shipments are to final customers. Includes imported cement. Data are based on annual survey of plants and may differ from tables 8 and 9, which are based on consolidated monthly shipments data from companies.

5/ Value at mill (or import terminal) of portland (all types, including white) and masonry cement shipments to final domestic customers. Although presented unrounded, the data contain estimates for survey nonrespondents.

6/ Total value at mill or import terminal of cement shipments to final customers divided by total tonnage of same. Although presented unrounded, the data contain estimates for survey nonrespondents.

7/ Hydraulic cement (all types) plus clinker.

8/ Hydraulic cement, all types.

9/ Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in stocks.

10/ Total hydraulic cement. May incorporate clinker exports for some countries.

TABLE 2
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/ 2/

(Thousand metric tons unless otherwise specified)

	1996					1997				
			Capacity 3/		Stocks 4/			Capacity 3/		Stocks 4/
District	Plants active	Produc- tion 5/	Finish grinding	Percent utilized	at mills, Dec. 31	Plants active	Produc- tion 5/	Finish grinding	Percent utilized	at mills, Dec. 31
Maine and New York	4	2,966	3,348	88.6	234	4	3,147	3,529	89.2	242
Pennsylvania, eastern	7	4,057	5,152	78.7	243	7	4,501	5,084	88.5	236
Pennsylvania, western	4	1,615	2,009	80.4	105	4	1,858	2,045	90.8	129
Illinois	4	2,619	2,871	91.2	149	4	2,594	3,399	76.3	194
Indiana	4	2,347	2,731	85.9	185	4	2,396	2,731	87.8	167
Michigan	5	5,387	6,999	77.0	295	5	5,696	7,243	78.6	287
Ohio	3	1,054	1,588	66.4	62	3	1,043	1,878	55.5	56
Iowa, Nebraska, South Dakota	5	3,931	5,489	71.6	322	5	4,224	5,525	76.4	354
Kansas	4	1,725	1,783	96.7	149	4	1,690	1,783	94.8	134
Missouri	5	4,531	5,150	88.0	410	5	4,731	5,150	91.9	404
Florida	6	3,445	4,667	73.8	280	6	3,747	5,262	71.2	293
Georgia, Virginia, West Virginia	5	2,473	3,700	66.8	219	5	2,577	3,277	78.7	242
Maryland	3	1,609	1,837	87.6	105	3	1,790	1,904	94.0	133
South Carolina	3	2,368	3,075	77.0	85	3	2,515	3,075	81.8	93
Alabama	5	4,326	4,804	90.0	271	5	4,279	4,744	90.2	275
Kentucky, Mississippi, Tennessee	4	2,216	2,474	89.6	187	4	2,316	2,528	91.6	157
Arkansas and Oklahoma	4	2,553	2,889	88.4	191	4	2,714	3,162	85.8	149
Texas, northern	6	3,906	4,712	82.9	270	6	3,887	4,719	82.4	208
Texas, southern	5	4,332	4,726	91.7	218	5	4,393	4,772	92.1	204
Arizona and New Mexico	3	2,217	2,367 r/	93.7 r/	63	3	2,239	2,563	87.4	64
Colorado and Wyoming	4	2,031	2,377	85.4	125	4	2,018	2,445	82.5	100
Idaho, Montana, Nevada, Utah	7	2,216	2,887 r/	76.8 r/	209	7	2,344	2,926	80.1	168
Alaska and Hawaii	1	312	499	62.5	45	1	252	499	50.5	52
California, northern	3	2,610	2,880	90.6	125	3	2,773	2,797	99.1	115
California, southern	8	7,297	7,943	91.9	279	8	7,488	7,957	94.1	313
Oregon and Washington	4	1,655	1,960	84.4	133	4	1,737	2,204	78.8	99
Total or average 6/	116	75,797	90,915 r/	83.4 r/	5,108 r/ 7/	116	78,948	93,198	84.7	5,356 7/
Puerto Rico	2	1,552	2,004	77.4	37	2	1,673	2,004	83.5	31

r/ Revised.
1/ Includes Puerto Rico.
2/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas.
3/ Grinding capacity based on fineness necessary to grind Types I and II cement, making allowance for downtime required for routine maintenance.
4/ Includes imported cement.
5/ Includes cement produced from imported clinker.
6/ Data may not add to totals shown because of independent rounding.
7/ Total stocks include inventory, not shown on a District basis, held by independent importers.

TABLE 3
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

District	1996 Plants active	1996 Production 3/	1996 Stocks 2/ at mills, Dec. 31	1997 Plants active	1997 Production 3/	1997 Stocks 2/ at mills, Dec. 31
Maine and New York	4	102	16	4	107	16
Pennsylvania, eastern	5 r/	170	31	6	187	33
Pennsylvania, western	4	105	16	4	109	14
Indiana	3 r/	W	W	4	W	54
Michigan	5	232	28	5	289	29
Ohio	2	W	W	2	W	W
Iowa, Nebraska, South Dakota	4	W	6	4	W	10
Kansas	3	24	9	3	W	W
Missouri	1	W	W	1	W	W
Florida	4	422	26	4	406	24
Georgia, Virginia, West Virginia	5 r/	376	32	5	382	38
Maryland	2	W	W	3	W	13
South Carolina	3 r/	286	W	3	W	W
Alabama	4 r/	309	37	4	346	48
Kentucky, Mississippi, Tennessee	3	W	W	3	88	9
Arkansas and Oklahoma	4	117	21	4	105	14
Texas, northern	4	W	8	4	110	10
Texas, southern	4 r/	100	7	4	94	8
Arizona and New Mexico	2 r/	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	3 r/	W	W	2	W	2
Alaska and Hawaii	1	5	1	1	3	1
California, northern	2 r/	W	W	2	W	W
California, southern	3	160	W	3	W	W
Oregon and Washington	1 r/	W	W	3	W	W
Total or average 4/	78 r/	3,469 5/	380 6/	83	3,634 5/	428 6/

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "Total or average."
1/ Excludes Puerto Rico (did not produce any masonry cement).
2/ Includes imported cement.
3/ Includes cement made from imported clinker.
4/ Data may not add to totals shown because of independent rounding. Includes Districts indicated by W.
5/ Production directly from clinker accounted for 89% of the total in 1996 and almost 94% in 1997. Production from portland cement accounted for the remainder.
6/ Total stocks include inventory, not shown on a District basis, held by independent importers.

TABLE 4

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 1997, BY DISTRICT

District	Active plants 1/ Process used Wet	Dry	Both	Total	Number of kilns	Daily capacity (thousand metric tons)	Average number of days routine mainte- nance	Apparent annual capacity 2/ (thousand metric tons)	Produc- tion (thousand metric tons)	Percent utilized
Maine and New York	3	1	--	4	5	9.7	34.0	3,209	2,968	92.5
Pennsylvania, eastern	2	5	--	7	13	14.5	29.5	4,871	4,274	87.7
Pennsylvania, western	3	1	--	4	8	5.9	26.9	2,000	1,808	90.4
Illinois	--	4	--	4	8	8.1	23.1	2,758	2,412	87.5
Indiana	2	2	--	4	8	8.5	22.9	2,914	2,495	85.6
Michigan	1	2	--	3	8	13.7	22.9	4,645	4,254	91.6
Ohio	1	1	--	2	3	3.3	16.0	1,140	980	86.0
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.4	25.1	4,566	3,937	86.2
Kansas	2	2	--	4	11	5.5	29.8	1,850	1,635	88.4
Missouri	2	3	--	5	7	14.0	25.9	4,711	4,445	94.4
Florida	2	2	--	4	7	9.0	28.0	3,025	2,874	95.0
Georgia, Virginia, West Virginia	1	3	--	4	7	9.3	26.0	3,114	2,449	78.6
Maryland	1	2	--	3	7	5.5	19.9	1,892	1,684	89.0
South Carolina	2	1	--	3	7	7.5	18.1	2,573	2,221	86.3
Alabama	--	5	--	5	6	13.2	18.8	4,553	4,007	88.0
Kentucky, Mississippi, Tennessee	2	2	--	4	5	6.6	20.6	2,275	2,183	96.0
Arkansas and Oklahoma	2	2	--	4	10	7.6	27.7	2,576	2,525	98.0
Texas, northern	3	3	--	6	14	12.9	40.9	4,158	3,727	89.6
Texas, southern	--	4	1	5	6	12.7	25.8	4,340	4,158	95.8
Arizona and New Mexico	--	3	--	3	9	6.5	15.0	2,294	2,170	94.6
Colorado and Wyoming	1	3	--	4	7	6.9	24.1	2,335	1,964	84.1
Idaho, Montana, Nevada, Utah	4	3	--	7	10	7.8	25.5	2,672	2,226	83.3
California, northern	--	3	--	3	3	8.7	37.0	2,893	2,647	91.5
California, southern	--	8	--	8	17	24.3	30.2	8,221	7,177	87.3
Oregon and Washington	1	2	--	3	3	4.9	26.0	1,676	1,466	87.5
Total or average 3/	35	71	2	108	198	240.0	26.4	81,262	72,686	89.4
Puerto Rico	--	2	--	2	2	5.0	24.0	1,698	1,426	84.0

1/ Includes white cement plants.

2/ Calculated on the basis of individual company data using 365 days minus reported days for routine maintenance multiplied by the reported unrounded daily capacity.

3/ Data may not add to totals shown because of independent rounding.

TABLE 5
RAW MATERIALS USED IN PRODUCING CEMENT
IN THE UNITED STATES 1/ 2/ 3/

(Thousand metric tons)

Raw materials	1996	1997
Calcareous:		
Limestone (includes aragonite, marble, chalk)	80,016	83,770
Cement rock (includes marl)	25,746	25,704
Coral	682	653
Aluminous:		
Clay	4,747	4,434
Shale	4,202	4,010
Other (includes staurolite, bauxite, aluminum dross, alumina, volcanic material, other)	1,072 r/	323
Siliceous:		
Sand and calcium silicate	2,153	2,322
Sandstone, quartzite, other	638 r/	775
Ferrous: iron ore, pyrites, millscale, other	1,536 r/	1,452
Other:		
Gypsum and anhydrite	4,126	4,274
Clinker, imported 4/	2,133	2,585
Blast furnace slag	133	460
Fly ash 5/	1,478 r/	2,067
Other, n.e.c.	51 r/	35
Total 6/	128,713	132,865

r/ Revised.
1/ Includes Puerto Rico.
2/ Nonfuel materials only.
3/ Includes portland and masonry cement.
4/ Outside purchases by producing plants; excludes purchases of domestic clinker.
5/ Includes bottom ash as follows: 1996--220; 1997--523.
6/ Data may not add to totals shown because of independent rounding.

TABLE 6
CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY
IN THE UNITED STATES, BY PROCESS 1/ 2/

	Clinker produced			Fuel consumed					Waste fuel		
Kiln process	Plants active	Quantity (thousand metric tons)	Percentage of total	Coal (thousand metric tons)	Coke (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
1996:											
Wet	35	18,502	25.8	2,343	101	492	30,158	223,987 r/	42	54	649,978
Dry	74 r/	51,777 r/	72.2 r/	6,217 r/	357	776	32,789 r/	413,383 r/	145 r/	18	260,175
Both	2 r/	1,427 r/	2.0 r/	203 r/	--	28	--	72,286 r/	4 r/	--	--
Total 3/	111	71,706	100.0	8,764	458	1295	62,948 r/	709,656 r/	191	72	910,153
1997:											
Wet	35	19,090	25.8	2,623	118	343	39,421	173,718	69	55	671,385
Dry	73	53,481	72.2	6,184	233	917	46,814	433,908	194	13	163,795
Both	2	1,540	2.1	228	--	28	--	64,719	14	--	--
Total 3/	110	74,112	100.0	9,035	351	1288	86,235	672,345	277	68	835,179

r/ Revised.
1/ Includes portland and masonry cement. Excludes grinding plants.
2/ Includes Puerto Rico.
3/ Data may not add to totals shown because of independent rounding.

TABLE 7
ELECTRIC ENERGY USED AT CEMENT PLANTS
IN THE UNITED STATES, BY PROCESS 1/

	Electric energy used							
	Generated at plant		Purchased		Total		Finished cement 2/ produced (thousand metric tons)	Average consumption (kilowatt-hours per ton of cement produced)
Plant process	Number of plants	Quantity (million kilowatt-hours)	Number of plants	Quantity (million kilowatt-hours)	Quantity (million kilowatt-hours)	Percentage		
1996:								
Integrated plants								
Wet	--	--	35 r/	2,806 r/	2,806 r/	24.4 r/	20,520 r/	137
Dry	4	500	74 r/	7,969 r/	8,469 r/	73.6 r/	56,516 r/	150
Both	--	--	2 r/	231 r/	231 r/	2.0 r/	1,534 r/	151
Total 3/	4	500	111 r/	11,006 r/	11,506 r/	100.0	78,571 r/	146 r/
Grinding plants 4/	--	--	5	135	135	--	2,081	65
Exclusions 5/	--	--	2	--	--	--	57	--
1997:								
Integrated plants								
Wet	--	--	35	2,867	2,867	24.2	21,706	132
Dry	4	493	73	8,226	8,719	73.7	58,481	149
Both	--	--	2	246	246	2.1	1,642	150
Total 3/	4	493	110	11,340	11,833	100.0	81,829	145
Grinding plants 4/	--	--	6	151	151	--	2,211	68
Exclusions 5/	--	--	2	--	--	--	68	--

r/ Revised.
1/ Includes Puerto Rico.
2/ Includes portland and masonry cement. Excludes portland cement consumed in the production of masonry cement.
3/ Data may not add to totals shown because of independent rounding.
4/ Excludes plants that reported production only of masonry cement.
5/ Tonnage of cement produced by plants that reported production only of masonry cement.

TABLE 8
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1996	Portland cement 1997	Masonry cement 1996	Masonry cement 1997
Destination:				
Alabama	1,474	1,425	133	137
Alaska	100	107	W	W
Arizona	2,517 r/	2,563	W	W
Arkansas	905	1,009	56	54
California, northern	3,215 r/	3,587	14 r/	13
California, southern	5,166 r/	5,883	W	W
Colorado	1,891	2,013	21	25
Connecticut 3/	654	690	12	13
Delaware 3/	240	247	9	10
District of Columbia 3/	115	105	1	1
Florida	6,082	6,435	538	536
Georgia	3,179	3,225	233	237
Hawaii	313	251	5	3
Idaho	449	473	1	1
Illinois, excluding Chicago	1,538	1,525	35	33
Chicago, metropolitan 3/	1,943	1,995	43	49
Indiana	1,947	2,140	93	96
Iowa	1,601	1,739	12	12
Kansas	1,527	1,508	16	15
Kentucky	1,258	1,328	93	98
Louisiana 3/	1,751	1,820	53	50
Maine	212	187	5	5
Maryland	1,179	1,225	73	80
Massachusetts 3/	1,074	1,262	24	24
Michigan	2,992	3,201	143	153
Minnesota 3/	1,605	1,693	32	30
Mississippi	931	968	56	53
Missouri	2,269	2,311	41	40
Montana	273	303	1	1
Nebraska	994	1,020	10	10
Nevada	1,784 r/	1,899	19 r/	15
New Hampshire 3/	275	263	7	7
New Jersey 3/	1,471	1,700	61	63
New Mexico	747	739	8	7
New York, eastern	484	518	21	23
New York, western	759	879	31	35
New York, metropolitan 3/	1,203	1,291	42	46
North Carolina 3/	2,259	2,599	273	296
North Dakota 3/	322 r/	266	13 r/	4
Ohio	3,725	3,774	190	197
Oklahoma	1,145	1,188	41	43
Oregon	1,165	1,195	(4/)	1
Pennsylvania, eastern	1,840	1,958	60	63
Pennsylvania, western	1,035	1,124	68	70
Rhode Island 3/	111	127	3	3
South Carolina	1,160	1,200	116	125
South Dakota	333	420	4	3
Tennessee	1,965	2,041	211	211
Texas, northern	4,373	4,543	162	150
Texas, southern	4,413	4,834	90	81
Utah	1,267	1,354	3	1
Vermont 3/	111	106	3	3
Virginia	1,794	1,910	149	157
Washington	1,722	1,862	6	5
West Virginia	443	440	29	30
Wisconsin	2,013	2,129	38	37
Wyoming	196	228	1	1
U.S. total 5/ 6/	87,509 r/	92,824	3,569 r/	3,627
Foreign countries 7/	355	349	4 r/	1
Puerto Rico	1,555	1,670	--	--
Total shipments 5/	89,419 r/	94,843	3,573 r/	3,628

See footnotes at end of table.

TABLE 8-Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1996	Portland cement 1997	Masonry cement 1996	Masonry cement 1997
Origin:				
United States	76,356 r/	79,403	3,534 r/	3,583
Puerto Rico	1,555	1,670	--	--
Foreign countries 8/	11,508 r/	13,769	39 r/	45
Total shipments 5/	89,419 r/	94,843	3,573 r/	3,628

r/ Revised. W Withheld to avoid disclosing company proprietary data; included with "U.S. total."

1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers, Canadian cement manufacturers, and other importers.

2/ Data are developed from monthly consolidated surveys of shipments by company and may differ from data in tables 1, 10, 11, 12, 14, and 15, which are from annual surveys of individual plants and importers.

3/ Has no cement plants.

4/ Less than 1/2 unit.

5/ Data may not add to totals shown because of independent rounding.

6/ Includes States indicated by the symbol W.

7/ Includes shipments to U.S. possessions and territories.

8/ Imported cement distributed in the United States by domestic producers, Canadian cement manufacturers, and other importers.

TABLE 9
CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT) 1/ 2/

Region and census district	Portland cement: Thousand metric tons 1996	Portland cement: Thousand metric tons 1997	Portland cement: Percentage of U.S. total 1996	Portland cement: Percentage of U.S. total 1997	Masonry cement: Thousand metric tons 1996	Masonry cement: Thousand metric tons 1997	Masonry cement: Percentage of U.S. total 1996	Masonry cement: Percentage of U.S. total 1997
Northeast:								
New England 3/	2,438	2,634	3	3	54	55	2	2
Middle Atlantic 4/	6,792	7,469	8	8	282	301	8	8
Total 5/	9,230	10,103	11	11	337 r/	356	9 r/	10
South:								
South Atlantic 6/	16,452	17,386	19	19	1,421	1,472	40 r/	41
East South Central 7/	5,627	5,762	6	6	493	498	14	14
West South Central 8/	12,587	13,394	14 r/	14	402	378	11 r/	10
Total 5/	34,666	36,541	40 r/	39	2,316	2,349	65 r/	65
Midwest:								
East North Central 9/	14,159	14,765	16	16	541	566	15 r/	16
West North Central 10/	8,650 r/	8,958	10	10	127 r/	114	4	3
Total 5/	22,809 r/	23,722	26	26	668 r/	680	19 r/	19
West:								
Mountain 11/	9,123 r/	9,572	10	10	149 r/	140	4 r/	4
Pacific 12/	11,682 r/	12,886	13 r/	14	99 r/	102	3 r/	3
Total 5/	20,805 r/	22,457	24	24	248 r/	242	7 r/	7
U.S. total 5/	87,509 r/	92,824	100	100	3,569 r/	3,627	100	100

r/ Revised.
1/ Includes imported cement shipped by importers. Excludes Puerto Rico and exported cement.
2/ Data are developed from monthly consolidated surveys of shipments by company and may differ from data in tables 1, 10, 11, 12, 14, and 15, which are from annual surveys of individual plants and importers.
3/ New England includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
4/ Middle Atlantic includes New Jersey, New York, and Pennsylvania.
5/ Data may not add to totals shown because of independent rounding.
6/ South Atlantic includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.
7/ East South Central includes Alabama, Kentucky, Mississippi, and Tennessee.
8/ West South Central includes Arkansas, Louisiana, Oklahoma, and Texas.
9/ East North Central includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.
10/ West North Central includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.
11/ Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.
12/ Pacific includes Alaska, California, Hawaii, Oregon, and Washington.

TABLE 10
SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND
IN CONTAINERS, BY TYPE OF CARRIER 1/

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total
	In bulk	In containers 2/	In bulk	In containers 2/	In bulk	In containers 2/	shipments to consumer 3/ 4/
1996:							
Railroad	10,527	54	5,036	433	520	53	6,042
Truck	3,143	147	43,986 r/	1,708	27,679 r/	870	74,243 r/
Barge and boat	7,021	--	565	3	810	--	1,378
Other 5/	1,810 r/	--	--	--	14	2	16
Total 3/	22,502	201	49,588 r/	2,144	29,023 r/	927	81,681 r/
1997:							
Railroad	11,221	56	4,390	416	1,436	61	6,304
Truck	3,635	99	47,552	2,042	31,739	576	81,908
Barge and boat	8,270	--	146	--	11	--	156
Other 5/	1,929	--	--	--	--	--	--
Total 3/	25,055	156	52,088	2,458	33,186	637	88,368

r/ Revised.
1/ Includes Puerto Rico. Includes imported cement and cement made from foreign clinker.
2/ Includes bags and jumbo bags.
3/ Data may not add to totals shown because of independent rounding.
4/ Shipments calculated based on annual survey of plants and importers; may differ from tables 8 and 9, which are based on consolidated company monthly data.
5/ Includes cement used at plant.

TABLE 11

PORTLAND CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

District	1996 Quantity (thousand metric tons) 5/	1996 Value 4/ Total (thousands)	1996 Value 4/ Average per ton	1997 Quantity (thousand metric tons) 5/	1997 Value 4/ Total (thousands)	1997 Value 4/ Average per ton
Maine and New York	1,770 r/	$107,613 r/	$60.79 r/	1,826	$115,365	$63.19
Pennsylvania, eastern	4,095	307,830	75.17	4,454	283,965	63.75
Pennsylvania, western	1,612	112,747	69.94	1,689	121,649	72.04
Illinois	2,653	183,736	69.26	2,590	186,281	71.91
Indiana	2,570	168,032	65.38	2,663	187,076	70.24
Michigan	5,470	403,465	73.76	5,739	425,705	74.18
Ohio	1,013	74,100	73.15	1,107	81,655	73.75
Iowa, Nebraska, South Dakota	3,966	291,842 r/	73.59 r/	4,247	323,321	76.12
Kansas	1,859	128,848	69.31	1,798	129,970	72.28
Missouri	5,141	332,715	64.72	5,563	377,411	67.84
Florida	4,575	325,302	71.10	4,750	346,945	73.04
Georgia, Virginia, West Virginia	2,644	193,907	73.34	2,773	212,006	76.45
Maryland	1,924	118,832	61.76	2,064	132,049	63.98
South Carolina	2,463	193,115	78.41	2,531	194,938	77.02
Alabama	4,138	311,819	75.36	4,103	329,663	80.34
Kentucky, Mississippi, Tennessee	2,712	197,788	72.93	2,911	216,284	74.31
Arkansas and Oklahoma	2,545	170,721	67.08	2,673	185,509	69.40
Texas, northern	3,562	242,030	67.95	4,028	299,071	74.25
Texas, southern	5,152	320,441	62.20	5,141	338,549	65.86
Arizona and New Mexico	2,238	172,938	77.27	2,313	189,424	81.90
Colorado, Wyoming	2,001	160,521	80.22	2,056	163,640	79.60
Idaho, Montana, Nevada, Utah	2,398	190,588	79.48	2,646	213,531	80.71
Alaska, Hawaii, Oregon, Washington	1,493	125,137	83.79	2,292	193,545	84.46
California, northern	2,151	147,089	68.38	2,425	180,158	74.28
California, southern	6,897	415,781	60.28	7,521	503,632	66.96
Total 6/ 7/ 8/ or average	80,130 r/	5,629,371 r/	70.25 r/	86,692	6,293,261	72.59
Puerto Rico	1,555	W	W	1,677	W	W

r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Includes cement produced from imported clinker.

2/ Includes imported cement shipped by producers.

3/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas.

4/ Values represent ex-plant (f.o.b -plant) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00.

5/ Shipments calculated based on annual survey of plants and importers; may differ from tables 8 and 9, which are based on consolidated company monthly data.

6/ Data may not add to totals shown because of independent rounding.

7/ Does not include cement consumed at plant.

8/ Total includes imports shipped by independent importers.

TABLE 12
MASONRY CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

District	1996 Quantity (thousand metric tons) 5/	1996 Value 4/ Total (thousands)	1996 Value 4/ Average per ton	1997 Quantity (thousand metric tons) 5/	1997 Value 4/ Total (thousands)	1997 Value 4/ Average per ton
Maine and New York	102	$8,440	$83.10 r/	107	$9,348	$87.15
Pennsylvania, eastern	181	17,783	98.07 r/	203	20,408	100.30
Pennsylvania, western	99	10,861	109.18 r/	104	11,829	113.92
Illinois, Indiana, Ohio	451 r/	42,756	94.72 r/	498	48,415	97.31
Michigan	254	22,271	87.68	283	23,248	82.17
Iowa, Nebraska, South Dakota	46	5,075	110.60 r/	43	3,644	84.76
Kansas and Missouri	141 r/	8,691	61.77 r/	144	9,387	65.08
Florida	418	34,901	83.50	387	34,556	89.29
Georgia, Virginia, West Virginia	366	40,174	109.77	410	39,009	95.07
Maryland and South Carolina	363 r/	34,901	96.12 r/	424	44,470	104.82
Alabama	311	32,240	103.67	314	32,847	104.44
Kentucky, Mississippi, Tennessee	113	10,391	91.96	97	8,254	85.35
Arkansas and Oklahoma	110	9,487	86.33 r/	108	7,965	73.97
Texas	195 r/	18,289	93.89	184	17,081	93.08
Arizona, Colorado, Idaho, Montana,						
New Mexico, Nevada, Utah, Wyoming	122 r/	11,186	91.59 r/	130	11,751	90.64
Alaska and Hawaii	4	454	102.41 r/	3	354	102.32
California, Oregon, Washington	198 r/	14,729	74.30 r/	175	14,119	80.66
Total 6/ 7/ or average	3,477	322,832	92.85	3,667	344,203	93.87

r/ Revised.
1/ Shipments are to final domestic customers and include shipments of imported cement.
2/ Includes data for three white cement facilities as follows: California, Pennsylvania, and Texas.
3/ Excludes Puerto Rico (did not produce any masonry cement).
4/ Values are mill net and represent ex-plant (f.o.b. - plant or import terminal) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimated for some plants. Accordingly, the data should be viewed as cement-value indicators, good to no better than the nearest $0.50 or even $1.00.
5/ Shipments calculated on the basis of annual survey of plants and importers; may differ from tables 8 and 9, which are based on consolidated company monthly data.
6/ Data may not add to totals shown because of independent rounding.
7/ Total includes imports shipped by independent importers.

TABLE 13
AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES 1/ 2/

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
1996 r/	69.38	183.1	70.25	92.85	71.19
1997	71.85	177.1	72.59	93.87	73.49

r/ Revised.
1/ Excludes Puerto Rico. Mill net value is the actual value of sales to customers, f.o.b. plant or import terminal, less all discounts and allowances, less any freight charges from U.S. producing plant to distribution terminal and to final customers.
2/ Although unrounded, the data incorporate estimates for some plants, and are good to no better than two significant figures.

TABLE 14
PORTLAND CEMENT SHIPMENTS IN 1997, BY DISTRICT AND TYPE OF CUSTOMER 1/ 2/

(Thousand metric tons)

District	Ready mixed concrete	Concrete product manufacturers 3/	Contractors 4/	Building material dealers	Oil well, mining, waste 5/	Government and miscellaneous 6/	District total 7/ 8/
Maine and New York	1,309	278	149	85	(9/)	3	1,826
Pennsylvania, eastern	2,927	853	365	209	45	56	4,454
Pennsylvania, western	617	232	389	277	23	151	1,689
Illinois	1,756	329	108	157	242	--	2,590
Indiana	2,154	382	28	81	11	9	2,663
Michigan	4,399	600	637	62	21	19	5,739
Ohio	755	171	157	15	7	2	1,107
Iowa, Nebraska, South Dakota	3,082	570	353	89	63	91	4,247
Kansas	1,330	195	221	24	23	7	1,798
Missouri	4,189	545	611	163	--	53	5,563
Florida	3,319	732	251	372	22	52	4,750
Georgia, Virginia, West Virginia	2,145	386	143	88	12	--	2,773
Maryland	1,507	313	230	14	--	(9/)	2,064
South Carolina	1,886	432	86	69	48	10	2,531
Alabama	3,050	629	192	197	24	11	4,103
Kentucky, Mississippi, Tennessee	2,326	217	318	25	4	22	2,911
Arkansas and Oklahoma	1,933	201	414	30	94	2	2,673
Texas, northern	2,274	425	699	169	442	19	4,028
Texas, southern	3,487	286	751	145	280	191	5,141
Arizona and New Mexico	1,635	320	138	70	38	113	2,313
Colorado and Wyoming	1,180	183	87	55	550	--	2,056
Idaho, Montana, Nevada, Utah	2,113	201	132	30	59	110	2,646
Alaska and Hawaii	258	19	6	17	(9/)	6	305
California, northern	1,832	346	113	100	--	34	2,425
California, southern	5,704	1,100	341	242	106	28	7,521
Oregon and Washington	1,559	141	199	74	1	12	1,986
Total 8/ 10/	62,591	10,639	7,246	3,022	2,164	1,030	86,692
Puerto Rico	853	172	50	600	--	2	1,677

1/ Includes shipments of imported cement. Data, other than district totals, are presented unrounded but incorporate estimates for some plants and are likely accurate to only two significant figures.
2/ Previously referred to as District of origin, but in fact refers only to the location of the reporting facility.
3/ Shipments to concrete product manufacturers include brick-block--4,062; precast--2,341; pipe--1,486; and other or unspecified--2,922.
4/ Shipments to contractors include airport--508; road paving--4,017; soil cement--1,641 and other or unspecified--1,130.
5/ Shipments to oil well, mining, and waste include oil well drilling--1,377; mining--621; and waste stabilization--206.
6/ Includes shipments for which customer types were not specified.
7/ Shipments calculated on the basis of annual survey of plants and importers; may differ from tables 8 and 9, which are based on consolidated monthly data.
8/ Data may not add to totals shown because of independent rounding.
9/ Less than 1/2 unit.
10/ Includes imports shipped by independent importers.

TABLE 15

PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE 1/ 2/

(Thousand metric tons)

Type	1996	1997
General use and moderate heat (Types I and II), (Gray)	73,666 r/	79,312
High early strength (Type III)	2,942	3,109
Sulfate resisting (Type V)	2,000	2,456
Block	416	506
Oil well	1,041	1,229
White	615	634
Blended:		
Portland-slag and portland (natural) pozzolan	770	639
Other blended cement 3/	63	314
Expansive and regulated fast setting	81	120
Miscellaneous 4/	89	50
Total 5/	81,685 r/	88,368

r/ Revised.

1/ Includes imported cement. Includes Puerto Rico.

2/ Shipments calculated based on annual survey of plants and importers; may differ from tables 8 and 9, which are based on consolidated company monthly data.

3/ Includes blends with fly ash and silica fume.

4/ Includes waterproof and low heat (Type IV).

5/ Data may not add to totals shown because of independent rounding.

TABLE 16

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1996		1997	
Country of destination	Quantity	Value 2/	Quantity	Value 2/
Australia	4	247	5	402
Bahamas, The	5	538	8	858
British Virgin Islands	5	296	6	516
Canada	611	42,193	605	42,106
Chile	--	19	10	542
Germany	22	1,814	23	963
Latvia	--	--	8	355
Mexico	30	4,805	45	5,997
Panama	1	233	7	623
Russia	1	78	6	298
Other	124 r/	7,929 r/	66	6,951
Total 3/	803	58,152	791	59,611

r/ Revised.

1/ Includes portland and masonry cement.

2/ Free alongside ship (f.a.s.) value. The value of exports at the U.S. seaport or border port of export based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of exportation. The value excludes the cost of loading.

3/ Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of the Census.

TABLE 17
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country of origin	1996 Quantity	1996 Value Customs 2/	1996 Value C.i.f. 3/	1997 Quantity	1997 Value Customs 2/	1997 Value C.i.f. 3/
Bulgaria	148	4,433	6,274	146	4,086	5,987
Canada	5,351	246,694	270,198	5,350	269,471	293,868
China	394	15,771	19,714	610	24,951	32,196
Colombia	924	36,520	46,872	906	36,898	47,177
Denmark	399	17,593	26,393	579	24,576	34,993
France	55	9,783	10,944	441	27,157	31,471
Greece	1,098	40,803	52,046	1,860	68,741	88,620
Italy	209	8,432	11,751	401	17,041	21,876
Mexico	1,272	47,736	59,390	995	37,804	47,612
Norway	226	8,181	11,032	283	10,182	12,906
Spain	1,595	63,274	83,739	1,845	75,282	100,988
Sweden	765	24,337	33,495	886	28,620	38,437
Turkey	68	2,471	3,187	973	35,805	46,111
United Kingdom	64	2,631	2,911	153	7,289	8,700
Venezuela	1,517	58,424	73,536	1,994	76,189	95,503
Other	69 r/	5,166 r/	7,074 r/	174	7,975	10,884
Total 4/	14,154	592,249	718,556	17,596	752,067	917,329

r/ Revised.
1/ Includes portland, masonry, and other hydraulic cements. Includes Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ C.i.f. (Cost, insurance, and freight). The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of the Census.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1996			1997		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Anchorage:						
Canada	5	138	309	7	265	286
China	59	2,413	3,443	64	2,555	3,602
Japan	--	--	--	(4/)	5	5
Total 3/	64	2,551	3,752	71	2,825	3,892
Baltimore:						
China	--	--	--	(4/)	2	4
Greece	38	1,447	1,643	--	--	--
Spain	15	551	551	--	--	--
United Kingdom	(4/)	18	27	--	--	--
Venezuela	131	5,421	5,421	169	7,001	7,001
Total 3/	184	7,437	7,642	169	7,004	7,005
Boston:						
Canada	--	--	--	9	258	262
Netherlands	--	--	--	(4/)	13	14
Turkey	--	--	--	11	386	574
Total 3/	(4/)	--	--	20	656	850
Buffalo:						
Canada	740	37,270	39,996	836	47,226	50,125
Netherlands	--	--	--	(4/)	28	28
Total 3/	741 r/	37,270	39,996	836	47,254	50,154
Charleston:						
Canada	--	--	--	19	653	942
France	--	--	--	(4/)	3	5
Netherlands	(4/)	19	20	(4/)	33	36
Spain	(4/)	36	39	--	--	--
Sweden	--	--	--	12	664	785
Turkey	--	--	--	15	541	815
United Kingdom	(4/)	91	126	(4/)	59	83
Venezuela	66	2,689	3,639	80	3,244	4,399
Total 3/	66 r/	2,835	3,824	125	5,197	7,065
Chicago:						
Japan	(4/)	59	69	(4/)	20	22
United Kingdom	--	--	--	(4/)	3	4
Total 3/	(4/)	59	69	(4/)	23	26
Cleveland:						
Canada	497	25,320	26,051	628	35,817	36,622
Netherlands	(4/)	12	15	(4/)	94	111
United Kingdom	(4/)	13	16	(4/)	93	122
Total 3/	497	25,345	26,081	628	36,003	36,854
Columbia Snake:						
China	335	13,330	16,238	367	14,735	19,014
Colombia	18	685	867	54	2,189	2,997
Taiwan	--	--	--	10	435	546
Total 3/	353	14,015	17,105	432	17,360	22,556
Dallas-Fort Worth: United Kingdom	(4/)	6	7	--	--	--
Detroit:						
Canada	1,647	79,423	84,419	1,664	86,466	95,989
Germany	--	--	--	(4/)	2	2
Netherlands	(4/)	135	162	(4/)	86	101
United Kingdom	--	--	--	25	761	771
Total 3/	1,647	79,559	84,581	1,689	87,315	96,863
Duluth: Canada	332	13,559	15,562	345	13,468	15,485
El Paso:						
China	--	--	--	(4/)	2	2
Mexico	467	14,980	20,287	455	15,214	19,978
Total 3/	467	14,980	20,287	455	15,215	19,979

See footnotes at end of table.

TABLE 18--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1996			1997		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Great Falls:						
Canada	274	11,548	13,435	222	9,404	10,730
Japan	(4/)	2	6	(4/)	2	3
United Kingdom	(4/)	16	25	--	--	--
Total 3/	274 r/	11,566	13,465	223	9,406	10,734
Honolulu:						
Australia	42	1,499	2,141	83	2,692	4,013
Belgium	(4/)	15	19	--	--	--
France	(4/)	21	26	--	--	--
Venezuela	115	3,491	5,792	180	5,433	9,063
Total 3/	157	5,027	7,977	263	8,125	13,076
Houston-Galveston:						
Colombia	46	1,739	2,729	51	1,891	2,942
Denmark	30	1,067	1,438	192	6,818	9,134
France	(4/)	83	99	3	373	487
Greece	--	--	--	217	7,874	10,206
Japan	(4/)	46	55	(4/)	74	87
Spain	675	24,872	32,188	520	20,429	25,445
Turkey	--	--	--	32	1,696	2,176
United Kingdom	(4/)	41	55	(4/)	20	26
Venezuela	27	899	1,120	--	--	--
Total 3/	780	28,748	37,684	1,015	39,174	50,504
Laredo: Mexico	69 r/	7,121	7,590	70	7,060	7,630
Los Angeles:						
China	--	--	--	170	7,036	8,818
Colombia	--	--	--	32	1,284	1,757
Denmark	(4/)	3	5	--	--	--
France	--	--	--	62	3,261	3,329
Mexico	382	13,945	17,027	19	693	846
Spain	--	--	--	693	26,177	38,761
Turkey	--	--	--	32	1,704	1,722
United Kingdom	--	--	--	(4/)	14	24
Total 3/	382	13,948	17,031	1,007	40,169	55,257
Miami:						
Belgium	2	251	340	2	388	422
Canada	24	871	1,153	--	--	--
Denmark	44	1,942	3,290	8	476	857
Greece	--	--	--	14	488	631
Italy	--	--	--	(4/)	2	3
Portugal	(4/)	23	24	--	--	--
Spain	435	19,166	27,430	513	24,058	30,236
Sweden	441	13,529	18,471	497	15,349	20,183
Turkey	--	--	--	16	515	694
United Kingdom	(4/)	1	1	--	--	--
Venezuela	189	7,439	9,913	204	7,874	10,517
Total 3/	1,135 r/	43,223	60,622	1,254	49,150	63,543
Milwaukee: Canada	219	9,069	10,279	171	7,863	9,763
Minneapolis: Germany	(4/)	12	13	(4/)	9	10
Mobile:						
Belgium	--	--	--	52	1,764	2,230
Bulgaria	122	3,368	4,863	55	1,548	2,234
Canada	163	5,087	6,948	--	--	--
France	--	--	--	51	1,623	2,080
Greece	73	2,446	3,317	--	--	--
Venezuela	25	819	1,007	115	4,181	5,123
Total 3/	383	11,721	16,135	273	9,115	11,667

See footnotes at end of table.

TABLE 18--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1996			1997		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
New Orleans:						
Austria	(4/)	6	8	--	--	--
Canada	88	3,065	4,047	--	--	--
China	(4/)	28	33	4	389	466
Colombia	120	5,131	6,768	--	--	--
Croatia	5	605	873	5	585	801
France	10	1,576	1,906	80	4,269	5,326
Greece	282	10,601	13,993	578	21,013	27,975
Italy	208	8,431	11,745	374	15,966	20,519
Spain	9	340	438	18	717	885
Sweden	236	7,837	10,906	369	12,269	17,063
Turkey	34	1,271	1,592	303	11,275	14,865
Venezuela	--	--	--	34	1,286	1,582
Total 3/	993	38,889	52,309	1,764	67,769	89,483
New York City:						
Belgium	--	--	--	(4/)	21	22
Denmark	--	--	--	55	2,814	3,097
Greece	206	7,455	8,215	357	13,331	15,777
Italy	(4/)	1	6	27	1,073	1,354
Japan	(4/)	7	7	--	--	--
Netherlands	(4/)	226	241	(4/)	195	207
Norway	226	8,181	11,032	283	10,182	12,906
Spain	236	10,465	13,136	--	--	--
Tunisia	--	--	--	(4/)	12	18
Turkey	--	--	--	258	8,932	10,498
United Kingdom	--	--	--	(4/)	12	16
Venezuela	--	--	--	21	738	902
Total 3/	667 r/	26,335	32,637	1,001	37,309	44,797
Nogales: Mexico	350 r/	11,189	13,944	439	13,342	17,446
Norfolk:						
Croatia	--	--	--	(4/)	2	4
Denmark	214	8,460	11,079	223	8,162	10,871
France	45	8,103	8,914	59	11,598	12,610
Greece	438	16,756	22,029	513	19,795	25,641
Netherlands	(4/)	87	97	--	--	--
South Africa, Republic of	--	--	--	(4/)	9	11
United Kingdom	(4/)	124	173	2	564	760
Venezuela	5	208	213	20	834	1,110
Total 3/	703	33,737	42,504	817	40,964	51,008
Ogdensburg:						
Canada	260	8,789	9,679	334	12,814	14,361
Netherlands	(4/)	56	69	--	--	--
Total 3/	260 r/	8,845	9,748	334	12,814	14,361
Pembina: Canada	143	6,812	7,724	186	8,650	9,910
Philadelphia:						
Germany	(4/)	23	23	--	--	--
Japan	(4/)	12	15	--	--	--
United Kingdom	(4/)	10	22	--	--	--
Total 3/	(4/)	44	60	--	--	--
Portland: Canada	10	478	581	15	828	910
Providence:						
Canada	--	--	--	26	733	770
Spain	--	--	--	82	3,072	4,669
Total 3/	(4/)	(4/)	1	108	3,806	5,440
San Diego: Mexico	4	501	542	9	1,200	1,366
San Francisco:						
France	--	--	--	(4/)	15	21
Germany	(4/)	11	15	--	--	--

See footnotes at end of table.

TABLE 18--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

Customs district and country	1996 Quantity	1996 Value Customs 1/	1996 Value C.i.f. 2/	1997 Quantity	1997 Value Customs 1/	1997 Value C.i.f. 2/
San Francisco--Continued:						
Japan	(4/)	49	63	--	--	--
New Zealand	1	703	852	--	--	--
United Kingdom	--	--	--	(4/)	19	23
Venezuela	--	--	--	29	874	880
Total 3/	1	764	929	29	908	924
San Juan:						
Belgium	4	341	583	7	609	1,049
Canada	--	--	--	(4/)	2	3
Denmark	16	1,314	2,293	20	1,557	2,783
Luxembourg	5	439	764	1	63	110
Mexico	--	--	--	3	294	345
Spain	119	4,044	4,863	6	385	408
Turkey	--	--	--	8	376	572
Venezuela	43	1,890	2,332	161	5,854	6,744
Total 3/	187 r/	8,029	10,836	206	9,140	12,014
Savannah:						
Bulgaria	26	1,064	1,410	91	2,538	3,753
Canada	78	2,389	3,335	--	--	--
Colombia	19	1,027	1,181	56	3,034	3,489
Denmark	13	852	1,420	(4/)	10	10
France	--	--	--	187	6,014	7,615
United Kingdom	64	2,310	2,460	126	5,730	6,853
Venezuela	106	3,801	5,134	114	4,025	5,004
Total 3/	307	11,443	14,939	574	21,351	26,724
Seattle:						
Canada	744	36,518	38,962	796	39,810	42,125
China	--	--	--	5	232	292
Colombia	198	7,769	11,244	191	7,770	11,046
Japan	(4/)	20	24	(4/)	128	156
Taiwan	--	--	--	12	522	642
Total 3/	942	44,307	50,230	1,005	48,462	54,261
St. Albans:						
Canada	99	5,327	6,271	90	5,215	5,583
Netherlands	(4/)	123	143	(4/)	136	152
Total 3/	99 r/	5,450	6,413	90	5,351	5,735
Tampa:						
Canada	27	1,032	1,445	--	--	--
Colombia	520	20,019	23,916	522	20,731	24,946
Denmark	83	3,955	6,870	80	4,739	8,240
Greece	61	2,099	2,849	181	6,240	8,389
Spain	105	3,800	5,095	12	443	584
Sweden	88	2,970	4,118	9	338	406
Turkey	34	1,201	1,595	298	10,381	14,196
Venezuela	751	29,388	36,197	741	29,908	36,897
Total 3/	1,669	64,463	82,086	1,844	72,780	93,659
U.S. Virgin Islands:						
Antigua and Barbuda	--	--	--	(4/)	20	41
British Virgin Islands	1	98	118	2	5	10
Colombia	3	150	167	--	--	--
Costa Rica	--	--	--	(4/)	2	2
Netherlands Antilles	5	167	183	--	--	--
Trinidad and Tobago	3	114	119	--	--	--
Venezuela	59	2,378	2,769	65	2,543	3,026
Total 3/	70	2,907	3,356	67	2,571	3,080
Wilmington:						
Netherlands	(4/)	6	12	(4/)	24	26
United Kingdom	--	--	--	(4/)	16	20

See footnotes at end of table.

TABLE 18--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1996			1997		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Wilmington--Continued:						
Venezuela	--	--	--	59	2,393	3,253
Total 3/	(4/)	6	12	59	2,433	3,300
Grand total 3/	14,154	592,249	718,556	17,596	752,067	917,329

r/ Revised.
1/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
2/ C.i.f. (Cost, insurance, and freight). The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry. It is computed by adding "freight" to the "customs value."
3/ Data may not add to totals shown because of independent rounding.
4/ Less than 1/2 unit.

Source: U.S. Bureau of the Census.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1996			1997		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Canada	3,953	182,457	198,857	4,086	202,335	218,025
China	393	15,743	19,682	606	24,560	31,726
Colombia	685	27,734	35,737	734	30,580	39,409
Denmark	303	11,803	16,000	467	17,175	22,614
France	(4/)	5	13	133	6,075	6,978
Greece	983	36,949	46,822	1,672	61,789	79,495
Italy	208	8,432	11,751	344	14,802	19,060
Mexico	1,178	37,470	48,367	885	25,945	34,707
Norway	218	7,410	10,176	276	9,407	12,051
Spain	1,428	53,769	72,737	1,782	67,773	92,586
Sweden	765	24,337	33,495	887	28,620	38,437
Turkey	68	2,471	3,187	827	31,037	39,751
United Kingdom	34	1,502	1,651	63	2,891	3,893
Venezuela	944	38,556	46,530	1,214	49,452	60,631
Other	7 r/	309 r/	335 r/	23	998	1,240
Total 5/	11,167	448,947	545,340	13,999	573,439	700,603

r/ Revised.
1/ Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ C.i.f. (Cost, insurance, and freight). The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of the Census.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1996			1997		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Belgium	6	591	923	9	998	1,473
Canada	135	12,170	12,700	215	16,858	18,024
Denmark	96	5,787	10,389	113	7,391	12,368
Luxembourg	6	439	764	1	63	110
Mexico	91	9,995	10,732	108	11,718	12,754
Norway	8	771	856	8	776	854
Spain	48	5,425	6,101	63	7,509	8,402
United Kingdom	--	--	--	4	197	284
Other	(4/)	228	244	(4/)	197	212
Total 5/	390	35,406	42,709	520	45,707	54,480

1/ Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ C.i.f. (Cost, insurance, and freight). The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of the Census.

TABLE 21
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1996			1997		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	42	1,499	2,141	83	2,692	4,013
Belgium	--	--	--	52	1,764	2,230
Bulgaria	148	4,433	6,274	146	4,086	5,987
Canada	1,253	50,345	56,695	1,019	45,601	52,877
Colombia	239	8,785	11,135	173	6,318	7,768
France	53	8,065	9,039	304	18,721	21,932
Greece	115	3,854	5,224	181	6,240	8,389
Italy	--	--	--	57	2,239	2,816
Spain	119	4,044	4,863	--	--	--
Turkey	--	--	--	145	4,768	6,360
United Kingdom	--	--	--	79	3,201	3,224
Venezuela	573 r/	19,861	26,996	780	26,730	34,863
Other	6	635	906	8	977	1,271
Total 4/	2,548 r/	101,521	123,273	3,027	123,336	151,732

r/ Revised.
1/ For all types of hydraulic cement. Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ C.i.f. (Cost, insurance, and freight). The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of the Census.

TABLE 22
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1993	1994	1995	1996	1997 e/
Afghanistan e/	115	115	115	116	116
Albania e/	200	200	200	200	150
Algeria	6,400 e/	6,060	6,822	6,900 r/	7,000
Angola e/	250	250 r/	250 r/	270 r/	301 2/
Argentina	5,647	6,276 r/	5,447	5,117	5,447 p/
Armenia	200	100	228	282	297 2/
Australia e/	5,500	6,500	6,500	6,500	6,500
Austria	4,941	4,828	3,843	3,874 r/	3,852 2/
Azerbaijan	600	500	200	200	315 2/
Bahrain	225	225 e/	197	193	172 2/
Bangladesh e/ 3/	275 2/	280	280	285	285
Barbados	62	78	75 r/	107 r/	173 2/
Belarus	1,900	1,488	1,235	1,467	1,876 2/
Belgium	7,612	9,000 r/ e/	8,700 r/ e/	6,996 r/	7,001 2/
Benin	506 r/	465 r/	579 r/	580 r/ e/	550
Bhutan e/	108 2/	120	140	160	160
Bolivia	654	768	892 r/	934	892 p/
Bosnia and Herzegovina e/	150	150	150	150 r/	200
Brazil	24,843	25,230 r/	28,256	34,597	38,096 2/
Brunei	--	--	--	100 e/	100
Bulgaria	2,007	2,200	2,070	2,137 r/	2,100
Burma	400	470	517	505	516 2/
Cameroon e/	620	620	620	600	600
Canada	6,672	10,584	10,440	11,587 r/	12,015 p/
Chile	3,021	2,995	3,275	3,634	3,877 2/
China	367,880	421,180	475,910	491,190 r/	492,600 2/
Colombia	7,930	9,322	9,624	8,254 r/	7,854 2/
Congo (Brazzaville) e/	114	114	100	100	20
Congo (Kinshasa) e/ 4/	149 2/	50	25	10	10
Costa Rica	860	940	865 r/	830 r/	850
Côte d'Ivoire e/	500	500	500	500	500
Croatia	1,683	2,055	1,708	1,842	2,134 2/
Cuba	1,049	1,081	1,470 r/	1,453	1,713 2/
Cyprus	1,089	1,053	1,021	1,000 r/ e/	1,000
Czech Republic	5,393	5,303	4,825	5,011	5,000
Denmark (sales)	2,270	2,430	2,584	2,629	2,683 2/
Dominican Republic	1,271	1,303 r/	1,092 r/	1,478 r/	1,500
Ecuador	2,098	2,164	2,616 r/	2,677	2,688 p/
Egypt	16,000	17,000 r/ e/	17,665	18,000 e/	18,000
El Salvador	861	850	890 r/	948	960
Eritrea 5/	-- r/	45 r/ e/	50	47 r/	47
Estonia	500 e/	402	417	388 r/	400
Ethiopia	350 r/ e/	464 r/	611	650 r/ e/	650
Fiji	80	94	91	84 r/	84
Finland	835	864	907	975 r/	960
France	20,464	21,296	19,692	18,340 r/	19,000
Gabon	132	126	154 r/ e/	180 r/	200
Georgia	300	100	100 e/	85 r/	91 2/
Germany	36,649	40,380	37,480 r/	36,104	37,000
Ghana	1,203	1,346	1,300 r/ e/	1,400 e/	1,400
Greece	12,618	12,636	12,500 r/ e/	13,000 r/ e/	13,000
Guadeloupe e/	230	230	230	230	230
Guatemala	1,119	1,200	1,152 r/	1,090	1,280 2/
Haiti e/	100	75	-- r/	-- r/	--
Honduras	723	1,100 e/	721 r/	952 r/	980
Hong Kong	1,712	1,927	1,913	2,027	1,925 2/
Hungary	2,533	2,813	2,875	2,776	2,800
Iceland	86	81	82	88 r/	88
India e/	53,812 2/	57,000	62,000	75,000 r/	80,000
Indonesia	18,934	21,907	23,129	25,000 e/	26,000

See footnotes at end of table.

TABLE 22--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1993	1994	1995	1996	1997 e/
Iran e/	16,000	16,000	16,300	18,000 r/	18,000
Iraq e/	2,000	2,000	2,108 2/	2,100	2,100
Ireland	1,450 r/	1,623 r/	1,730 r/	1,800 r/ e/	1,800
Israel	4,536	4,800	6,204 r/	6,700 r/ e/	6,700
Italy	33,771 r/	32,713 r/	33,715	33,327 r/	33,721 2/
Jamaica	451	445	522 r/	555	600
Japan	88,046	91,624	90,474	94,492	91,938 2/
Jordan	3,514	4,000 e/	3,508	3,415 r/	3,251 2/
Kazakstan	4,000	2,000	2,616	1,120 r/	661
Kenya	1,417	1,182 r/	1,122 r/	1,102 r/	1,150
Korea, North e/	17,000	17,000	17,000	17,000	17,000
Korea, Republic of	47,313	50,730	55,130	57,260 r/	59,796 2/
Kuwait e/	500	1,000	1,950 2/	2,000	2,000
Kyrgyzstan	700	40	300	500	658 2/
Laos e/	7	10	10	9 r/	9
Latvia	300 e/	244	203	325 r/	246 2/
Lebanon e/	3,000	3,450	3,538 2/	3,700 r/	4,000
Liberia e/	8	10 r/	10 r/	10 r/	10
Libya	2,300 e/	2,700 e/	3,210	3,550	3,500
Lithuania	1,000 e/	736	649	600 e/	600
Luxembourg	720 r/	711 r/	714 r/	667 r/	700
Macedonia	499	486	524	491 r/	500
Madagascar e/	60	60	60	60	60
Malawi	127	122	139	140 e/	140
Malaysia	8,797	9,928	10,713	12,349 r/	12,700 2/
Mali e/	20	15 r/	13 r/	15 r/	15
Maritinique e/	220	220 r/	220 r/	220 r/	220
Mauritania e/	111	374	120	120 e/	125
Mexico	27,120	29,700	23,366	25,366 r/	27,548 2/
Moldova	100	39	49	40 r/	122 2/
Mongolia	82	86	109	106	112 2/
Morocco	6,350 e/	6,350 r/	6,401	8,000 r/	8,000
Mozambique e/	20	60 r/	60 r/	100 r/	200
Nepal	274	316	327	309 r/	300
Netherlands	3,078 r/	3,180 r/	3,200 r/ e/	3,300 e/	3,000
New Caledonia e/	90	90	100	100	100
New Zealand e/	800	900 r/	950 r/	974 r/ 2/	976 2/
Nicaragua	255	309	324 r/	350	360
Niger e/	29	30	30	30	30
Nigeria e/	3,200 r/	2,600 2/	3,000	3,000	3,000
Norway	1,344	1,444	1,613	1,664 r/	1,700
Oman	1,000 e/	1,200 e/	1,177	1,260 r/	1,300
Pakistan	8,321	8,100	8,586	8,900 e/	9,000
Panama	571	615	615 r/	647 r/	610
Paraguay	490	570	635	620	620 p/
Peru e/	2,500	3,000	3,000	3,848 2/	3,000
Philippines e/	7,962 2/	10,400	10,600	12,000	15,000
Poland	12,228	13,834	13,884	13,879	14,910 2/
Portugal	7,617 r/	7,977 r/	8,123 r/	8,300 e/	8,500
Qatar	544 r/	469 r/	475 r/	690	700
Romania	6,240	5,998	6,842	6,956 r/	7,298 2/
Russia	49,900	37,200	36,500	27,800	26,600 2/
Rwanda e/	60	10	5 2/	5 r/	5
Saudi Arabia	15,300 e/	15,000 e/	15,773	16,437	15,400 2/
Senegal e/	590 2/	590	650 r/	700 r/	700
Serbia and Montenegro	1,088	1,612	1,696	2,205	2,011 2/
Singapore e/	2,980	3,100	3,200	3,300	3,300
Slovakia e/	2,500	2,500	2,500	2,500	2,500
Slovenia	707	898	991	900 r/	900
Somalia e/	25	25	25	30	30
South Africa	7,356	7,905	9,071	9,000 r/ e/	9,000

See footnotes at end of table.

TABLE 22--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1993	1994	1995	1996	1997 e/
Spain (including Canary Islands)	22,878	25,150	26,423	25,157	27,632 2/
Sri Lanka	676	925	900 e/	905 e/	910
Sudan e/	250	250	391 2/	380	380
Suriname e/	50	50	50	50	50
Sweden	2,162 r/	2,153 r/	2,339 r/	2,447	2,320 2/
Switzerland e/	4,000	4,300	4,000 r/	3,800 r/	3,800
Syria	4,500	4,500 e/	4,463	4,500 r/ e/	4,500
Taiwan	23,971	22,722	22,478	21,537	21,522 2/
Tajikistan	300	200	100	50	35 2/
Tanzania e/	540	490	800	800	800
Thailand e/	26,870 2/	29,900	34,900	35,000	36,000
Togo e/	350	350	350	350	400
Trinidad and Tobago	528	583	559	617	653 2/
Tunisia	4,269	4,606	4,938	4,567	4,431 2/
Turkmenistan	1,100	700	437	451	450
Turkey	31,241	29,493	33,153 r/	35,214 r/	36,035 2/
Uganda e/	50	42 r/	85 r/	150 r/	150
Ukraine	15,000	11,400	7,600	5,000	5,100 2/
United Arab Emirates e/	4,000	5,000	5,918 2/	6,000	6,000
United Kingdom	11,039	12,307 r/	11,805	12,214 r/	12,900
United States (including Puerto Rico) 6/	75,117	79,353	78,320	80,818	84,255 2/
Uruguay	500 e/	700 e/	600	685	700 p/
Uzbekistan	5,300	4,800	3,400	5,000	5,000
Venezuela	6,842	6,927 r/	7,672 r/	7,556 r/	7,600
Vietnam e/	4,200	4,700	5,200	5,700	6,000
Yemen	800 e/	800 e/	1,088	1,040	1,100
Zambia e/	350	280 2/	250	350	300
Zimbabwe	1,000 e/	1,070	1,100 r/ e/	1,150	1,150
Total 7/	1,290,905 r/	1,373,013 r/	1,443,328 r/	1,488,262 r/	1,515,442

e/ Estimated. p/ Preliminary. r/ Revised.
1/ Table includes data available through September 22, 1998. Data may include clinker exports for some countries.
2/ Reported figure.
3/ Data for year ending June 30 of that stated.
4/ Formerly Zaire.
5/ Eritrea became an independent country in May 1993.
6/ Portland and masonry cement only.
7/ Data may not add to totals shown because of independent rounding.

CEMENT

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Samir Hakim and Paul F. Kasulis, statistical assistants, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Concrete and mortar are basic construction materials that comprise mixes of hydraulic cement, aggregates (fine and coarse aggregates in concrete, fine sizes only in mortars), and water that, through complex hydration reactions in the cement, harden into rocklike masses with specific properties. As the binding agent in concrete and mortar, cement is basic to most construction activity, and the production and consumption of cement are thus fundamental indicators for a country’s construction industry. Summary data on U.S. cement production, consumption, and trade are given for 1994 through 1998 in table 1, with production details for 1997-98 being shown in tables 3 through 6. In 1998, total U.S. production of portland and masonry cements reached a new record of 83.9 million metric tons (Mt), of which 95% was portland cement, and clinker production reached a new record level of 74.5 Mt. Clinker and cement output continued to be at or near full practical capacity levels. The United States ranked second in the world in cement production; world output was about 1.5 billion metric tons (Gt) (table 23).

Consumption of cement in 1998 was again at record levels. Apparent consumption of cement increased by 7.8% to 103.5 Mt and consumption measured as sales to final domestic customers rose by 7.2% to 103.4 Mt (table 9)—the first time either measure has exceeded 100 Mt. Imports of cement rose dramatically to meet this excess demand. Exports remained a very small component of total U.S. cement trade and again declined slightly during the year. As in 1997, the availability of inexpensive imported material appeared to have constrained price increases. The total ex-plant value reported for annual cement shipments from mills and terminals to final customers increased by 12% to about $7.4 billion. The same unit values applied to reported larger tonnage sales to final customers yielded a total value for 1998 of about $7.9 billion, an increase of 11%. By using typical cement-in-concrete mix ratios, the delivered value of concrete, excluding mortar, in the United States was estimated to be at least $30 billion in 1998.

Hydraulic cements are those that will set and harden in water and are overwhelmingly the dominant form of cement produced in the United States and the rest of the world. In turn, the production of hydraulic cements is dominated by that of portland and similar cements, including derived masonry cement. Except for certain trade and international production data, this report is concerned only with portland, as broadly defined, and masonry cements. Thus excluded are certain other hydraulic varieties, such as pure pozzolan and aluminous cements; these cumulatively make up only a small fraction of the U.S. cement market.

In the strictest sense, the term “portland cement” refers to the finished product, which is a finely interground mixture of portland cement clinker and 3% to 5% gypsum. A few States allow the addition of 1% to 3% of other cementitious material, such as granulated blast furnace slag, either as an extender or as a grinding aid, within the (straight) portland cement designation. Portland cement can be made by either integrated cement plants, which both manufacture clinker and grind it to make cement, or by stand-alone grinding facilities that use clinker obtained elsewhere. Clinker comprises mostly calcium silicates and is made by controlled high-temperature burning in a kiln of a measured blend of calcareous rocks (usually limestone) and, as needed, lesser quantities of siliceous, aluminous, and ferrous materials. The kiln feed blend (also called raw meal or raw mix) is adjusted depending on the chemical composition of the raw materials and the type of portland cement desired. In the United States, five basic types (Types I through V) of portland cement, denoting such properties as high sulfate resistance and high early strength, are recognized. Other designations may be used in other countries for similar portland cements. Portland cement is almost always gray, but a more valuable variety, white cement, can be obtained if care is taken to burn only iron-free raw materials.

Within statistical reporting of portland cement, common U.S. industry practice includes all nonmasonary cement varieties that are broadly based on portland cement clinker; this includes so-called blended cements. Blended cements are interground mixtures of finished portland cement (or ground clinker plus gypsum) and cementitious or pozzolanic additives. The proportion of these additives is quite variable but is commonly in the range of 15% to 50% by weight. Broadly defined, pozzolans are siliceous materials, such as certain rocks [mainly tuffs, diatomaceous earths, and burned clays or shales] and industrial byproducts [mainly ground granulated blast furnace slag, fly ash, cement kiln dust (CKD), and silica fume], that exhibit hydraulic cementitious properties when finely ground and interacted with free lime and water. In a blended cement, the free lime is that released during the hydration of portland cement. Blended cements have similar final strengths as straight portland cements, commonly have improved resistance to certain types of chemical attack, and offer low heat of hydration and reduced environmental impact of manufacture.

With the exception of table 16, blended cements are included within the portland cement designation in this report. Blended cement data (beginning with January 1998) are also available in separate Minerals Industry Surveys publications of the U.S. Geological Survey (USGS) showing monthly sales volumes by State. These data show that sales of blended cement make up only about 1.2% of total cement sales. However, these data (and those for cement raw materials in table 6) significantly underrepresent the use of pozzolans in making concrete, because many concrete companies buy pozzolans, especially fly ash and ground granulated blast furnace slag, directly and mix them with purchased straight portland cement instead of buying blended cement. Various sales data for fly ash and slag and limited surveys of concrete manufacturers suggest that, on average, pozzolans now compose, at least in some regions, perhaps as much as 10% of the cementitious material in ready-mixed concrete, which is the major form of concrete manufactured.

The determination of pozzolan consumption levels in the United States is complicated by the fact that some "pure" pozzolan cements are consumed. Blended cements rely on the lime released by the hydration of portland cement in the mix to activate the pozzolans, whereas pure pozzolan cements contain no portland cement and the required lime or other activator must therefore be added. Consumption data for pure pozzolan cements are lacking, but levels are likely very small. A further complication stems from the fact that data from pozzolans suppliers tend to lump sales to the cement and concrete manufacturers and commonly do not differentiate sales of pozzolans from similar but nonreactive material used as aggregates or as kiln feed.

As with portland cement, the term "masonry cement" is used broadly in this report and includes portland lime and plastic cements. Because this combination is not the universal practice of the industry, some portland lime and plastic cement data may have been reported within the portland cement designation, particularly in the monthly sales data summed within tables 9 and 10. Overall, however, the misassigned tonnages likely are small. Masonry-type cements are used in mortars, which are pastes for binding together building blocks, such as bricks and stones. Masonry cements can be made either from portland cement or directly from clinker and incorporate high percentages (e.g., 30% to 50%) of additives, commonly ground limestone or lime. In some cases, particularly with portland lime cements, the purchased components can be mixed at the construction site. Accordingly, the data in this report, which are for masonry cement produced and sold by cement manufacturers only, underestimate the true production and consumption of this material.

The bulk of this report, particularly tables 1 through 8 and 11 through 16, incorporates and discusses data compiled from USGS[1] annual surveys of individual cement and clinker manufacturing plants and certain terminals and importers. The 1998 survey form differed from that of 1997, primarily in that the 1998 form queried additional details concerning sales of blended cements and of consumption of raw materials. In 1998, responses were received from 134 of the 138 facilities canvassed, including all but 3 small producers, 1 of which had shut early in the year; the reporting facilities accounted for more than 99% of total U.S. cement production and shipments. In 1997, responses were received from 135 of the 136 facilities canvassed, recording 100% of production and more than 99% of shipments. Tables 9 and 10, in contrast, are based on monthly shipments surveys of the cement-producing companies and importers, and for these, the response rate was 100% for both years. The annual and monthly canvasses solicit data in short tons and other nonmetric units. The data are then converted for reporting purposes to metric units (sometimes in thousands), and rounding errors are possible, particularly within tabulated U.S. totals.

For annual survey nonrespondents and in cases where questionnaires were returned incompletely or improperly filled out, follow up inquiries were made, after which estimates were made and incorporated for any remaining missing data. Estimates for most information categories constituted only very small percentages of the aggregated totals and, thus, the introduced estimation errors are considered to be insignificant. Two important exceptions, however, continue to be the data for values shown in tables 1 and 12 through 14, where a significant but declining number of facilities routinely omit or incorrectly report the information, and the data for portland cement shipments by customer (user) type, shown in table 15, where the cement producers readily admit to having incomplete knowledge and where there is some overlap among the user categories.

As in previous years, the tonnage discrepancy between the annual shipments totals for portland cement shown in tables 1 and 11 through 16 and the larger, monthly-data-based totals shown in tables 9 and 10 is significant. The discrepancy appears due mainly to the fact that the monthly surveys commonly are returned by companies on a consolidated basis inclusive of several plants and/or terminals, whereas the annual surveys are returned by individual plants and some terminals, but some terminals may be missed. Particularly if imports are involved, missing terminals can individually account for substantial tonnage differences. Errors with the monthly reporting, in contrast, generally are smaller on an individual respondent basis, and most commonly are from the mistaken inclusion by companies of some sales to other cement companies instead of just sales to final customers (this leads to double-counting). Corrections of such errors generally are submitted to the USGS within a month or two. Unlike the case with portland cement, the difference in the totals for the two reporting systems for masonry cement is small. Because they are more complete, the data in tables 9 and 10 are the preferred measure of true U.S. consumption (see Consumption section); these data (actually the component monthly data) are used by cement companies to estimate their market shares and to perform many other economic analyses. Integration of the data from tables 9 and 10 with those from the other tables has not been done to avoid creating additional internal inconsistencies.

Tables 17 through 22 show nonproprietary trade data from the Bureau of the Census in lieu of the proprietary data collected through the USGS monthly questionnaires. The world hydraulic cement production data shown in table 23 were derived by USGS country specialists from a variety of sources.

In some tables, State data are combined within State groupings or districts, generally corresponding to Census Districts or subsets thereof, where required to protect

[1]Data in table 1 for 1994 were collected by the former U.S. Bureau of Mines.

proprietary information. To provide additional market information, certain major cement-producing States have been subdivided along county lines; the county breakouts are given in table 2.

Several important changes in cement company and/or plant ownership took place in 1998. On January 1, the purchase of Riverside Cement Co., a California company, by Texas Industries, Inc. (TXI), based in Texas, came into effect. The deal for this had been signed the previous September (International Cement Review, 1999). The seller was Ssangyong Cement Industrial Co., Ltd., a Korean company. At the end of June, Southdown, Inc., the country's third largest cement producer, purchased Medusa Corp., the eighth largest producer (Southdown, Inc., 1999a, p. 40); the merger moved Southdown ahead of Lafarge Corp. as the second largest cement company in the country. In mid-October, Lafarge completed its purchase of an integrated plant in Seattle, WA from Holnam, Inc. (Lafarge Corp., 1998). In July, the U.S. and Canadian operations of Lehigh Portland Cement Co., a subsidiary of Heidelberger Zement, Inc., of Germany, and Cimenteries CBR S.A., a Belgian company 55.9% owned by Heidelberger, were formally merged under the Lehigh name (Cimenteries CBR S.A., 1999, p. 5). The North American CBR operations thus affected were those of Calaveras Cement Co., in California; Tilbury Cement Ltd., in Canada and Washington; and Inland Cement Ltd., in Canada.

Legislation and Government Programs

Economic Issues.—Government economic policies and programs affecting the cement industry chiefly are those affecting cement trade, interest rates, and public sector construction spending. In terms of trade, the major issue in 1998 remained that of antidumping tariffs against Japan and Mexico, and a related voluntary restraint (import price) agreement with Venezuela, that were imposed in 1990 and 1992 following complaints in the late 1980's by a large coalition of U.S. producers. The complaints stemmed from the large volumes of inexpensive cement and clinker imports that were undercutting U.S. producers' prices. Anticipation and eventual imposition of tariffs on Mexican imports led to a decline from a peak of 4.5 Mt in 1988 to 0.6 Mt in 1994, but they have been recovering somewhat since, and reached almost 1.3 Mt in 1998. The main Mexican company involved has repeatedly appealed the tariffs, but the appeals to date have all been turned down and the tariffs reaffirmed. In March 1998, the U.S. Department of Commerce released its determination for the (sixth) review period covering August 1995 through July 1996; the tariff for Mexican cement imports was set at 36.3% for the period (Southern Tier Cement Committee, 1998a). In early December, a North American Free Trade Agreement binational dispute resolution panel rejected an appeal of the 109.43% fourth review period tariff, covering imports for August 1993 through July 1994, from the main Mexican producer affected (Southern Tier Cement Committee, 1998b). The antidumping tariffs caused cement imports from Japan to drop to negligible levels by 1993, and they have remained so since. The agreement with Venezuela allowed substantial import levels to continue, but at higher prices than before. In line with a World Trade Organization (WTO) agreement, which became effective in 1995, antidumping tariffs can be imposed only for a period of 5 years, afterwhich a "sunset" review must be done to determine whether or not a need (determination that dumping is occurring and is causing injury) remains for the tariffs. In the case of the antidumping tariffs on cement (which were imposed prior to the WTO agreement), the requisite sunset review was to start in August 1999 (Dorn, 1999)

Public Law 105-178, the Transportation Equity Act for the 21st Century (TEA-21), signed into law June 9, 1998, authorizes $216.3 billion in funding for the 6-year period 1998-2003 for the purpose of upgrading the country's transportation infrastructure. The level of funding exceeds previous spending levels by about 44%, on a State average basis, and the bill contains substantial funding guarantees. The source of most of the funding is the Highway Trust Fund, composed mainly of Federal motor fuel tax revenues. Of greatest interest to the cement industry are the highway components in TEA-21. Funding provided for various facets of highways, including new roads and bridges and existing infrastructure upgrades and repair, totals about $173 billion, of which about 95% is guaranteed. Various estimates have been made as to how much (added) cement consumption will result from full-level TEA-21 spending; most of the studies have agreed on the range of 6 to 8 million metric tons per year (Mt/yr) (e.g. Kasprzak, 1999).

Environmental Issues.—Cement production has both mining and manufacturing components. In the United States, about 135 Mt of nonfuel raw materials are directly or indirectly mined (see table 6) each year for cement manufacture, generally from open pit operations close to the cement plant. Environmental issues affecting this activity are common to most surface mines and include potential problems with dust, increased sediment loads to local streams, noise, and ground vibrations from blasting. Of greater concern overall are the environmental impacts of the cement manufacturing process itself, most of which stem from the manufacture of clinker. Clinker kilns burn about 12 Mt/yr of fossil and/or other organic fuels (table 7) to thermo-chemically break down (calcine) calcareous and other rocks to instigate clinker-mineral-forming chemical reactions.

In the debate over climatic change, the impact of "greenhouse gases" on atmospheric warming is a major issue. The most common greenhouse gas is carbon dioxide (CO_2), and both fuel combustion and calcination of carbonate (limestone) feed in the clinker kilns generate large quantities of this gas. As explained more thoroughly in the 1996 edition of this report, precise determinations of the CO_2 emissions of the U.S. cement industry are not available, but the amount for the country may be estimated to within 5% to 10% on the basis of various assumptions of the composition of the raw materials and fuels consumed or that of the clinker produced. The clinker manufacturing technology also plays a role—wet kilns consume more fuel on a unit of clinker output basis than do dry kilns. If a lime or calcia (CaO) content in clinker of 65% is assumed and if it is assumed that all of this CaO is derived from calcium carbonate then calcination can be assumed to yield 0.51 metric ton (t) of CO_2 per ton of clinker. If some CaO in clinker is derived from other sources, such as slag feeds, then the amount of CO_2 released by calcination will be less. Calcination also involves other variables, but they are relatively minor. Fuel consumption is technology dependent and is subject to more variables, but the combustion component may be estimated at about 0.48 to 0.50 t of CO_2 per ton of clinker, on the basis of the mix of fuels shown in table 7. Thus, overall, about 1 t of CO_2 is released per ton of clinker produced, which translates to about 0.95 to 0.97 t of CO_2 per ton of portland cement produced. Because of their substantial component of materials other than portland cement or clinker, masonry cements generally equate to less CO_2 per ton of product than portland cement. Masonry recipes vary widely, but if the additives are mostly ground limestone, then the total CO_2 released would be about one-half to one-third that of portland cement. If lime is the additive, then the total is closer to, but less than, that of portland cement because lime manufacture uses less fuel than clinker manufacture. Calculation of CO_2 emissions from calcination is better done, as above, from data on clinker production rather than applying emissions factors to mix of raw materials burned (e.g. table 6), because data will seldom, if ever, be available on a national basis for the chemical composition of these feeds. Calculation of emissions based on data for cement production can introduce large errors unless the breakout of cement, by type, is well known and the composition of each type of cement is also known. This level of detail is generally lacking in production data for cement, but it is important, particularly if the cements incorporate significant amounts of pozzolans; that is, are blended cements. Most blended cement specifications allow significant compositional variations. Many pozzolans, especially fly ash and blast furnace slag, are themselves products of major CO_2-generating industries, such as coal-fired powerplants and blast furnaces, but the emissions from this manufacture would be charged to those industries.

By using the clinker data in table 5, release of CO_2 by cement manufacture in the United States is estimated at about 75 Mt in 1998. In addition, U.S. cement plants consumed electricity (table 8) equivalent to about 7 to 8 Mt of CO_2, but this generally would be charged to the electrical power industry.

The concern of the cement industry with CO_2 emissions continues to be the possibility that the Government will seek to reduce emissions through the imposition of carbon taxes or emissions quotas. At the United Nations Framework Convention on Climate Change held in December 1997 in Kyoto, Japan, measures were agreed to that would have so-called developed countries reduce their emissions of greenhouse gases to levels below those of 1990; for the United States, the Kyoto Protocol reduction requirement was 7% below 1990 levels, by 2012. Current U.S. emissions of greenhouse gases are substantially higher than the 1990 levels; estimates of the margin vary but typically are in the range of 20% to 25%. Consequently, the Kyoto targeted reduction for the United States is substantial. At least initially, developing countries would be encouraged, but not required, to reduce their emissions of greenhouse gases. Detailed methodologies were being developed by the Intergovernmental Panel on Climate Change (IPCC) to estimate the amount of CO_2 and other greenhouse gases emitted by various industries, including cement, and other national-level sources, and based to the degree possible on readily obtainable product output data. To this end, the IPCC held an international conference in January 1999 in Washington, DC.

It remains unclear how a large reduction in U.S. CO_2 emissions could be achieved without substantial increases in energy and general production costs throughout the economy, or without having domestic manufacturers facing increased competition from imports originating in countries not encumbered by the Kyoto-mandated emissions reductions. Although the United States signed the Kyoto Protocol on November 12, 1998, Congress has yet to ratify the agreement, which is nonbinding until this happens. Even without ratification, the cement industry expected that the Government would encourage a reduction in CO_2 and other greenhouse gas emissions (Cement Americas, 2000).

For the U.S. cement industry, meeting the Kyoto levels of reduction in CO_2 emissions could require the shutdown of a number of older plants, especially those operating less energy-efficient wet kilns, and/or the upgrading of plant equipment to more efficient technologies. Upgrading is already underway at many plants, but is an expensive process. Mandated emissions reductions could force plants to burn less carbon-intensive fuels; for example, natural gas rather than coal. This is technically easy to do, as many cement plants in the United States are already able to switch among a variety of fuels. A shift towards natural gas consumption by the cement industry could, however, lead to local shortages and price increases for that fuel, particularly if a switch to gas is also made by other major fuel-burning industries, such as powerplants. A significant contribution to the reduction of CO_2 emissions would be achievable through a drastic change in the formulation of finished portland cement; specifically, a major reduction in the average clinker component (currently about 95%) of cement produced at domestic integrated plants. In other words, the U.S. cement industry could change from a product line dominated by straight portland cement to one dominated by blended cements. Although blended cements can have satisfactory performance characteristics, a general shift to their use would require changes in some building codes; namely changing the cement specifications from a compositional basis to a performance basis. Further, a major shift to blended cements could lead to regional shortages of suitable pozzolans and increased prices for these materials. As noted above, many concrete manufacturers are already using substantial quantities of cementitious additive in their concrete mixes. Although this practice could be slightly constraining U.S. cement imports, it has yet to impact domestic cement (clinker) manufacture. Another approach to reducing the clinker impact of cement manufacture is to reduce the emissions from calcination by using alternative sources of CaO as feed. A process patented by TXI and known as CemStar makes use of substitution for some of the kiln feed by steel slag. The slag, apart from supplying a measure of needed CaO, supplies silica and iron oxide, is said to melt very easily, has a mineralogy similar to that of clinker, and reacts exothermically;

its use is claimed to increase the existing kiln's clinker output by up to about 10%, with unit emissions proportionately lower. The process has been licensed to a number of plants (Texas Industries, Inc., 1998).

Another major waste product of clinker manufacturing is CKD, made up of fine particles of clinker, incompletely reacted raw materials and solid fuels, and material eroded from the kiln''s refractory brick lining. Almost all CKD is captured by either electrostatic precipitation or baghouse filtration. On a national average, about 70% is recycled to the kilns as part of the raw meal, and another 5% or so is used for other purposes, commonly as a soil conditioner (liming agent) or for road bases, or in the product line as additives in masonry cements or even as a pozzolan. The remaining CKD, amounting to about 3 Mt/yr, is removed to landfills; this is required for CKD that contains contaminants (e.g., excessive alkalis, chromium, vanadium, and toxic organic compounds) at concentrations that preclude recycling. The U.S. Environmental Protection Agency (EPA) was studying whether to classify CKD as a hazardous waste and was drafting regulations pertaining to its handling and storage. A draft set of proposed regulations was released by EPA during the year but, following extensive comments by the industry, the agency agreed to revise the document; the revision had not been released as of yearend. Commentaries, from the cement industry standpoint, on the proposed regulations are provided by Kelly (2000) and Weiss (2000).

Government proposals to reduce cement industry emissions of nitrogen oxides (NOx) and sulfur oxides (SOx), dioxins and furans, and other contaminants are of concern to the industry, particularly because changing emission limits may necessitate changes in testing procedures, equipment, and operating practices. These limits also affect the ability of plants to use waste fuels cheaply because the emissions are largely a function of fuel type and combustion conditions within the kiln. The Government was moving towards regulating kiln emissions within the regulatory Maximum Achievable Control Technology (MACT) framework, under which the standards adopted for each contaminant would be the average emissions levels of the 12% least polluting plants. The U.S. EPA had issued preliminary MACT standards in 1996, but had not issued final standards as of yearend 1998.

Production

In 1998, cement was produced at 118 plants in 37 States and in Puerto Rico, by 39 companies (other company totals are possible depending on ownership breakdowns), 1 of which was State-owned. Production and related data are shown in tables 3 through 8. As of yearend 1998, about 60% of U.S. cement production and 61% of capacity was foreign owned.

Many cement companies were in the process or planning stages of upgrading their production facilities to increase production efficiencies and/or overall production capacity. Among the projects announced or completed during the year, Ash Grove Cement Co. completed the upgrade of the Durkee, OR, plant to about 0.85 Mt/yr capacity (Portland Cement Association, 1998a). California Portland Cement Co. was planning to upgrade its Rillito, AZ, plant to a capacity of about 2.1 Mt/yr of cement (Portland Cement Association, 1998d). Essroc Materials Corp. brought back on line a 0.1-Mt/yr kiln at Nazareth, PA (Portland Cement Association, 1998b). North Texas Cement Ltd. announced plans to construct a 1-Mt/yr cement plant near Dallas, TX (World Cement, 1998); construction was expected to be completed in early 2001. St. Lawrence Cement, Inc. announced plans to build a 2-Mt/yr cement plant at Greenport, NY (St. Lawrence Cement, Inc., 1998). Southdown, Inc. was continuing extensive upgrades at its Victorville, CA, plant, and announced a 0.6-Mt/yr expansion of the Kosmosdale plant at Louisville, KY; this facility is a joint venture between Southdown (75%) and Lone Star Industries, Inc. (25%) (Southdown, Inc., 1999a, p. 24). TXI was building a new 1.8-Mt/yr kiln at its Midlothian, TX, plant (International Cement Review, 1999). Monarch Cement Co. was planning to upgrade its Humboldt, KS, plant to a capacity of about 0.9 Mt/yr (Portland Cement Association, 1999a). National Cement Co. was installing a new preheater tower at its Lebec, CA, plant to increase capacity to almost 0.9 Mt/yr (Portland Cement Association, 1998c).

Royal Cement Co., Inc., a small integrated plant in southern Nevada, closed at the end of March 1998; this was the only portland cement plant closure during the year. Lehigh, however, closed its Buffington, IN, calcium aluminate cement plant, intending to replace its output with that from a facility in Pula, Croatia (Cimenteries CBR, S.A., 1999, p. 40).

Portland Cement.—In the United States and Puerto Rico, portland cement was manufactured at 115 plants out of 116 claiming clinker-grinding capacity (the remaining plant only reported masonry cement production). Five of the portland-producing facilities were dedicated clinker-grinding plants; some of these also ground slag. The regional distribution of these plants, cement production and capacities, and yearend cement stockpiles, are given in table 3.

In 1998, portland cement production rose by 1.3% to a new record of almost 80 million tons. Nevertheless, the increase was modest compared with the large increase in sales noted in the Consumption section below and in table 9. The production shortfall reflected the as-yet unfinished status of a number of production-capacity upgrade projects and the ready availability of imported cement. In the case of some grinding plants, imported cement allowed the switch of some grinding capacity over to grinding imported granulated blast furnace slag. As shown in table 3, portland cement production increases were noted in most districts. As in 1997, the top five producing States in 1998 were, in descending order, California, Texas, Pennsylvania, Michigan, and Missouri.

Portland cement (grinding) capacity utilization continued at very high levels nationwide— about 85% overall. This statistic, however, is misleading in that it compares the reported grinding capacity with only the portland cement output. A better average would result by including the masonry cement tonnage (table 4), which would increase the overall grinding capacity utilization for the country to 89%. Given the fact that the reported (plant) capacities are supposed to exclude all but routine downtime, the utilization levels shown are likely to be at or very close to practical limits. Some of the 1997-98 changes could reflect capacity improvement projects underway at various plants. When completed, such upgrades would be expected to yield production increases, but where ongoing, the projects might cause short-term decreases in outputs if major equipment were to be shut down for alteration or replacement. Some of the changes shown could simply reflect a difference in reporting personnel or in different interpretations of what defines capacity. Thus, small district capacity changes shown for total U.S. grinding capacity and capacity utilization in 1998 are likely not statistically significant. The significant increase in capacity utilization seen for Ohio largely reflects the reduced State capacity stemming from the early 1997 closure of a grinding plant. As in previous years, the 1998 regional grinding capacities shown substantially exceed those for clinker given in table 5. The main reasons for this are the inclusion of grinding plants that produce cement but not clinker in table 3; some plants have extra capacity for grinding imported domestic or foreign clinker and/or inert or pozzolan extenders; and it is cheaper to construct grinding capacity than clinker capacity.

Reported yearend 1998 portland cement stockpiles were about 0.38 Mt lower than those in 1997, but the evaluation of stockpile changes, especially small ones, is difficult for several reasons. An increase in yearend stocks could represent a buildup of material ahead of shutting down kilns and/or finish mills (for routine maintenance or other work) to allow plants to continue their normal sales deliveries of cement. The timing of such shutdowns can vary regionally. Cement stockpile buildups would normally follow those for clinker, data for which were unavailable prior to 1998. Thus, the most meaningful stockpile data would be for those at the end of a kiln and/or mill shut-down period for major maintenance or other work. Collection of such data, as opposed to those for a uniform date, is impractical, however. Buildups could represent the coming on-stream or the reaching of full production levels of new or upgraded production capacity. Changes in yearend stockpiles could reflect changes in sales volumes towards yearend or buildups in anticipation of sales to major projects. They can reflect mass changes associated with conversion to other types of cement, such as a "straight" portland cement being converted to a larger mass of blended or a masonry cement. In the case of imports, the yearend stockpiles could be influenced by the early or delayed arrival of ships. Finally, stockpiles appear to be prone to accounting inconsistencies, as evidenced by the fact that yearend stocks for a given facility reported in one year commonly are significantly different from the beginning year stockpiles reported in the subsequent year's survey.

Data are not collected on the production of specific types of portland cement (e.g., Type I vs. Type III), but it is likely that production by type, at least of the major varieties, was proportional to the reported shipments by type shown in table 16. Assuming this to be true, gray portland cement Types I and II again accounted for about 90% of total output.

Portland cement producers in the United States ranged from companies operating a single plant of less than 0.5% of total U.S. capacity to large, multiplant corporations having in excess of 15% of total capacity. The ranking of these companies in terms of production and capacity is complicated by the facts that some companies are subsidiaries of common parents and that some plants are jointly owned by two or more companies. Consolidating companies having common parents and apportioning the joint ventures, the top 10 companies in 1998 were, in descending order of production, Holnam; Southdown; Lafarge; Lehigh; Blue Circle, Inc.; Ash Grove; Essroc; Lone Star; California Portland; and TXI. These, combined, accounted for 70% of U.S. portland cement production and 80% of capacity in 1998.

Masonry Cement.—Masonry cement production, as shown in table 4, increased by 9.8% to almost 4 Mt. Unlike the case with portland cement, the level of masonry cement production was very close to that of consumption (table 9). The change in stockpiles shown was minor. The large percentage increases in production and consumption reflect a strong housing market during the year, the small total tonnages involved, and the corrected reporting of sales of some types of masonry cement that had hitherto been erroneously reported within those of portland cement by some companies. In 1998, masonry cement was again produced by 83 plants, all but 2 of which also produced portland cement. As in 1997, about 94% of total masonry cement was produced from clinker, as opposed to being produced from portland cement. As noted in the introduction, these data underrepresent true output and consumption levels of masonry cement because some varieties, especially portland lime cement, can be easily mixed on the job site using purchased portland cement as the base.

Clinker.—The production of clinker increased by 2.5% to 74.5 Mt, another new record. Output increased in all but a few districts; none of these showed large declines. Including the facilities in Puerto Rico, clinker was produced by 110 integrated cement plants, operating 200 kilns. Two-thirds of the plants used dry-process kiln technology. Table 4 lists district-level information on clinker production and capacity. Capacity utilization for the country was about 90%, and all but two districts had utilization levels in excess of 82%. The Oregon-Washington district showed an abnormally low utilization level that was at least partly due to disruptions (including in data reporting) occasioned by a change in ownership of one plant during the year.

As with clinker (cement) grinding capacities discussed above, clinker output levels in 1998 continued to represent full or nearly full practical output levels. The clinker capacity and utilization data for 1998 and 1997, however, are not strictly comparable with data for earlier years. This is because of problems apparent in the pre-1997 reporting of the breakout of kiln downtimes by some plants. The time breakdown is critical to the derivation of annual capacities (calculated by multiplying plant-reported daily capacities by the normal operating year, which is defined as 365 days minus the days of routine maintenance downtime) for each kiln. For the 1997 and 1998 surveys, plants that reported in excess of 30 days of routine downtime were contacted to verify the correctness of the data. In most cases, these plants had originally overstated the routine downtime and understated the "other" downtime; corrected distributions were then obtained. If the days for routine downtime are overstated, then the calculated annual capacity for that plant will be too low, and the capacity utilization subsequently calculated will be too high. Some districts, in years prior to 1997, showed utilization levels in excess of 100%, which is unlikely for an entire district over the course of a year, especially for an industry that runs its facilities 24 hours per day. Plants that reported 30 or fewer days of routine downtime were assumed to have reported correctly, but this may not, in fact, be the case. Apart from these considerations, the daily and annual capacity data in table 5 are particularly vulnerable to propagation of rounding errors.

In 1998, the average plant operational annual capacity was 0.77 Mt and average annual capacity per kiln was 0.42 Mt. Plants operating only dry process kilns accounted for almost 73% of total clinker production in 1998 and wet process plants slightly more than 25% of production (table 7); the slight difference seen from the 1997 distribution likely reflects the late 1997 conversion of a wet process plant to dry technology (Holnam's Devil's Slide plant in Utah).

Although data are not collected for clinker consumed to make masonry cement, the amount of masonry reported as produced directly from clinker implies a clinker consumption for this cement of about 2.5 Mt. This would leave approximately 73.3 Mt of U.S. clinker production, including that of Puerto Rico, plus 4.1 Mt of imported clinker (table 22), available for portland cement manufacture. This would be sufficient to make between 79.9 and 81.6 Mt of straight portland cement, assuming a clinker component of 95% to 97%, which compares well with the actual output of 81.5 Mt (or 81.2 Mt after adjusting for the approximate pozzolan content of blended cement "production" estimated from the sales data shown in table 16), and which would imply no significant changes in clinker stockpiles over the year. Data for clinker stockpiles were unavailable prior to 1998 and are lacking for 1998 for five plants; there was no basis on which to estimate these volumes. The 1998 data show end-of-year stockpiles for the country (including Puerto Rico) of about 2.9 Mt, an increase of 0.5 Mt from those at the beginning of the year.

The top five clinker-producing States continued to be, in descending order, California, Texas, Pennsylvania, Missouri, and Michigan. Depending on the ownership combinations used, the top 5 companies had about 46% of total U.S. clinker production and capacity, and the top 10 companies had about 69% to 70% of both. In terms of ranked clinker production, the order of the top 10 companies is ownership dependent. Consolidating companies having the same parent corporations, and apportioning joint ventures, the rank of companies was, in declining order of clinker production, Holnam, Southdown, Lafarge, Lehigh, Ash Grove, Essroc, Blue Circle, Lone Star, TXI, and California Portland.

Raw Materials and Energy Consumed in Cement Manufacture.—The nonfuel raw materials used to produce cement, most of which were consumed to manufacture clinker, are shown in table 6. Limestone and other calcareous rocks made up about 81% of the total raw materials mix. As in previous years, approximately 1.6 tons of raw materials, including 1.3 tons of calcareous rocks, was consumed per ton of cement produced. The mass ratios among various major raw materials and the ratios of these materials to clinker and cement produced are essentially the same for 1998 and 1997.

Given increasing environmental interest in CO_2 output by cement plants and in the related, considered potentially remedial, output of blended cements and consumption of pozzolans, the 1998 survey form was redesigned so that consumption of raw materials could be apportioned between that for clinker manufacture and that subsequently used to make finished cement. Further, several additional types of materials, particularly among pozzolans and similar siliceous feeds, were specified; in prior years, data for these categories had been lumped. The breakout data are shown in table 6 but remain unavailable for 1997 and earlier years. In prior reports, the clinker-vs.-cement consumption breakout, which was based, in part, on crude comparisons of the total consumption of materials to the sales volumes of specific types (particularly blended) of cement, could only be qualitatively estimated. From the inception of the new survey, the ability of the industry to provide the additional details sought was not known. The results were better than expected, but were not completely successful. In particular, the amount of masonry cement manufactured in 1998, as shown in table 4, would support a consumption of limestone as much as double the amount shown in the "Cement" column in table 6; the missing amount presumably still resides in the "Clinker" column. The amount shown for lime likewise appears to be too low. The tonnage shown for cement kiln dust as consumed for clinker is clearly only a fraction of that actually consumed; evidently few plants quantitatively monitor the substantial amount of CKD that usually is directly recycled to the kilns. Similarly, despite being a fairly common additive in masonry cement and having some use as a pozzolan in blended cement, the amount of CKD reported as going into cement seems to be too low; the actual volume reported is subject to proprietary withholding. The categorization of certain materials that might chemically best fit into one category but that were actually consumed to supply something else continues to be a minor problem. For example, all slags were placed under the "Siliceous" feed category, but some types were actually consumed to supply iron.

In 1997 and prior years, the consumption of fly ash was shown inclusive of bottom ash, and greatly exceeded the amount that could be accommodated by the sales (as proxy for production) of fly ash blended cements shown in table 16. Accordingly, most of this material was thought to be consumed as a kiln feed; the data, as noted earlier, did not include the fly ash consumed directly by the concrete industry. The table 6 data for 1998 and the 1997 breakout shown for bottom ash clearly support the earlier years' conclusion. Almost all of this material is within the "Clinker" column and the small amount within the "Cement" column could be readily accommodated as a pozzolan in realistic proportion within the fly ash blended cement sales shown in table 16. As expected, all other forms of ash, mainly bottom ash, were entirely consumed to make clinker.

In prior years, all forms of slag were generally entered as "Blast furnace slag," although this material was thought to include steel slags, perhaps copper slags, and air cooled blast furnace slag, in addition to the granulated blast furnace slag that was actually being sought. Occasionally, a plant would specify one of these and enter it under an "Other" category. The additional slag breakout categories were made available in the 1998 survey and are shown in table 6; the inclusive 1997 slag data are now entered all as "Granulated blast furnace slag," but it remains unknown how much of this was really this material. Because the tonnage reported as "Blast furnace slag" could be accommodated by the sales of blast furnace slag blended cements (table 16) for 1996 and earlier years, essentially all of this material was thought at the time to have been consumed as a cementitious or pozzolan additive. The 1997 total seemed too high to fit within common proportions into the blended cement sales shown for the year, and a speculation was made that the data could have included misreported other slag types. The 1998 slag data strongly support a lumping of slag types in 1997, and call into question the dominantly blended cement use conclusion for 1996 and earlier years. As expected, the granulated blast furnace slag consumption in 1998 was all for finished cement. The amount shown (0.285 Mt), however, exceeded the small volume (0.165 Mt) of blast furnace slag blended cements sold to final customers (table 16); as a proxy for production, this sales volume would require a consumption more like 0.02 to 0.08 Mt of granulated blast furnace slag. Examination of the survey forms showed numerous plants consuming granulated blast furnace slag but reporting no blended cement sales. These plants were contacted to see if one or the other data category was being misreported or if granulated blast furnace slag was being used for some other purpose in the finish mills. It turned out that significant quantities of this material were being used by some plants as a grinding aid and/or as a 1% to 3% cementitious extender in Types I and II portland cements, where this use was permitted by individual States.

As expected, a significant tonnage of steel slag was reported in 1998 as having been consumed to produce clinker. This material is being increasingly used (although the data cannot, as yet, document this) as kiln feed, not only as a "casual" feed to supply iron and calcia, but also to effect an increase in the throughput capacity of the kiln by plants using TXI's patented CemStar process.

Although some CKD was reported as being used as a pozzolan, data for this use appear to be incomplete and, like those for the tiny amounts of more exotic pozzolans (such as silica fume), cannot be shown for proprietary protection reasons. In the case of silica fume, in particular, it seems likely that most of the material is consumed directly at the concrete plants and is not incorporated in a purchased blended cement.

Consumption of fuels by kiln process is shown in table 7. Overall, the consumption of coal, or coal plus coke, relative to clinker production was substantially unchanged in 1998. A significant decline in the burning of tires appears to have been offset by increased burning of coke, other solid wastes, and natural gas. The biggest changes in 1998 were seen in the large decline in fuel oil burned by plants operating wet kilns, which was offset by a very large increase in the consumption of liquid waste fuels.

Table 8 lists electricity consumption by the cement industry, differentiated by process type. Electricity consumption at integrated plants is dominated by the raw meal and finished cement grinding circuits and, to a lesser extent, by rotating the kiln. In modern dry plants, however, significant amounts of electricity also are used to operate various fans and blowers in preheater and precalciner equipment. Thus, dry process kiln lines, at least those equipped with preheaters and/or precalciners, consume more electricity than equivalent capacity wet process lines. In 1998, overall consumption of electricity per ton of cement decreased slightly compared with that in 1997, but the change may not be statistically significant. Changes of this small magnitude could be from changes at just a few plants, such as the installation of more modern equipment, a change in the feed or product types (for example, a Type III portland cement needs to be more finely ground than a Type I or II), or the need to estimate some of the data.

Per-ton electricity consumption by dedicated grinding plants showed a small increase in 1998; if statistically significant, this change could reflect the fact that some of these facilities also grind granulated blast furnace slag; slag is harder than clinker, and requires finer grinding. The grinding plant average was about 48% of the overall unit consumption by integrated plants, which is higher than the consumption by the equivalent components (finish milling, conveying, packaging, storage, and loading circuits) at an integrated plant. The higher unit consumption would appear to reflect the fact that the dedicated grinding plants contain ancillary functions (raw materials unloading, storage, conveying, administrative) that, functionally, would be more broadly distributed at an integrated plant.

Consumption

Consumption of cement is shown as an apparent consumption statistic in table 1, and as sales to final customers in tables 9 and 10. Apparent consumption is a mass balance among production; imports, which were adjusted to remove clinker imports, as the production includes cement made from imported clinker; exports; and changes in yearend cement stockpiles. As noted above in the Production section, yearend stockpiles have little meaning, and so the sensitivity of apparent consumption to stockpiles degrades the usefulness of the statistic. For consistency, beginning year stockpiles have been set as equal to the preceding yearend inventory, but this is not always in accord with the actual survey data for January 1 stocks. Another problem is that the trade data used are from the Bureau of the Census and are for all forms of hydraulic cement and clinker, not just for portland and masonry cements, although these two cement types would dominate the data; data specific to masonry cement are unavailable. Also, apparent consumption includes cement moving in inter- and intra-cement-company shipments; that is, material that has yet to be consumed. Nonetheless, apparent consumption is a standard statistic, useful for comparing consumption of cement to that of many other commodities. As noted in the Introduction, apparent consumption of portland plus masonry cement rose 7.8% in 1998 to 103.5 Mt.

Another measure of consumption and the one preferred by the cement industry for its market analyses is that of cement sales or shipments to final customers. Shipments from one cement producer to another are not counted; the materials are considered to have been sold when the receiving cement producer transfers it to a final customer. Likewise, shipments between plants and terminals within a single company are not counted. The definition of who/what is and is not a final customer is left to the reporting cement producer, but is generally understood to include concrete manufacturers, building supply dealers, construction contractors, and the like. The designation ignores the possibility that a customer might put some cement into stockpiles extending beyond yearend or might resell cement to other users. No data on such storage or transfers are available, but they are believed to be small, probably no more than 5% of any single month's shipments, and would likely balance out over a period of months.

The USGS collects data monthly on the shipments of cement to final customers by State of destination and by State or country of origin; that is, manufacture. The monthly destination data are the best available for cement consumption in the United States and are shown totaled for 1997 and 1998 in tables 9 and 10. The annualized portland data listed for 1998 include data for blended cements; these are listed separately on the 1998 monthly surveys themselves. Because this split was not done prior to 1998, the 1997 monthly portland data were already inclusive of blended cements.

Tables 11 through 16 list various data on or derived from shipments of cement reported by cement producers and import terminals as canvassed in the annual surveys. Some of the data, especially those in tables 12 and 13, look superficially similar to the data in tables 9 and 10, but there are important differences between the two data sets, particularly for portland cement. Table 9 lists total portland cement shipments (consumption) of 92.815 Mt in 1997 and 99.272 Mt in 1998, whereas table 13 shows portland cement shipments of 86.692 Mt and 92.809 Mt for the same years, respectively. The difference (6.1 to 6.5 Mt/yr) is similar to those found in earlier years, and would appear to be caused by the different nature of the two types of surveys, as noted in the introduction. As explained there, the larger, more complete, portland cement volumes shown in tables 9 and 10 are preferred as a measure of true consumption. No attempt has been made to impose table 9 and 10 national portland cement totals on the other tables. Agreement between national totals for masonry cement in the two data sets (tables 9 and 13) appears to be close, probably reflecting the relatively (compared to portland) small volumes of this material produced and imported.

There is another important difference between the shipments data in table 9 and those in tables 12 and 13. The data in table 9 data are presented on an individual State basis, but some of the data in tables 12 and 13 are grouped on a multi-State basis where needed to conceal proprietary data for individual plants or companies. This precaution is necessary because the data in tables 12 and 13 represent only the activities of plants and terminals within the given State; that is, the regionality reflects the location and activity of the reporting facilities, not where the cement was sold. Proprietary precautions are not required in table 9 because the States are the locations of the consumers, who can receive materials from multiple sources. Sales for States and districts in tables 12 and 13 can include sales to customers in other regions. Revisions for certain 1997 district data in tables 12 and 13 reflect an apportionment of shipments for importers for which district locations could be assigned; these shipments were included within the 1997 national total in the previous edition of the report.

As an example of the difference between the two data sets, Michigan is shown in table 9 as having consumed 3.411 Mt of portland cement from all sources in 1998, and has having shipped, in total, 5.747 Mt to all domestic consuming regions (table 12). Clearly, Michigan was a net exporter of portland cement in 1998. California (northern and southern combined) shows a consumption of 10.245 Mt for the year (table 9), but shipments of only 9.423 Mt (table 12). Clearly, California was a net importer of cement.

National Consumption.—In 1998, consumption of portland cement grew by 7.0% to a new record level of 99.3 Mt, or 101.2 Mt including Puerto Rico, as listed in table 9. The import component of this rose by 32.3% to 18.2 Mt. Masonry cement consumption increased by 13.1% to 4.1 Mt, with only minor imports; as noted in the introduction, this underrepresents true consumption because some masonry cement is made from portland cement at the job site rather than at a plant. This large increase probably represents, in part, improved splitting out by some companies of masonry varieties from the portland cement data.

Construction spending overall increased by 4.7% in 1998 from that of 1997 (revised) to $544.7 billion (1992 dollars), according to Bureau of the Census data quoted by the Portland Cement Association (1999b). Within this total, residential construction grew by 7.8% to $239.2 billion, spurred by a 12.2% increase to $153.9 billion in single-family dwellings. This reflected very low mortgage interest rates; this sector had been stagnant in 1997 compared with 1996 levels. Multifamily housing grew by 4.1% to $19.9 billion in 1998 compared with a 9.1% (revised) growth in 1997. Nonresidential construction grew by 5.6% in 1998 to $148.0 billion. Public construction fell slightly (0.8%) to $120.4 billion, including a similar percentage decline in spending for roads to $37.5 billion. Road (and related construction) was expected to rise significantly in 1999 owing to the 1998 passage of TEA-21, which mandated large increases in highway funds for road repairs and improvements, averaging about 44% per State.

As was the case in 1996 and 1997, growth in overall construction spending in 1998 was substantially less than that in overall cement consumption. In part, this can be attributed to the modest cement price increases over this period (see Values section below) but is mainly due to a higher "penetration rate" of cement in overall construction; that is, more cement is now being consumed per dollar of construction spending than in past years. The source of this increase is not readily apparent, but appears to be a successful outcome of promotional efforts by cement and concrete companies.

As listed in tables 9 and 10, most States and all regions showed consumption increases in 1998, as was the case in 1997. None of the major cement-consuming States showed decreases. The five largest portland-cement-consuming States were, in declining order, Texas, California, Florida, Ohio, and Illinois; this was the same order as in 1997 except for a reversal of the first two States. There were 15 States that showed consumption increases of 10% or more, and a further 12 (including 4 of the top 5 consuming States) had increases of between 5% and 9.9%.

Table 11 lists portland cement shipments to final customers in terms of transportation method. As in previous years, bulk deliveries directly from plants and via terminals by truck continued to dominate deliveries to customers. In contrast, railroad transport was the most important method of shipping cement from plants to terminals. Waterborne shipments increased modestly for deliveries to terminals but almost ninefold for deliveries to customers. Although imported cement barged along the Mississippi River system increased substantially in 1998, the dramatic increase in total waterborne deliveries during the year may reflect poor data for 1997, which showed an almost 90% decrease in levels from 1996.

Values.—The value data listed in tables 12 through 14 are mill net or ex-plant valuations provided by the plants and import terminals for their total shipments to domestic final customers of gray portland cement, white cement, and masonry cement. Because value data are highly proprietary and some companies express misgivings about providing value data of any type, values are not requested for shipments by individual types of portland cement, although the tonnages, by type, are reported and are listed in table 16. No distinction is made between bulk and container (bag) shipments; container shipments would be expected to have higher unit values. Except in table 14, data for white cement have been lumped in with those for gray portland cement. Notwithstanding these obscuring protections, about one-fifth of the respondents did not provide value data for the 1998 survey (a modest improvement from previous years). In such cases, the values supplied by other plants in the same market area were averaged and applied as an estimate; the number of plants so averaged varied regionally.

For integrated plants, the values sought have been "mill net," which can be defined as the (sales) value at, or "free on board" (f.o.b.), the manufacturing plant, including any packaging charges, but excluding any discounts and shipping charges to the final customers. For independent terminals, particularly import terminals, the equivalent statistic sought would be the "terminal net" value. In the case of imports, this would essentially represent the "cost, insurance, and freight" (c.i.f.) value of the imports plus unloading and storage costs plus the terminal's markup.

Given the entrained problems with the value data, readers are cautioned that the values shown, although unrounded, are merely estimates; most especially, the unit value data cannot be viewed as regional shopping prices for cement. The data for portland cement are assumed to be dominated by the values of the Types I and II varieties.

The total ex-plant value of portland cement shipments to final domestic customers listed in table 12 rose by 11.4% to about $7.0 billion in 1998, reflecting a 7.1% sales volume increase and, within the aforementioned data constraints, an average ex-plant unit value increase of 4%. If the average price listed is applied to the larger shipments (consumption) volume listed in table 9, then the 1998 total rises to $7.5 billion. This followed a 3% increase in unit value and about 9% in total value in 1997 relative to 1996.

Given the large increase in consumption, the modest increase in mill net unit value is most likely due to the ready availability of large volumes of inexpensive imported cement and clinker; the average c.i.f. price of imported cement and clinker (combined) fell by 5.1% in 1998 (table 18). Testing the impact of the imports on a regional basis is ambiguous. Although the regional breakouts in table 12, as noted in the Consumption section, reflect the location of the reporting facilities and not the sales, a crude regionality can be construed. Whereas the unit values for independent importers (not otherwise assigned to districts) did fall, all States and districts having major imports showed value increases or at least stagnant prices. The increases were generally slightly less than those in nonimporting districts; the 10.8% increase for southern California is highly anomalous and makes suspect the value data for that district. This supports the conjecture that imports constrained price increases, if only slightly.

Table 13 lists the distribution of masonry cement sales and the values thereof in terms of the location of the reporting facilities. In 1998, the average unit value of sales increased by about 4% to about $98 per ton; total sales increased by 15% to about $397 million. The total value rises only slightly if the tonnage in table 9 is used. The much higher total value and tons sold in 1998 reflect, in part, more accurate reporting of masonry as a cement separate from portland.

Table 14 is a summary of unit values for the country. The data for white cement are to be viewed with caution because of the limited number of producers and importers of this cement and because a significant share of sales to final customers is as (marked up) resales by gray cement companies. Also, there is a larger component of (expensive compared to bulk) package sales. It is likely that the 8.8% drop in "price" shown in 1998 is exaggerated, and probably reflects too high a value in 1997. Unit values for imported white cement calculated from the 1998 data in table 21 are much lower ($102.12 per ton c.i.f.) than those in table 14 and show only a 2.5% drop, overall, from values in 1997.

The only data for domestic delivered prices for cement are those for Type I portland (per short ton) and masonry cement (per 70-pound bag) published monthly by the journal Engineering News Record. The data represent a survey of customers, likely to be ready-mixed concrete producers for portland cement and building supply depots for masonry, in 20 U.S. cities. The 20-city average delivered price in 1998 for Type I portland converts to $85.31 per metric ton, an increase of 2.7% from that of 1997. The average price ranged over the year by only $2.11 per ton, and showed a general increase over the year, ending at $86.02. The $9.80 per ton difference between the average Engineering News Record price and the average unit value in table 12 is an indicator of the approximate delivery charge to final customers; the differential in 1997 was $10.45 per ton. The Engineering News Record specific city data show a number of regional price differences, some of which differ significantly from those listed in table 12. The variations could reflect regional differences in shipping methods and costs. The Engineering News Record prices for some cities covered, however, did not vary at all during the year, thus making the validity of the data questionable. The smaller differential in 1998 could reflect lower transportation charges because fuel prices were generally low during the year but, again, could also reflect poor data. The Engineering News Record 20-city average masonry cement price for the year was $4.74 per bag (literally converts to $149.28 per ton), an increase of 3.5%; the large difference in "price" between this and the average value in tables 13 and 14 is probably a combination of packaging, handling, and delivery charges.

Types of Cement Customer.—Data for 1998 on portland cement shipments to final customers are shown, broken out by customer (user) type and region, in table 15. As with shipments data in table 12, the regional splitouts represent the locations of reporting facilities, not necessarily those of the consumers.

As with the value data, the user-type data must be viewed as crude estimates. The problem is the fact that the survey requests more details (user categories) than many companies are able to provide. A few cement plants seem not to track their customers by user type at all, and many others track their sales only in terms of very broad user types, such as "Concrete product manufacturers." In the latter case, the shipments typically would be entered on the form either all under the broad classification header "Concrete products," or under its breakout subheading "Other." Thus, the subheading(s) "Other," intended to capture miscellaneous uses not otherwise broken out, instead misleadingly serve largely as a catchall. Even for companies that track customer user types in detail, the user categories that they use might not match those of the survey. Also, some categories present assignment ambiguities. Perhaps the most important of these are cases where a cement plant knows how much of its cement gets used by a ready-mixed concrete manufacturer customer for the purpose of building or repairing roads. The dilemma, then, is whether to register those tons under the "Ready-mixed concrete" or the "Contractors— road paving" categories. Further, although generally listed as exact tonnages, some company responses calculate to simple (broad) percentages of the total shipments, the breakdown being the "best guess" of that cement plant. In a few instances, the apportioning appears to have been guided by past published breakdowns. Plants that initially provided inadequate details for user types on the 1998 survey were solicited on a followup basis for additional details, with only modest success. Some of the minor use categories remain questionable and probably underrepresented.

Notwithstanding these limitations, the data clearly indicate that the dominant customer type for portland cement in 1998 continued to be ready-mixed concrete producers, accounting for 75% of the total. This is in accord with data for recent past years, once allowance was taken for a share of ready-mixed concrete lumped under the past years' "Government and miscellaneous" and "Road paving" categories. Most other major user category tonnages were relatively unchanged in 1998, but detailed evaluation is equivocal. Within concrete manufacturers, brick and block makers appear to have consumed 26% more cement in 1998, probably reflecting strong residential construction, as noted in the National Consumption section above. Sales to precast concrete companies fell by 5%, possibly in line with reduced public sector construction and stagnant nonresidential building construction; likewise, pipe manufacturers took about 2% less cement than in 1997. Within the "Contractors" category, sales to airport pavers fell by 3%, and soil cement usage fell by 16%; both of these are in line with reduced public sector construction. Road paving contractors, however, purchased 14% more cement than in 1997, which, despite lower public sector spending, may reflect a strong improvement in market penetration (vs. asphalt), or the data may simply be an artifact of overlap with the "Ready-mixed concrete" category. Cement sold to oil well drillers fell by about 24%, which is in line with low levels of drilling and low crude petroleum prices in 1998, but may understate cement use for this activity because shallow wells can use ordinary grades of portland cement. Mining usage of cement increased by 11%, which would support a trend, particularly in gold mining, towards more underground operations; cement is used in backfilling of stopes. The potential error in the mining use data is high because of the small tonnages involved. Use of cement for waste stabilization showed a 13% decline, but this would appear to reflect poor data rather than a real drop; consumption for waste stabilization in 1997 may have been anomalously high; it was double the level shown in 1996. Usage is unlikely to vary by this much from year to year.

Types of Portland Cement Consumed.—Portland cement consumption in the United States in 1998 continued to be dominated by general-use varieties, namely Types I and II (table 16). Types I through V again accounted for about 96% of total portland cement, as broadly defined. Type V cement again showed a large increase in sales. Block cement sales rose by 17%, which is in line with higher levels of residential construction spending, but the increase is proportionately less than that for total cement sales to brick and block makers (table 15); the latter data are subject to significant error, however. Oil well cement sales fell sharply in accord with declines in reported total cement sales to oil well drillers.

For the 1998 survey, table 16 has been expanded to split out two extra classes of blended cements, with subtotals shown corresponding to the 1997 and earlier combined categories. Additional categories were actually queried, but insufficient sales tonnages were registered for these to allow their separate listing, for proprietary reasons. Overall, the amount of blended cements sold in 1998 increased by 17.5% to 1.1 Mt and is close to the 1.2 Mt of sales reported for 1998 in the monthly data published separately by the USGS (e.g. table 2a in van Oss, 1999). Monthly sales data for blended cements were not collected for 1997; the data were within the portland cement umbrella.

In recent editions of this report, a comparison of raw materials consumption (broken out in less detail than in the 1998 survey) with the sales data by type of cement led to the conclusion that all or most “blast furnace” slag consumption was for blended cement. Blast furnace slag blended cement was assumed to make up the bulk of the relevant blended sales category. However, comparison of raw materials consumption data in table 6 with sales data in table 16 shows that, for 1998, not only were slag blends only 37% of the hitherto combined blended category (the remainder of which was natural pozzolan blends), but the amount of slag blended cement sales was too small to accommodate the slag consumed. As noted in the raw materials discussion above, it turns out that much of the granulated blast furnace slag was consumed as a grinding aid or as other extender for Types I and II portland cement and was not used in blended cement. This practice probably was not new in 1998.

Combined sales of fly ash and other blended cements more than doubled in 1998, but only 65% of the 1998 sales were of fly ash blends. Earlier, the fly ash proportion of blended sales was assumed to be higher, on the basis of a large excess of fly ash consumed as raw material over what could be accommodated in the blended cement sales; about 25% to 35% of this ash probably was, in fact, bottom ash for pre-1998 data (table 6). This excess also led to the conclusion that most of the fly ash was therefore used as a kiln feed, and the 1998 data supports this. A determination cannot as yet be made whether or not fly ash blended cement sales are increasing; in any case, as was noted above, the bulk of fly ash sales are directly to concrete manufacturers and are thus invisible to the USGS annual cement survey.

Foreign Trade

Trade data from the Bureau of the Census are shown in tables 17 through 22. Exports of hydraulic cement (all types) and clinker, combined, decreased slightly in volume and increased slightly in value (table 17), but the overall volume of exports continued to be so small as to render such small shifts almost meaningless. The bulk of the exports were again to Canada.

Tables 18 and 19 list total imports of hydraulic cement and clinker for 1997 and 1998. Overall, imports rose by almost 37% in 1998 to about 24.1 Mt, including Puerto Rico, and accounted for almost 23% of total cement consumption. This trade was all the more remarkable given the fact that it followed a 24.3% increase in 1997. After rising by 2.7% in 1997, the overall unit value fell by 5.1% in 1998, reflecting substantial price decreases from most country sources. Table 19 lists the tonnages and values of combined cement and clinker imports by source country and Customs District of entry into the United States.

In 1998, the hydraulic cement component of imports (combination data in table 18 minus clinker imports from table 22) was almost 20 Mt, up 36.9%. Gray portland cement imports, which were 95% of this cement total, were up 35.7% (table 20). The average c.i.f. value of gray portland imports in 1998 was $48.70 per ton, down 2.7%, and ranged from $36.36 per ton for Thailand portland cement to $55.01 per ton for Colombian material; Mexican cement had a c.i.f. value of $38.86 per ton. The comparable customs values were $27.91 per ton (Thailand), $28.81 per ton (Mexico), and $44.27 per ton (Colombia). At 3.75 Mt (down 8%), Canada continued to be the largest import source of portland cement. Imports from China, which had been a growing, but still relatively minor overall component of total imports prior to 1998, more than quadrupled to 3.3 Mt in 1998. Imports from Mexico grew by almost 28%, despite continued antidumping tariffs on cement from that country. Cyprus, the Republic of Korea, Saudi Arabia, and Thailand all shipped significant amounts of cement into the United States in 1998 compared with none in 1997. Imports from most other countries also grew substantially.

White portland cement imports increased by about 25% (table 21), but the volumes remained a small component of total cement trade. The average unit value (c.i.f.) of white cement imports fell by 2.5% on average to $102.12 per ton. The total tonnage shown for 1998 (0.649 Mt) is much smaller than the 0.846 Mt monthly summation published previously (table 6 in van Oss, 1999). This is because the monthly data, at that time, included significant volumes of Canadian white cement entering the Cleveland Customs District (0.197 Mt for the year). When registering this material with U.S. Customs, the importer mistakenly used the white cement tariff code rather than the correct gray portland tariff code. Table 21 lists the correct volume of Canadian white cement imports. The major import sources of white cement continued to be Canada, Denmark, Mexico, and Spain.

Clinker imports rose by almost 37% to 4.1 Mt (table 22). Canada continued to be the largest source of imported clinker, with a 40% (import) market share; import tonnages increased by almost 63%. Imports from China were up dramatically to almost 0.2 Mt, but even more impressive was the appearance of 0.5 Mt from Thailand and about 0.2 Mt from the Republic of Korea; neither had been a source in 1997. The overall unit values of imported clinker fell by 16% (c.i.f.) to 19% (Customs) from their respective levels in 1997.

Imported cement and clinker prices were both down, from most sources and into most Customs Districts (table 19). In most regional markets, the price drops can be explained in terms of substantial surplus global cement and clinker capacity, generally low oceanic transportation costs, and a strong U.S. dollar. Even ahead of the late 1997 economic collapse in Southeast Asia, several countries in that region had excess production capacity, some of which had been built for the export market. Throughout 1998, large volumes of Southeast Asian and Chinese cement came onto the world market. Excess capacity for export was also available in Western Europe and in the Mediterranean and the Arabian Gulf regions. However, the large drops seen in unit prices for imported

Canadian clinker (about 30%) and, to some degree, cement (10%), are less obviously explained, because, with the exception of the Pacific Northwest, the major U.S. markets (Buffalo, Cleveland, Detroit) for Canadian material are relatively insulated from offshore competition, and much of the imports are by companies having production facilities in both countries. Local demand on the Ontario market was strong in 1998, leading to reduced Canadian surplus clinker available for export to the United States. Canadian clinker bound for Detroit appears to have been supplemented by inexpensive European and Thailand clinker (see table 19), which did not enter the United States cheaply because it was transshipped via Canada. Part of the Canadian price drop may be explained by the 7% depreciation of the Canadian dollar against the U.S. dollar in 1998, and the remainder could have been due to artificial or transfer pricing by some companies.

Examination of table 19 shows that the major increases in total imports were unevenly distributed regionally; some of the increases can be attributed to the opening or upgrading of terminals. Of note were large increases coming into the Charleston, Detroit, Houston-Galveston, Los Angeles, New Orleans, Philadelphia, San Diego, and San Francisco Customs Districts. New Orleans brought in both the most imports and showed the largest increase (of almost 100%) in 1998 of all Customs Districts. Imports into New Orleans included major increases in volumes from China and Thailand, in particular. Large quantities of cement and/or clinker from the Republic of Korea and/or Thailand were major components of imports into Houston-Galveston, Mobile, and Philadelphia Customs Districts. On the West Coast, large volumes of Chinese cement were displacing some Colombian, Mexican, and Spanish material, and imports into California from Thailand also became important during the year.

World Review

Individual country cement production data are listed in table 23. The data for some countries may include their exports of clinker. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may not be all inclusive. Because data for many countries are estimated, the annual world totals (which have been rounded) must be viewed as estimates. World hydraulic cement production declined by approximately 1% in 1998, but was still about 1.5 Gt.

China again was overwhelmingly the largest cement producer in the world, with about one-third of the total. Because of a major drop in output by Japan, the United States moved into apparent second place, followed by India (annual output estimated on the basis of reported fiscal year data ending midyear and so could have actually exceeded the United States in 1998). A ranking of the remaining top 15 producers would be, in descending order, Japan, the Republic of Korea, Brazil, Turkey, Germany, Italy, Thailand, Spain, Mexico, Russia, Indonesia, and Taiwan. The top 15 countries accounted for about 74% of the world total, and among these, about a dozen have accounted for the majority of growth in world production in the 1990's. China's growth, in particular, has been dramatic for the years covered in table 23, increasing its output by 92 Mt between 1994 and 1998. Based on preliminary data for 1998, the increase of only 1.8 Mt may reflect incomplete reporting. In the 1997 edition of this report, China's output for 1997 was reported to be 492.6 Mt, up only 1.4 Mt from the level in 1996. The 1997 datum now shows a large upwards revision of 19 Mt, and the 1998 value probably will be revised sharply upwards too.

On a regional basis, Asia (including Australasia) accounted for 57% of the world total, and its 13% growth in production between 1994 and 1998 has accounted for about 74% of the 149-Mt total increase in world production for the period. Because of the economic crisis that began in late 1997, however, major halts, delays, and cancellations of construction projects occurred throughout much of the region, particularly in Southeast Asia. In 1998, cement production in Asia overall fell by about 4% to 870 Mt, but this was buffered by the large increase in China. Without China, Asian production fell by almost 10% to 357 Mt; this included major declines in most of the major producing countries, most of which had been rapidly expanding their production capacities in recent years. For example, cement production declined by 22.4% in the Republic of Korea, an estimated 20% in Indonesia, almost 20% in Thailand, almost 18% in Malaysia, 11.5% in Japan, and about 9% each in the Philippines and Taiwan. Even the reduced production levels exceeded regional demand, with the result that large volumes of Asian cement and clinker were put onto the world market, seemingly, by every cement company that could find access to shipping. This material appears to have caused significant price reductions or at least constrained price increases for cement throughout much of the import-sensitive world, including the United States. It also had the effect of making cash-strapped Asian cement companies attractive acquisition targets of major, mostly European, international cement corporations.

In 1998, Europe was the world's second largest producing region, with 15% of the world total; Western Europe alone had 12%. Western Europe's output grew by 3% between 1994 and 1998, whereas Eastern Europe's output increased by only 1.6%, for the period. North America was the third largest producing region, with 8% of world output in 1998; cement output rose by 5% between 1994 and 1998. The Middle East (including Turkey) had almost 7% of total world production in 1998, up by almost 12% over that of 1994. Latin America accounted for 6% of total world output in 1998, and has been the fastest growth area in the world (38% between 1994 and 1998). Although only contributing 4% of world production, Africa has had a 14% increase in its output during the period. Cement production in Africa, however, is very unevenly distributed, with North African countries accounting for most of the activity and growth. Countries of the former Soviet Union contributed only about 3% of world cement output in 1998, and output fell significantly (by 32%) between 1994 and 1998.

Comparisons of production levels among some countries can be misleading, however, unless they are made for output of similar-quality cements. For example, portland and related cements from clinkers manufactured in large rotary kilns are generally considered to be of higher and more consistent quality than cements made in small “village-scale” vertical shaft kilns. The vertical shaft kilns might produce cements suitable for the construction of small houses and similar edifices, but for modern highways, large bridges and dams, tall buildings, etc., cements from modern rotary kilns are preferable. Unfortunately, few if any data on world production are available that differentiate between output of vertical shaft kiln plants and modern rotary kiln plants. Vertical shaft clinker kilns are almost universally found in so-called developing world countries, but the same countries may also have enormous, state-of-the-art rotary kilns. Where financing and demand permit, most countries with shaft kilns are replacing them with rotary kilns. For example, China has several thousand small vertical shaft kilns and a much smaller (but still large) number of medium and large rotary kilns. The rotary kilns were contributing only about 15% of the country’s total output, but this material was the entirety of China’s production of high- or export-quality cement. The Government of China was shutting down a large number of the vertical shaft kiln plants for environmental reasons and to reduce the country’s surplus capacity, thereby reducing downward pressures on cement prices (Tang, 1999).

Notwithstanding the Asian economic crisis, a large number of cement plant construction or upgrade projects continued underway in that region, and similar projects were common in most other regions as well. The privatization programs in Eastern Europe and elsewhere have attracted investment interest mainly by the same major European and Mexican cement companies that dominate the production of cement in Western Europe, the former Soviet Union, and the Americas.

Outlook

Demand for cement in the United States was expected to remain strong in 1999, with consumption growth rates at, or perhaps slightly below, levels in 1998. Interest rates were expected to rise somewhat, which likely would constrain growth in housing construction, but this was expected to be more than overcome by higher spending for public sector projects, particularly highway projects related to the TEA-21 program. Medium-to-long-term growth in cement annual consumption was expected, overall, to be between 2% and 4%.

One new plant was expected to come into full production in late 1999, and several million tons of new production capacity were slated to come on line (mostly as upgrades at existing plants) over the next few years. The added production capacity would likely result in some reduction in imports. Domestic producers were expected to maintain their overall control of cement imports.

Although the potential duration of the economic crisis in Southeast Asia was not known, a resurgence of major construction projects in the region was not expected over the short to medium term, and thus the region was expected to have substantial excess cement production capacity available for export for several years. Imports of inexpensive Asian cement and/or clinker into the United States were expected to increase as a result, and some of this was expected to be at the expense of imports from Europe and South America. Imports of cement and clinker from Mexico and Venezuela were expected to increase significantly if the antidumping tariffs or related pricing agreements affecting those countries were not renewed following “sunset” review; citing the strong U.S. cement market and the substantial control on imports held by U.S. producers, one major company announced that it would no longer support the continuation of antidumping tariffs (Southdown, Inc., 1999b). Given recent reductions in production capacity in Japan, a resumption of significant imports from that country was uncertain if the antidumping tariffs were dropped.

Apart from market factors, future growth of U.S. cement production or capacity may be constrained by restrictive environmental regulation, particularly any that seeks to limit output of CO_2, or that hinder the ability of the industry to utilize waste fuels.

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[2]Prior to January 1996, published by the U.S. Bureau of Mines.

TABLE 1
SALIENT CEMENT STATISTICS 1/

(Thousand metric tons, unless otherwise specified)

		1994	1995	1996	1997	1998
United States 2/						
Production 3/		77,948	76,906	79,266	82,582	83,931
Production of clinker		68,575	69,983	70,361	72,686	74,523
Shipments from mills 3/ 4/		79,087	78,518	83,963 r/	90,490 r/	96,857
Value 3/ 5/	thousands	$4,844,869	$5,329,187	$5,952,203	$6,622,464	$7,404,094
Average value per ton 3/ 6/		$61.26	$67.87	$71.19	$73.49	$76.46
Stocks at mills, yearend 3/		4,701	5,814	5,488	5,784	5,393
Exports 3/ 7/		633	759	803	791	743
Imports for consumption:						
Cement 8/		9,074	10,969	11,565	14,523	19,878
Clinker		2,206	2,789	2,402	2,867	3,905
Total		11,280	13,758	13,967	17,389	23,783
Consumption, apparent 9/		86,476	86,003	90,355	96,018	103,457
World: Production 10/		1,370,000 r/	1,444,000 r/	1,493,000 r/	1,540,000 r/	1,519,000

r/ Revised.
1/ Portland and masonry cements only, unless otherwise indicated.
2/ Excludes Puerto Rico.
3/ Includes cement produced from imported clinker and imported cement shipped by mills and import terminals.
4/ Shipments are to final customers. Includes imported cement. Data are based on annual survey of plants and may differ from tables 9 and 10, which are based on consolidated monthly shipments data from companies.
5/ Value at mill (or import terminal) of portland (all types) and masonry cement shipments to final domestic customers. Although presented unrounded, the data contain estimates for survey nonrespondents.
6/ Total value at mill or import terminal of cement shipments to final customers divided by total tonnage of same. Although presented unrounded, the data contain estimates for survey nonrespondents.
7/ Hydraulic cement (all types) plus clinker.
8/ Hydraulic cement, all types.
9/ Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in stocks.
10/ Total hydraulic cement. May incorporate clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties further north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties further south.
Chicago, metropolitan	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois	All counties other than those in Metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties further east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties further west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties further east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties further west.
Texas, northern	Angelina, Bell, Concho, Crane, Falls, Houston, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties further north.
Texas, southern	Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties further south.

TABLE 3
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/ 2/

(Thousand metric tons, unless otherwise specified)

District	1997 Plants active 5/	1997 Production 6/	1997 Capacity 3/ Finish grinding	1997 Capacity 3/ Percentage utilized	1997 Stocks 4/ at mills, yearend	1998 Plants active 5/	1998 Production 6/	1998 Capacity 3/ Finish grinding	1998 Capacity 3/ Percentage utilized	1998 Stocks 4/ at mills, yearend
Maine and New York	4	3,147	3,529	89.2	242	4	3,236	3,756	86.2	215
Pennsylvania, eastern	7	4,501	5,084	88.5	236	7	4,782	5,156	92.7	185
Pennsylvania, western	4	1,858	2,045	90.8	129	4	1,952	2,168	90.0	130
Illinois	4	2,594	3,399	76.3	194	4	2,691	3,204	84.0	106
Indiana	4	2,396	2,731	87.8	167	4	2,500	2,840	88.0	127
Michigan	5	5,696	7,243	78.6	287	5	5,707	6,980	81.8	325
Ohio	3	1,043	1,878	55.5	56	2	1,113	1,515	73.4	52
Iowa, Nebraska, South Dakota	5	4,224	5,525	76.4	354	5	4,241	5,531	76.7	303
Kansas	4	1,690	1,783	94.8	134	4	1,802	1,805	99.8	84
Missouri	5	4,731	5,150	91.9	404	5	4,569	5,186	88.1	404
Florida	6	3,747	5,262	71.2	293	6	3,472	5,334	65.1	207
Georgia, Virginia, West Virginia	4 r/	2,577	3,277	78.7	242	4	2,734	3,382	80.8	110
Maryland	3	1,790	1,904	94.0	133	3	1,756	1,837	95.6	82
South Carolina	3	2,515	3,075	81.8	93	3	2,640	3,311	79.7	81
Alabama	5	4,279	4,744	90.2	275	5	4,305	4,990	86.3	219
Kentucky, Mississippi, Tennessee	4	2,316	2,528	91.6	157	4	2,364	2,574	91.9	132
Arkansas and Oklahoma	4	2,714	3,162	85.8	149	4	2,598	3,162	82.2	175
Texas, northern	6	3,887	4,719	82.4	208	6	4,114	4,742	86.8	272
Texas, southern	5	4,393	4,772	92.1	204	5	4,319	4,781	90.3	167
Arizona and New Mexico	3	2,239	2,563	87.4	64	3	2,240	2,563	87.4	48
Colorado and Wyoming	4	2,018	2,445	82.5	100	4	2,138	2,445	87.4	163
Idaho, Montana, Nevada, Utah	7	2,344	2,926	80.1	168	7	2,605	3,196	81.5	218
Alaska and Hawaii	1	252	499	50.5	52	1	251	499	50.2	40
California, northern	3	2,773	2,797	99.1	115	3	2,768	2,835	97.6	125
California, southern	8	7,488	7,957	94.1	313	8	7,249	7,888	91.9	306
Oregon and Washington	4	1,737	2,204	78.8	99	4	1,796	2,491	72.1	207
Total or average 7/	115 r/	78,948	93,198	84.7	5,356 8/	114	79,942	94,170	84.9	4,981 8/
Puerto Rico	2	1,673	2,004	83.5	31	2	1,591	1,831	86.9	24

r/ Revised.
1/ Includes Puerto Rico.
2/ Includes data for three white cement facilities located in California, Pennsylvania, and Texas.
3/ Reported grinding capacity based on fineness necessary to grind individual plants' normal product mix, making allowance for downtime required for routine maintenance.
4/ Includes imported cement.
5/ Includes one plant that reported portland cement (clinker) grinding capacity, but no production of portland cement.
6/ Includes cement produced from imported clinker.
7/ Data may not add to totals shown because of independent rounding.
8/ Total stocks include inventory, not included on a district basis, held by independent importers.

TABLE 4
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons, unless otherwise specified)

District	1997 Plants active	1997 Production 3/	1997 Stocks 2/ at mills, yearend	1998 Plants active	1998 Production 3/	1998 Stocks 2/ at mills, yearend
Maine and New York	4	107	16	4	108	14
Pennsylvania, eastern	6	187	33	6	202	27
Pennsylvania, western	4	109	14	4	117	16
Indiana	4	W	54	4	W	46
Michigan	5	289	29	5	294	42
Ohio	2	W	W	2	W	W
Iowa, Nebraska, South Dakota	4	W	10	4	W	10
Kansas	3	W	W	3	W	W
Missouri	1	W	W	1	W	W
Florida	4	406	24	4	442	25
Georgia, Virginia, West Virginia	5	382	38	5	343	29
Maryland	3	W	13	3	W	12
South Carolina	3	W	W	3	W	W
Alabama	4	346	48	4	371	44
Kentucky, Mississippi, Tennessee	3	88	9	3	90	10
Arkansas and Oklahoma	4	105	14	4	126	15
Texas, northern	4	110	10	4	124	8
Texas, southern	4	94	8	4	93	8
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	2	W	2	2	W	1
Alaska and Hawaii	1	3	1	1	3	1
California, northern	2	W	W	2	W	W
California, southern	3	W	W	3	W	W
Oregon and Washington	3	W	W	3	W	W
Total 4/	83	3,634 5/	428 6/	83	3,989 5/	412 6/

W Withheld to avoid disclosing company proprietary data; included in "Total."
1/ Excludes Puerto Rico (did not produce any masonry cement).
2/ Includes imported cement.
3/ Includes cement produced from imported clinker.
4/ Data may not add to totals shown because of independent rounding. Includes Districts indicated by W.
5/ Production directly from clinker accounted for almost 94% of the total. Production from portland cement accounted for the remainder.
6/ Total stocks include inventory, not shown on a district basis, held by independent importers.

TABLE 5
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 1998, BY DISTRICT

District	Active plants 1/ Process used Wet	Dry	Both	Total	Number of kilns	Daily capacity (thousand metric tons)	Average number of days routine mainte-nance	Apparent annual capacity 2/ (thousand metric tons)	Produc-tion (thousand metric tons)	Percentage utilized
Maine and New York	3	1	--	4	5	10.4	34.2	3,442	3,109	90.3
Pennsylvania, eastern	2	5	--	7	14	14.8	23.9	4,973	4,456	89.6
Pennsylvania, western	3	1	--	4	8	5.9	24.4	2,012	1,834	91.1
Illinois	--	4	--	4	8	8.3	24.4	2,818	2,474	87.8
Indiana	2	2	--	4	8	8.5	21.6	2,903	2,577	88.8
Michigan	1	2	--	3	8	13.6	21.6	4,633	4,201	90.7
Ohio	1	1	--	2	3	3.3	20.3	1,129	1,016	90.0
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.6	27.8	4,587	4,021	87.7
Kansas	2	2	--	4	11	5.6	30.5	1,865	1,672	89.7
Missouri	2	3	--	5	7	14.0	23.9	4,723	4,472	94.7
Florida	2	2	--	4	7	9.3	23.7	3,146	2,952	93.8
Georgia, Virginia, West Virginia	1	3	--	4	7	9.4	28.9	3,153	2,602	82.5
Maryland	1	2	--	3	7	5.6	23.1	1,898	1,682	88.6
South Carolina	2	1	--	3	7	8.3	26.0	2,728	2,315	84.9
Alabama	--	5	--	5	6	13.2	24.0	4,414	4,180	94.7
Kentucky, Mississippi, Tennessee	2	2	--	4	5	6.6	19.6	2,288	2,235	97.7
Arkansas and Oklahoma	2	2	--	4	10	7.7	21.8	2,632	2,503	95.1
Texas, northern	3	3	--	6	14	13.1	27.5	4,385	4,039	92.1
Texas, southern	--	4	1	5	6	12.9	20.5	4,453	4,033	90.6
Arizona and New Mexico	--	3	--	3	9	6.5	18.4	2,266	2,184	96.4
Colorado and Wyoming	1	3	--	4	7	6.9	25.3	2,337	1,959	83.8
Idaho, Montana, Nevada, Utah	3	4	--	7	9	8.5	21.0	2,947	2,505	85.0
California, northern	--	3	--	3	3	8.7	36.0	2,849	2,632	92.4
California, southern	--	8	--	8	17	24.0	23.2	8,142	7,332	90.1
Oregon and Washington	1	2	--	3	3	5.9	26.3	1,997	1,537	77.0
Total or average 3/	34	72	2	108	198	244.4	24.7	82,718	74,523	90.1
Puerto Rico	--	2	--	2	2	5.0	30.0	1,671	1,319	78.9

1/ Includes white cement plants.
2/ Calculated on the basis of individual company data using 365 days minus reported days for routine maintenance multiplied by the reported unrounded daily capacity.
3/ Data may not add to totals shown because of independent rounding.

TABLE 6
RAW MATERIALS USED IN PRODUCING CEMENT
IN THE UNITED STATES 1/ 2/ 3/

(Thousand metric tons)

Raw materials	1997 total 4/	1998 Clinker	1998 Cement
Calcareous:			
Limestone (includes aragonite, marble, chalk, coral)	84,423 r/	87,077	707 5/
Cement rock (includes marl)	25,704	22,642	W
Cement kiln dust	NA	196 6/	W
Lime	NA	--	16 5/
Aluminous:			
Clay	4,434	4,513	--
Shale	4,010	3,726	--
Other (includes staurolite, bauxite, aluminum dross, alumina, volcanic material, other)	323	443	--
Ferrous: iron ore, pyrites, millscale, other	1,452	1,253	--
Siliceous:			
Sand and calcium silicate	2,322	2,834	--
Sandstone, quartzite, other	775	860	--
Fly ash	1,544 r/	1,432	99
Other ash, including bottom ash	523 7/	793	--
Granulated blast furnace slag	460 8/	--	285
Steel slag	NA 8/	307	--
Other slags	NA 8/	75	(9/)
Natural rock pozzolans 10/	NA 11/	--	52
Other pozzolans 12/	NA 11/	43	1
Other:			
Gypsum and anhydrite	4,274	--	4,408
Clinker, imported 13/	2,585	--	5,016
Other, n.e.c.	35	369	57
Total 14/	132,865	126,563	10,641

r/ Revised. NA Not available. W Withheld to avoid disclosing company proprietary data; included with "Other: Other, n.e.c."
1/ Includes Puerto Rico.
2/ Nonfuel materials only.
3/ Includes portland, blended, and masonry cements.
4/ Data for the breakout of consumption between clinker and finished cement manufacture are unavailable for years prior to 1998.
5/ Data are probably underreported on the basis of reported volumes of masonry cements.
6/ Data are probably underreported.
7/ Bottom ash only. Other ash not queried specifically, but included in fly ash.
8/ Not queried separately in 1997, but included within blast furnace slag.
9/ Less than 1/2 unit.
10/ Includes pozzolana, burned clays, and shales.
11/ Not queried in 1997, but some may have been included under aluminous materials.
12/ Includes diatomite, other microcrystalline silica, silica fume, and other pozzolans, whether or not used as such.
13/ Outside purchases by domestic plants; excludes purchases of domestic clinker.
14/ Data may not add to totals shown because of independent rounding.

TABLE 7
CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY
IN THE UNITED STATES, BY PROCESS 1/ 2/

Kiln process	Clinker produced: Plants active	Clinker produced: Quantity (thousand metric tons)	Clinker produced: Percentage of total	Fuel consumed: Coal (thousand metric tons)	Fuel consumed: Coke (thousand metric tons)	Fuel consumed: Petroleum coke (thousand metric tons)	Fuel consumed: Oil (thousand liters)	Fuel consumed: Natural gas (thousand cubic meters)	Waste fuel: Tires (thousand metric tons)	Waste fuel: Solid (thousand metric tons)	Waste fuel: Liquid (thousand liters)
1997:											
Wet	35	19,090	25.8	2,623	118	343	39,421	173,718	69	55	671,385
Dry	73	53,481	72.2	6,184	233	917	46,814	433,908	194	13	163,795
Both	2	1,540	2.1	228	--	28	--	64,719	14	--	--
Total 3/	110	74,112	100.0	9,035 4/	351	1,288	86,235	672,345	277	68	835,179
1998:											
Wet	34	18,905	24.9	2,536	122	323	23,443	174,974	86	52	1,172,357
Dry	74	55,481	73.2	6,305	310	853	49,483	456,429	171	23	95,809
Both	2	1,457	1.9	226	--	21	--	88,765	12	--	--
Total 3/	110	75,842	100.0	9,066 4/	432	1,197	72,926	720,168	269	74	1,268,166

1/ Includes portland and masonry cement. Excludes grinding plants.
2/ Includes Puerto Rico.
3/ Data may not add to totals shown because of independent rounding.
4/ Virtually all bituminous.

TABLE 8
ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS 1/

Plant process	Generated at plant: Number of plants	Generated at plant: Quantity (million kilowatt-hours)	Purchased: Number of plants	Purchased: Quantity (million kilowatt-hours)	Total: Quantity (million kilowatt-hours)	Total: Percentage	Finished cement 2/ produced (thousand metric tons)	Average consumption (kilowatt-hours per ton of cement produced)
1997:								
Integrated plants								
Wet	--	--	35	2,867	2,867	24.2	21,706	132
Dry	4	493	73	8,226	8,719	73.7	58,481	149
Both	--	--	2	246	246	2.1	1,642	150
Total or average 3/	4	493	110	11,340	11,833	100.0	81,829	145
Grinding plants 4/	--	--	6	151	151	--	2,211	68
Exclusions 5/	--	--	2	--	--	--	68	--
1998:								
Integrated plants								
Wet	--	--	34	2,831	2,831	23.6	21,296	133
Dry	4	496	74	8,421	8,917	74.4	60,221	148
Both	--	--	2	242	242	2.0	1,584	153
Total or average 3/	4	496	110	11,494	11,990	100.0	83,101	144
Grinding plants 4/	--	--	5	142	142	--	2,275	69
Exclusions 5/	--	--	2	--	--	--	145	--

1/ Includes Puerto Rico.
2/ Includes portland and masonry cements. Excludes portland cement consumed in the production of masonry cement.
3/ Data may not add to totals shown because of independent rounding.
4/ Excludes plants that reported production only of masonry cement.
5/ Tonnage of cement produced by plants that reported production of masonry cement only. One of these plants reports portland cement grinding capacity and so is included in table 3.

TABLE 9
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1997	Portland cement 1998	Masonry cement 1997	Masonry cement 1998
Destination:				
Alabama	1,425	1,503	137	144
Alaska	107	121	W	--
Arizona	2,563	2,921	W	99
Arkansas	1,009	1,050	54	56
California, northern	3,587	3,896	13	49
California, southern	5,883	6,349	W	300
Colorado	2,013	2,358	25	27
Connecticut 3/	690	751	13	14
Delaware 3/	247	287	10	11
District of Columbia 3/	105	98	1	--
Florida	6,435	6,887	536	570
Georgia	3,225	3,535	237	265
Hawaii	251	256	3	4
Idaho	473	488	1	(4/)
Illinois, excluding Chicago	1,525	1,539	33	32
Chicago, metropolitan 3/	1,995	2,105	49	48
Indiana	2,140	2,260	96	99
Iowa	1,739	1,759	12	11
Kansas	1,508	1,530	15	16
Kentucky	1,328	1,320	98	101
Louisiana 3/	1,820	1,912	50	54
Maine	187	235	5	5
Maryland	1,225	1,216	80	79
Massachusetts 3/	1,262	1,562	24	26
Michigan	3,201	3,411	153	161
Minnesota 3/	1,693	1,887	30	31
Mississippi	968	963	53	58
Missouri	2,311	2,359	40	39
Montana	303	314	1	1
Nebraska	1,020	1,060	10	13
Nevada	1,899	1,946	15	29
New Hampshire 3/	263	288	7	7
New Jersey 3/	1,700	1,966	63	71
New Mexico	739	732	7	7
New York, eastern	518	598	23	24
New York, western	879	887	35	38
New York, metropolitan 3/	1,291	1,473	46	50
North Carolina 3/	2,599	2,703	296	323
North Dakota 3/	266	321	4	4
Ohio	3,774	4,002	197	197
Oklahoma	1,188	1,364	43	42
Oregon	1,195	1,145	1	1
Pennsylvania, eastern	1,958	2,169	63	63
Pennsylvania, western	1,124	1,208	70	74
Rhode Island 3/	127	151	3	3
South Carolina	1,200	1,274	125	140
South Dakota	420	372	3	3
Tennessee	2,041	2,108	211	217
Texas, northern	4,543	5,030	150	168
Texas, southern	4,834	5,235	81	93
Utah	1,345 r/	1,493	1	1
Vermont 3/	106	124	3	3
Virginia	1,910	2,002	157	153
Washington	1,862	1,877	5	5
West Virginia	440	430	30	30
Wisconsin	2,129	2,220	37	37
Wyoming	228	221	1	1
U.S. total 5/ 6/	92,815 r/	99,272	3,627	4,101
Foreign countries 7/	349	321	1	1
Puerto Rico	1,670	1,581	--	--
Grand total 5/	94,834 r/	101,174	3,628	4,101

See footnotes at end of table.

TABLE 9--Continued
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1997	Portland cement 1998	Masonry cement 1997	Masonry cement 1998
Origin:				
United States	79,395 r/	81,374	3,583	4,043
Puerto Rico	1,670	1,581	--	--
Foreign countries 8/	13,770 r/	18,221	45	58
Total shipments 5/	94,834 r/	101,174	3,628	4,101

r/ Revised. W Withheld to avoid disclosing company proprietary data; included in "U.S. total."
1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers and other importers
2/ Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 11, 12, 13, 15, and 16, which are from annual surveys of individual plants and importers.
3/ Has no cement plants.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.
6/ Includes States indicated by the symbol W.
7/ Includes shipments to U.S. possessions and territories.
8/ Imported cement distributed in the United States by domestic producers and other importers.

TABLE 10
CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT) 1/ 2/

Region and census district	Portland cement: Thousand metric tons 1997	Portland cement: Thousand metric tons 1998	Portland cement: Percentage of U.S. total 1997	Portland cement: Percentage of U.S. total 1998	Masonry cement: Thousand metric tons 1997	Masonry cement: Thousand metric tons 1998	Masonry cement: Percentage of U.S. total 1997	Masonry cement: Percentage of U.S. total 1998
Northeast:								
New England 3/	2,634	3,111	3	3	55	58	2	1
Middle Atlantic 4/	7,469	8,302	8	8	301	277	8	7
Total 5/	10,103	11,413	11	11	356	335	10	8
South:								
South Atlantic 6/	17,386	18,432	19	19	1,472	1,571	41	38
East South Central 7/	5,762	5,894	6	6	498	520	14	13
West South Central 8/	13,394	14,591	13	15	378	413	10	10
Total 5/	36,541	38,917	39	39	2,349	2,504	65	61
Midwest:								
East North Central 9/	14,765	15,537	16	16	566	574	16	14
West North Central 10/	8,958	9,288	10	9	114	117	3	3
Total 5/	23,722	24,825	26	25	680	691	19	17
West:								
Mountain 11/	9,563 r/	10,473	14	11	140	165	4	4
Pacific 12/	12,886	13,644	10	14	102	237	3	6
Total 5/	22,449 r/	24,117	24	24	242	402	7	10
U.S. total 5/	92,815 r/	99,272	100	100	3,627	4,101	100	100

r/ Revised.
1/ Includes imported cement shipped by importers. Excludes Puerto Rico and exported cement.
2/ Data are developed from monthly consolidated surveys of shipments by company and may differ from data in tables 1, 11, 12, 13, 15, and 16, which are from annual surveys of individual plants and importers.
3/ New England includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
4/ Middle Atlantic includes New Jersey, New York, and Pennsylvania.
5/ Data may not add to totals shown because of independent rounding.
6/ South Atlantic includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.
7/ East South Central includes Alabama, Kentucky, Mississippi, and Tennessee.
8/ West South Central includes Arkansas, Louisiana, Oklahoma, and Texas.
9/ East North Central includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.
10/ West North Central includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.
11/ Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.
12/ Pacific includes Alaska, California, Hawaii, Oregon, and Washington.

TABLE 11
SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND
IN CONTAINERS, BY TYPE OF CARRIER 1/

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total
	In bulk	In containers 2/	In bulk	In containers 2/	In bulk	In containers 2/	shipments to consumer 3/ 4/
1997:							
Railroad	11,221	56	4,390	416	1,436	61	6,304
Truck	3,635	99	47,552	2,042	31,739	576	81,908
Barge and boat	8,270	--	146	--	11	--	156
Other 5/	1,929	--	--	--	--	--	--
Total 3/	25,055	156	52,088	2,458	33,186	637	88,368
1998:							
Railroad	11,285	38	5,301	380	1,182	(6/)	6,863
Truck	4,118	151	50,845	1,810	32,527	613	85,795
Barge and boat	8,423	--	442	--	900	--	1,342
Other 5/	--	--	153	(6/)	251	2	406
Total 3/	23,826	189	56,742	2,190	34,860	615	94,408

1/ Includes Puerto Rico. Includes imported cement and cement made from imported clinker.
2/ Includes bags and jumbo bags.
3/ Data may not add to totals shown because of independent rounding.
4/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.
5/ Includes cement used at plant.
6/ Less than 1/2 unit.

TABLE 12
PORTLAND CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

	1997			1998		
		Value 4/			Value 4/	
District 5/ 6/	Quantity (thousand metric tons) 7/	Total (thousands)	Average per metric ton	Quantity (thousand metric tons) 7/	Total (thousands)	Average per metric ton
Maine and New York	2,008 r/	$127,940 r/	$63.72 r/	3,631	$245,768	$67.69
Pennsylvania, eastern	4,454	283,965	63.75	4,916	321,819	65.46
Pennsylvania, western	1,689	121,649	72.04	1,768	131,601	74.43
Illinois	2,590	186,281	71.91	2,726	210,145	77.08
Indiana	2,663	187,076	70.24	2,878	202,334	70.31
Michigan	5,739	425,705	74.18	5,747	437,621	76.15
Ohio	1,107	81,655	73.75	1,196	92,977	77.71
Iowa, Nebraska, South Dakota	4,247	323,321	76.12	4,374	339,304	77.58
Kansas	1,798	129,970	72.28	1,648	126,617	76.83
Missouri	5,563	377,411	67.84	5,889	415,897	70.62
Florida	5,689 r/	405,969 r/	71.36 r/	6,126	456,559	74.53
Georgia, Virginia, West Virginia	2,773	212,006	76.45	2,932	222,079	75.74
Maryland	2,064	132,049	63.98	1,785	124,858	69.95
South Carolina	2,531	194,938	77.02	2,606	207,586	79.66
Alabama	4,103	329,663	80.34	4,375	358,430	81.93
Kentucky, Mississippi, Tennessee	2,911	216,284	74.31	2,624	201,087	76.63
Arkansas and Oklahoma	2,673	185,509	69.40	2,621	190,086	72.53
Texas, northern	4,028	299,071	74.25	4,319	339,463	78.59
Texas, southern	5,141	338,549	65.86	5,364	373,097	69.56
Arizona and New Mexico	2,313	189,424	81.90	3,465	301,763	87.09
Colorado and Wyoming	2,056	163,640	79.60	2,219	181,686	81.87
Idaho, Montana, Nevada, Utah	2,646	213,531	80.71	2,721	229,257	84.26
Alaska, Hawaii, Oregon, Washington	3,084 r/	256,669 r/	83.23 r/	3,102	259,792	83.75
California, northern	2,425	180,158	74.28	2,573	194,317	75.51
California, southern	7,521	503,632	66.96	6,850	508,011	74.16
Independent importers, n.e.c. 8/	2,874	227,196	79.05	4,352	335,423	77.07
Total or average 9/	86,692	6,293,261	72.59	92,809	7,007,577	75.51
Puerto Rico	1,677	W	W	1,599	W	W

r/ Revised. W Withheld to avoid disclosing company proprietary data.
1/ Includes cement produced from imported clinker.
2/ Includes imported cement shipped by producers.
3/ Includes data for three white cement facilities located in California, Pennsylvania, and Texas.
4/ Values represent ex-plant (f.o.b.-plant) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00.
5/ Includes shipments by independent importers where district assignation is possible.
6/ The district location is that of the reporting facility. Shipments may include material sold into other districts.
7/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly
8/ Shipments by importers for which district assignations were not possible.
9/ Data may not add to totals shown because of independent rounding.

TABLE 13

MASONRY CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

District 5/	1997 Quantity (thousand metric tons) 6/	1997 Value 4/ Total (thousands)	1997 Value 4/ Average per metric ton	1998 Quantity (thousand metric tons) 6/	1998 Value 4/ Total (thousands)	1998 Value 4/ Average per metric ton
Maine and New York	108 r/	$9,404 r/	$87.07 r/	109	$9,538	$87.79
Pennsylvania, eastern	203	20,408	100.30	220	20,892	95.06
Pennsylvania, western	104	11,829	113.92	109	11,219	102.48
Illinois, Indiana, Ohio	498	48,415	97.31	499	49,248	98.77
Michigan	283	23,248	82.17	286	27,222	95.10
Iowa, Nebraska, South Dakota	43	3,644	84.76	51	4,753	94.05
Kansas and Missouri	144	9,387	65.08	132	8,942	67.86
Florida	400 r/	35,951 r/	89.88 r/	426	39,132	91.76
Georgia, Virginia, West Virginia	410	39,009	95.07	367	39,622	108.11
Maryland and South Carolina	424	44,470	104.82	493	56,161	113.86
Alabama	314	32,847	104.44	379	39,972	105.37
Kentucky, Mississippi, Tennessee	97	8,254	85.35	90	7,782	86.15
Arkansas and Oklahoma	108	7,965	73.97	124	9,268	74.60
Texas	184	17,081	93.08	203	19,207	94.79
Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming	130	11,751	90.64	128	12,096	94.44
Alaska and Hawaii	3	354	102.32	3	342	101.95
California, Oregon, Washington	175	14,128 r/	80.73 r/	417	40,393	96.78
Independent importers, n.e.c. 7/	39	6,058	155.33	12	1,029	85.75
Total or average 8/	3,667	344,203	93.87	4,048	396,817	98.03

r/ Revised.

1/ Shipments are to final domestic customers and include shipments of imported cement.

2/ Includes data for three white cement facilities located in California, Pennsylvania, and Texas.

3/ Excludes Puerto Rico (did not produce any masonry cement).

4/ Values are mill net and represent ex-plant (f.o.b.-plant or import terminal) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per ton.

5/ Includes shipments by independent importers where district assignation is possible.

6/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

7/ Shipments by importers for which district assignations were not possible.

8/ Total includes imports shipped by independent importers.

TABLE 14

AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES 1/ 2/

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
1997	71.85	177.05	72.59	93.87	73.49
1998	74.76	161.40	75.51	98.03	76.46

1/ Excludes Puerto Rico. Mill net value is the actual value of sales to customers, f.o.b. plant or import terminal, less all discounts and allowances, less any freight charges from U.S. producing plant to distribution terminal and to final customers.

2/ Although unrounded, the data incorporate estimates for some plants and are good to no better than two significant figures.

TABLE 15
PORTLAND CEMENT SHIPMENTS IN 1998, BY DISTRICT AND TYPE OF CUSTOMER 1/

(Thousand metric tons)

District 2/ 3/	Ready-mixed concrete	Concrete product manufacturers 4/	Contractors 5/	Building material dealers	Oil well, mining, waste 6/	Government and miscellaneous 7/	District total 8/ 9/
Maine and New York	2,893	273	364	80	9	20	3,631
Pennsylvania, eastern	3,093	795	593	339	31	66	4,916
Pennsylvania, western	1,232	126	151	8	26	227	1,768
Illinois	1,380	331	151	34	824	6	2,726
Indiana	2,277	410	72	105	12	3	2,878
Michigan	4,420	506	686	112	22	--	5,747
Ohio	792	170	198	31	--	5	1,196
Iowa, Nebraska, South Dakota	3,247	650	328	77	40	32	4,374
Kansas	1,269	137	195	25	16	6	1,648
Missouri	4,323	642	682	194	--	47	5,889
Florida	4,186	1,154	256	464	--	66	6,126
Georgia, Virginia, West Virginia	1,979	588	170	160	14	23	2,932
Maryland	1,253	293	207	17	(10/)	17	1,785
South Carolina	1,973	429	75	74	45	11	2,606
Alabama	3,432	588	149	161	23	21	4,375
Kentucky, Mississippi, Tennessee	2,215	198	167	18	4	21	2,624
Arkansas and Oklahoma	1,883	189	454	30	63	2	2,621
Texas, northern	2,773	407	675	104	313	48	4,319
Texas, southern	4,149	327	558	101	221	7	5,364
Arizona and New Mexico	2,752	319	139	97	44	112	3,465
Colorado and Wyoming	1,733	203	228	31	25	(10/)	2,219
Idaho, Montana, Nevada, Utah	2,158	222	143	30	58	110	2,721
Alaska and Hawaii	269	19	6	17	(10/)	7	318
California, northern	2,013	358	89	111	--	1	2,573
California, southern	4,980	1,056	313	337	117	46	6,850
Oregon and Washington	2,246	260	205	48	8	18	3,102
Total 9/ 11/	69,305	11,125	7,406	3,030	1,051	1,011	92,809
Puerto Rico	854	152	55	536	(10/)	3	1,599

1/ Includes shipments of imported cement. Data, other than district totals, are presented unrounded but incorporate estimates for some plants and are likely accurate to only two significant figures.
2/ District location is that of the reporting facility. Shipments may include material sold into other districts.
3/ Includes shipments by independent importers, where district assignations were possible.
4/ Shipments to concrete product manufacturers include brick-block--5,126; precast--2,222; pipe--1,464; and other or unspecified--2,469.
5/ Shipments to contractors include airport--492; road paving--4,577; soil cement--1,384 and other or unspecified--1,014.
6/ Shipments to oil well, mining, and waste include oil well drilling--1,052; mining--689; and waste stabilization--180.
7/ Includes shipments for which customer types were not specified.
8/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated monthly data.
9/ Data may not add to totals shown because of independent rounding.
10/ Less than 1/2 unit.
11/ Includes imports shipped by independent importers for which district assignations were not possible.

TABLE 16
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE
UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE 1/ 2/

(Thousand metric tons)

Type	1997	1998
General use and moderate heat (Types I and II), (Gray)	79,312	85,066
High early strength (Type III)	3,109	3,151
Sulfate resisting (Type V)	2,456	2,757
Block	506	594
Oil well	1,229	797
White	634	790
Blended:		
Portland--natural pozzolans	NA	284
Portland--granulated blast furnace slag	NA	165
Total 3/	639	449
Portland--fly ash	NA	438
Other blended cement 4/	NA	234
Total 3/	314	671
Expansive and regulated fast setting	120	53
Miscellaneous 5/	50	79
Grand total 3/	88,368	94,408

NA Not available.
1/ Includes imported cement. Includes Puerto Rico.
2/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.
3/ Data may not add to totals shown because of independent rounding.
4/ Includes blends with cement kiln dust and silica fume.
5/ Includes waterproof and low heat (Type IV).

TABLE 17
U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1997		1998	
Country of destination	Quantity	Value 2/	Quantity	Value 2/
Aruba	5	70	6	327
Australia	5	402	5	239
Bahamas, The	8	858	15	1,222
Canada	605	42,106	565	39,205
Dominica	--	--	13	806
Dominican Republic	3	349	5	299
Germany	23	963	15	676
Latvia	8	355	4	145
Mexico	45	5,997	54	6,846
Panama	7	623	15	764
Other	80 r/	7,888 r/	46	6,029
Total 3/	789	59,611	743	56,558

r/ Revised.
1/ Includes portland and masonry cements.
2/ Free alongside ship (f.a.s.) value. The value of exports at the U.S. seaport or border port of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of exportation. The value excludes the cost of loading.
3/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Country of origin	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	83	2,692	4,013	155	3,986	6,663
Belgium	61	2,781	3,723	285	12,438	14,921
Canada	5,350	269,471	293,868	5,957	255,893	286,146
China	610	24,951	32,196	3,489	132,926	168,024
Colombia	906	36,898	47,177	1,165	49,945	61,873
Cyprus	--	--	--	161	6,196	7,844
Denmark	579	24,576	34,993	580	26,126	36,537
France	441	27,157	31,471	361	24,149	28,441
Greece	1,860	68,741	88,620	2,124	83,757	106,183
Italy	401	17,041	21,876	736	26,780	35,252
Korea, Republic of	--	--	--	260	5,576	9,731
Mexico	995	37,804	47,612	1,280	48,518	61,495
Norway	283	10,182	12,906	322	11,867	15,252
Saudi Arabia	--	--	--	185	5,815	8,151
Spain	1,845	75,282	100,988	2,204	94,578	123,737
Sweden	886	28,620	38,437	937	30,389	40,539
Thailand	--	--	--	758	17,989	24,937
Turkey	973	35,805	46,111	1,070	40,324	52,774
United Kingdom	153	7,289	8,700	118	5,814	7,138
Venezuela	1,994	76,189	95,503	1,781	72,193	87,420
Other	176 r/	6,588 r/	9,135 r/	158	7,408	9,003
Total 4/	17,596	752,067	917,329	24,085	962,667	1,192,061

r/ Revised.
1/ Includes portland, masonry, and other hydraulic cements. Includes Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Anchorage:						
Canada	7	265	286	7	305	305
China	64	2,555	3,602	74	2,836	3,485
Japan	(3/)	5	5	--	--	--
Total 4/	71	2,825	3,892	83	3,141	3,790
Baltimore:						
Bahamas, The	--	--	--	26	967	967
China	(3/)	2	4	--	--	--
Germany	--	--	--	3	16	16
Netherlands	--	--	--	(3/)	126	132
Thailand	--	--	--	13	568	769
Turkey	--	--	--	27	1,018	1,018
Venezuela	169	7,001	7,001	190	8,190	8,193
Total 4/	169	7,004	7,005	258	10,884	11,094
Boston:						
Canada	9	258	262	24	677	687
Netherlands	(3/)	13	14	(3/)	135	150
Turkey	11	386	574	--	--	--
Total 4/	20	656	850	25	812	837
Buffalo:						
Canada	836	47,226	50,125	774	34,018	36,382
Netherlands	(3/)	28	28	--	--	--
United Kingdom	--	--	--	(3/)	10	10
Total 4/	836	47,254	50,154	774	34,028	36,393
Charleston:						
Canada	19	653	942	--	--	--
China	--	--	--	12	474	633
France	(3/)	3	5	27	896	1,159
Italy	--	--	--	54	305	793
Netherlands	(3/)	33	36	--	--	--
Saudi Arabia	--	--	--	20	298	595
Spain	--	--	--	253	9,911	13,363
Sweden	12	664	785	64	3,087	3,904
Thailand	--	--	--	62	1,026	1,690
Turkey	15	541	815	--	--	--
United Kingdom	(3/)	59	83	31	1,145	1,430
Venezuela	80	3,244	4,399	77	3,025	3,815
Total 4/	125	5,197	7,065	601	20,166	27,383
Chicago:						
Croatia	--	--	--	(3/)	4	4
Japan	(3/)	20	22	(3/)	17	19
United Kingdom	(3/)	3	4	(3/)	6	9
Total 4/	(3/)	23	26	1	26	32
Cleveland:						
Canada	628	35,817	36,622	966	43,807	45,364
Italy	--	--	--	(3/)	45	54
Netherlands	(3/)	94	111	--	--	--
United Kingdom	(3/)	93	122	(3/)	196	235
Total 4/	628	36,003	36,854	967	44,048	45,653
Columbia Snake:						
China	367	14,735	19,014	427	17,175	22,496
Colombia	54	2,189	2,997	--	--	--
Taiwan	10	435	546	--	--	--
Total 4/	432	17,360	22,556	427	17,175	22,496
Detroit:						
Belgium	--	--	--	129	6,477	6,527
Canada	1,664	86,466	95,989	2,130	79,382	94,347
France	--	--	--	11	920	930
Germany	(3/)	2	2	--	--	--
Greece	--	--	--	54	2,297	2,327
Netherlands	(3/)	86	101	(3/)	92	97
Thailand	--	--	--	27	1,467	1,477

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Detroit--Continued:						
United Kingdom	25	761	771	--	--	--
Total 4/	1,689	87,315	96,863	2,351	90,634	105,705
Duluth: Canada	345	13,468	15,485	327	14,312	16,564
El Paso:						
China	(3/)	2	2	--	--	--
Mexico	455	15,214	19,978	583	19,776	26,107
Total 4/	455	15,215	19,979	583	19,776	26,107
Great Falls:						
Canada	222	9,404	10,730	200	9,575	11,393
Japan	(3/)	2	3	--	--	--
Total 4/	223	9,406	10,734	200	9,575	11,393
Honolulu:						
Australia	83	2,692	4,013	103	2,617	4,256
China	--	--	--	113	3,164	3,842
United Kingdom	--	--	--	(3/)	12	15
Venezuela	180	5,433	9,063	--	--	--
Total 4/	263	8,125	13,076	217	5,794	8,114
Houston-Galveston:						
Canada	--	--	--	(3/)	5	7
Colombia	51	1,891	2,942	58	2,304	3,499
Denmark	192	6,818	9,134	204	7,779	10,019
France	3	373	487	(3/)	130	144
Germany	--	--	--	(3/)	8	10
Greece	217	7,874	10,206	411	15,068	20,278
Italy	--	--	--	15	589	757
Japan	(3/)	74	87	(3/)	54	66
Korea, Republic of	--	--	--	84	1,937	3,490
Saudi Arabia	--	--	--	68	2,701	3,343
Spain	520	20,429	25,445	487	19,925	27,903
Switzerland	--	--	--	34	1,333	1,638
Thailand	--	--	--	114	1,794	3,229
Turkey	32	1,696	2,176	250	9,079	12,811
United Kingdom	(3/)	20	26	(3/)	8	10
Venezuela	--	--	--	57	2,404	2,922
Total 4/	1,015	39,174	50,504	1,786	65,120	90,126
Laredo: Mexico	70	7,060	7,630	92	9,703	10,509
Los Angeles:						
Australia	--	--	--	(3/)	4	4
China	170	7,036	8,818	1,499	56,559	70,279
Colombia	32	1,284	1,757	--	--	--
France	62	3,261	3,329	--	--	--
Japan	--	--	--	15	561	702
Mexico	19	693	846	--	--	--
Spain	693	26,177	38,761	203	7,627	11,271
Thailand	--	--	--	41	1,892	2,042
Turkey	32	1,704	1,722	--	--	--
United Kingdom	(3/)	14	24	3	394	590
Total 4/	1,007	40,169	55,257	1,759	67,036	84,887
Miami:						
Belgium	2	388	422	(3/)	403	427
Colombia	--	--	--	(3/)	43	56
Denmark	8	476	857	26	908	1,199
Greece	14	488	631	--	--	--
Italy	(3/)	2	3	--	--	--
Mexico	--	--	--	11	849	1,104
Saudi Arabia	--	--	--	63	1,657	2,665
Spain	513	24,058	30,236	689	31,590	39,909
Sweden	497	15,349	20,183	626	18,458	24,581
Turkey	16	515	694	--	--	--
United Kingdom	--	--	--	(3/)	83	104
Venezuela	204	7,874	10,517	153	5,950	7,662
Total 4/	1,254	49,150	63,543	1,569	59,941	77,708

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Milwaukee: Canada	171	7,863	9,763	83	3,832	4,735
Minneapolis: Germany	(3/)	9	10	--	--	--
Mobile:						
Belgium	52	1,764	2,230	--	--	--
Bulgaria	55	1,548	2,234	26	715	1,032
China	--	--	--	34	1,180	1,596
Colombia	--	--	--	31	743	832
France	51	1,623	2,080	--	--	--
Korea, Republic of	--	--	--	103	2,566	3,791
Thailand	--	--	--	100	1,855	2,319
United Kingdom	--	--	--	(3/)	7	7
Venezuela	115	4,181	5,123	27	950	1,230
Total 4/	273	9,115	11,667	322	8,015	10,806
New Orleans:						
Belgium	--	--	--	148	4,971	6,952
China	4	389	466	885	32,800	43,076
Croatia	5	585	801	5	1,122	1,318
France	80	4,269	5,326	77	4,054	4,883
Greece	578	21,013	27,975	751	30,630	39,270
Italy	374	15,966	20,519	548	21,367	28,093
Korea, Republic of	--	--	--	35	486	1,049
Norway	--	--	--	34	1,227	1,674
Spain	18	717	885	133	5,369	6,864
Sweden	369	12,269	17,063	247	8,844	12,054
Thailand	--	--	--	158	3,690	4,762
Turkey	303	11,275	14,865	241	10,027	12,666
Venezuela	34	1,286	1,582	186	7,364	8,917
Total 4/	1,764	67,769	89,483	3,450	131,950	171,576
New York City:						
Belgium	(3/)	21	22	--	--	--
Denmark	55	2,814	3,097	65	3,557	4,256
Germany	--	--	--	(3/)	174	175
Greece	357	13,331	15,777	419	16,447	19,409
Italy	27	1,073	1,354	77	3,015	3,824
Netherlands	(3/)	195	207	(3/)	159	169
Norway	283	10,182	12,906	288	10,639	13,578
Tunisia	(3/)	12	18	--	--	--
Turkey	258	8,932	10,498	277	10,230	11,892
United Kingdom	(3/)	12	16	(3/)	57	66
Venezuela	21	738	902	--	--	--
Total 4/	1,001	37,309	44,797	1,127	44,278	53,369
Nogales: Mexico	439	13,342	17,446	566	17,105	22,366
Norfolk:						
Croatia	(3/)	2	4	--	--	--
Cyprus	--	--	--	134	5,382	7,027
Denmark	223	8,162	10,871	168	6,396	8,449
France	59	11,598	12,610	61	11,998	13,076
Greece	513	19,795	25,641	354	14,395	18,514
South Africa	(3/)	9	11	--	--	--
Tunisia	--	--	--	11	468	603
United Kingdom	2	564	760	1	247	272
Venezuela	20	834	1,110	90	3,031	4,097
Total 4/	817	40,964	51,008	819	41,918	52,039
Ogdensburg:						
Canada	334	12,814	14,361	208	7,374	7,984
Germany	--	--	--	(3/)	3	4
Total 4/	334	12,814	14,361	209	7,376	7,987
Pembina: Canada	186	8,650	9,910	232	10,684	13,228
Philadelphia:						
Colombia	--	--	--	27	972	1,220
Germany	--	--	--	(3/)	8	9
Korea, Republic of	--	--	--	39	587	1,401

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Philadelphia--Continued:						
Thailand	--	--	--	164	2,863	4,017
Total 4/	--	--	--	230	4,430	6,647
Portland:						
Canada	15	828	910	30	2,477	2,583
Switzerland	--	--	--	31	965	1,246
Total 4/	15	828	910	62	3,443	3,829
Providence:						
Canada	26	733	770	24	629	653
Colombia	--	--	--	30	1,527	1,652
Greece	--	--	--	21	941	1,026
Spain	82	3,072	4,669	216	11,146	13,124
Total 4/	108	3,806	5,440	290	14,244	16,455
San Diego:						
China	--	--	--	160	5,989	7,229
Mexico	9	1,200	1,366	28	1,038	1,332
Total 4/	9	1,200	1,366	188	7,026	8,561
San Francisco:						
China	--	--	--	215	9,909	11,813
France	(3/)	15	21	--	--	--
Japan	--	--	--	(3/)	3	3
Thailand	--	--	--	40	1,865	2,780
Turkey	--	--	--	24	852	1,692
United Kingdom	(3/)	19	23	--	--	--
Venezuela	29	874	880	--	--	--
Total 4/	29	908	924	279	12,629	16,288
San Juan:						
Belgium	7	609	1,049	7	586	1,014
Canada	(3/)	2	3	--	--	--
Colombia	--	--	--	30	975	1,024
Cyprus	--	--	--	26	814	817
Denmark	20	1,557	2,783	14	1,182	2,136
France	--	--	--	27	819	1,075
Italy	--	--	--	41	1,460	1,731
Japan	--	--	--	(3/)	71	107
Luxembourg	1	63	110	--	--	--
Mexico	3	294	345	1	47	77
Spain	6	385	408	67	2,435	2,734
Turkey	8	376	572	10	373	580
Venezuela	161	5,854	6,744	80	2,607	3,159
Total 4/	206	9,140	12,014	303	11,369	14,455
Savannah:						
Australia	--	--	--	52	1,365	2,403
Bulgaria	91	2,538	3,753	--	--	--
Colombia	56	3,034	3,489	93	5,145	5,919
Denmark	(3/)	10	10	18	1,326	1,920
France	187	6,014	7,615	158	5,332	7,174
Saudi Arabia	--	--	--	34	1,159	1,548
Thailand	--	--	--	39	969	1,853
United Kingdom	126	5,730	6,853	83	3,628	4,365
Venezuela	114	4,025	5,004	48	2,090	2,523
Total 4/	574	21,351	26,724	526	21,014	27,705
Seattle:						
Canada	796	39,810	42,125	779	38,362	40,187
China	5	232	292	56	2,256	2,851
Colombia	191	7,770	11,046	234	9,749	13,727
Japan	(3/)	128	156	6	372	493
Taiwan	12	522	642	--	--	--
Total 4/	1,005	48,462	54,261	1,076	50,739	57,257
St. Albans:						
Canada	90	5,215	5,583	171	10,453	11,728
Netherlands	(3/)	136	152	--	--	--
Total 4/	90	5,351	5,735	171	10,453	11,728

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Tampa:						
China	--	--	--	15	585	724
Colombia	522	20,731	24,946	660	28,486	33,945
Denmark	80	4,739	8,240	83	4,977	8,558
Greece	181	6,240	8,389	112	3,979	5,359
Spain	12	443	584	156	6,575	8,569
Sweden	9	338	406	--	--	--
Turkey	298	10,381	14,196	241	8,745	12,116
Venezuela	741	29,908	36,897	720	30,215	36,558
Total 4/	1,844	72,780	93,659	1,989	83,563	105,829
U.S. Virgin Islands:						
Antigua and Barbuda	(3/)	20	41	--	--	--
British Virgin Islands	2	5	10	--	--	--
Costa Rica	(3/)	2	2	--	--	--
Trinidad and Tobago	--	--	--	(3/)	1	2
Venezuela	65	2,543	3,026	51	2,121	2,545
Total 4/	67	2,571	3,080	51	2,122	2,548
Wilmington:						
Netherlands	(3/)	24	26	(3/)	38	40
United Kingdom	(3/)	16	20	(3/)	22	25
Venezuela	59	2,393	3,253	101	4,245	5,798
Total 4/	59	2,433	3,300	101	4,304	5,863
Grand total 4/	17,596	752,067	917,329	24,085	962,667	1,192,061

1/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
2/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry. It is computed by adding "freight" to the "customs value."
3/ Less than 1/2 unit.
4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Canada	4,086	202,335	218,025	3,745	166,444	179,797
China	606	24,560	31,726	3,307	127,254	160,882
Colombia	734	30,580	39,409	942	41,705	51,823
Cyprus	--	--	--	134	5,382	7,027
Denmark	467	17,175	22,614	459	17,852	23,182
France	133	6,075	6,978	124	4,926	6,134
Greece	1,672	61,789	79,495	1,957	77,481	98,496
Italy	344	14,802	19,060	709	25,746	33,886
Korea, Republic of	--	--	--	43	1,302	2,040
Mexico	885	25,945	34,707	1,131	32,586	43,948
Norway	276	9,407	12,051	314	11,048	14,352
Saudi Arabia	--	--	--	150	4,656	6,603
Spain	1,782	67,773	92,586	2,034	83,568	111,178
Sweden	887	28,620	38,437	937	30,383	40,532
Thailand	--	--	--	253	7,061	9,198
Turkey	827	31,037	39,751	1,071	40,324	52,774
United Kingdom	63	2,891	3,893	111	4,414	5,260
Venezuela	1,214	49,452	60,631	1,326	55,033	66,376
Other	23	998	1,240	243	9,109	11,377
Total 4/	13,999	573,439	700,603	18,990	745,897	924,865

1/ Includes imports into Puerto Rico.
2/ Custms value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 21
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1997			1998		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Belgium	9	998	1,473	8	989	1,441
Canada	215	16,858	18,024	285	22,530	24,176
Denmark	113	7,391	12,368	120	8,264	13,344
Luxembourg	1	63	110	--	--	--
Mexico	108	11,718	12,754	135	14,699	16,177
Norway	8	776	854	8	819	900
Spain	63	7,509	8,402	87	8,199	9,252
United Kingdom	4	197	284	5	271	475
Venezuela	--	--	--	1	131	139
Other	(4/)	197	212	(4/)	341	374
Total 5/	520	45,707	54,480	649	56,243	66,278

1/ Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 22
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	1997 Quantity	1997 Value Customs 2/	1997 Value C.i.f. 3/	1998 Quantity	1998 Value Customs 2/	1998 Value C.i.f. 3/
Australia	83	2,692	4,013	155	3,982	6,659
Belgium	52	1,764	2,230	129	6,477	6,527
Canada	1,019	45,601	52,877	1,657	49,841	63,491
China	4	392	470	182	5,672	7,142
Colombia	173	6,318	7,768	223	8,197	9,994
France	304	18,721	21,932	233	16,979	19,837
Greece	181	6,240	8,389	167	6,276	7,687
Korea, Republic of	--	--	--	218	4,274	7,691
Thailand	--	--	--	504	10,928	15,740
Venezuela	780	26,730	34,863	453	16,908	20,739
Other	431 r/	14,878 r/	19,190 r/	213	6,819	8,416
Total 4/	3,027	123,336	151,732	4,134	136,353	173,923

r/ Revised.
1/ For all types of hydraulic cement. Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 23
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1994	1995	1996	1997	1998 e/
Afghanistan e/	115	115	116	116	116
Albania e/	100 r/	200	200	150	150
Algeria	6,060	6,822	6,900	7,100 r/ e/	7,800
Angola e/	240 r/	200 r/	270	301 2/	350
Argentina	6,276	5,447	5,117	6,858 r/	7,100
Armenia	100	228	282	297	310
Australia e/	6,500	6,500	6,500	6,500	6,500
Austria	4,828	3,843	3,874	3,852	3,850
Azerbaijan	467 r/	196 r/	223 r/	315 r/	201 2/
Bahrain	225 e/	197	193	172	230 2/
Bangladesh e/ 3/	280	280	650 r/	875 r/	900
Barbados	78	75	107	173	259 2/
Belarus	1,488	1,235	1,467	1,876	2,035 2/
Belgium	8,412 r/	8,223 r/	7,857 r/	8,052 r/	8,000
Benin	465	579	360 r/ e/	450 r/ e/	520
Bhutan e/	120	140	160	160	150
Bolivia	768	892	934	1,035 r/	1,050
Bosnia and Herzegovina e/	244 r/ 2/	226 r/ 2/	150	200	300
Brazil	25,230	28,256	34,597	38,069 r/	43,000
Brunei	--	--	100 e/	400 r/ e/	400
Bulgaria	1,910 r/	2,070	2,137	1,656 r/	1,700
Burkina Faso e/	--	30	30	40	40
Burma	470	517	505	516	365 2/
Cambodia e/	100	100	200	200	300
Cameroon e/	479 r/	552 r/	600	620 r/	450
Canada	10,584	10,440	11,587	12,015	12,064 p/
Chile	2,995	3,275	3,634	3,735 r/	3,750
China	421,180	475,910	491,190	511,730 r/	513,500 p/
Colombia	9,322	9,407 r/	8,907 r/	8,446 r/	9,190 2/
Congo (Brazzaville)	87 r/	96 r/	50 r/ e/	-- r/	-- 2/
Congo (Kinshasa) 4/	166 r/	235 r/	157 r/	140 r/	120
Costa Rica	940	865	830	940 r/	1,180 2/
Côte d'Ivoire e/	1,100 r/	1,000 r/	1,000 r/	1,100 r/	650
Croatia	2,055	1,708	1,842	2,134	2,000
Cuba	1,081	1,470	1,453	1,713	1,800
Cyprus	1,053	1,021	1,022 r/	910 r/	1,200 2/
Czech Republic	5,303	4,825	5,015 r/	4,877 r/	5,000
Denmark 5/	2,430	2,584	2,629	2,683	2,528 2/
Dominican Republic	1,276 r/	1,453 r/	1,642 r/	1,835 r/	1,885 2/
Ecuador	2,164	2,616	2,677	2,688	2,690
Egypt	16,100 r/	17,665	18,700 r/	18,100 r/	19,203 2/
El Salvador	850	890	948	1,020 r/	1,077 2/
Eritrea	45 e/	50	47	60 r/ e/	50
Estonia	402	417	388	423 r/	321 2/
Ethiopia	464	611	663 r/	750 r/ e/	775
Fiji	94	91	84	84 e/	80
Finland	869 r/	907	975	905 r/	903 2/
France	21,296	19,692	19,514 r/	19,780 r/	19,500
French Guiana	38	60	52	51	50
Gabon	126	154	185 r/	200 e/	196 2/
Georgia	100	100 e/	85	91	85
Germany	36,130 r/	33,302 r/	31,533 r/	35,945 r/	36,610
Ghana e/	1,346 2/	1,300	1,500 r/	1,700 r/	2,000
Greece e/	12,636 2/	14,480 r/	14,700 r/	14,982 r/	15,000
Guadeloupe e/	230	230	230	230	230
Guatemala	1,200	1,152	1,090	1,280	1,500 p/
Guinea e/	250	250	260	260	260
Haiti	-- r/	--	--	--	--
Honduras	615 r/	721	952	980 e/	1,250 p/
Hong Kong	1,927	1,913	2,027	1,925	1,539
Hungary	2,813	2,875	2,747 r/	2,811 r/	2,999 2/
Iceland	81	82	88	101 r/	100
India e/	57,000	62,000	75,000	80,000	85,000
Indonesia	21,907	23,129	25,000 e/	27,500 r/ e/	22,000

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1994	1995	1996	1997	1998 e/
Iran e/	16,000	16,300	16,500 r/	15,200 r/	17,000
Iraq e/	2,000	2,108 2/	2,100	1,598 r/	1,700
Ireland	1,623	1,730	1,933 r/	2,100 r/	2,000
Israel	4,800	6,204	6,700 e/	5,400 r/	5,400
Italy	32,713	33,715	33,327	33,721	35,000
Jamaica	445	522	557 r/	591 r/	558 2/
Japan	91,624	90,474	94,492	91,938	81,328 2/
Jordan	4,000 e/	3,508	3,415	3,251	1,386 2/
Kazakhstan	2,000	2,616	1,120	661 e/	600
Kenya	1,452 r/	1,566 r/	1,816 r/	1,506 r/	1,200
Korea, North e/	17,000	17,000	17,000	17,000	17,000
Korea, Republic of	50,730	55,130	58,434 r/	60,317 r/	46,791
Kuwait e/	1,000	1,950 2/	2,000	2,000	2,000
Kyrgyzstan	400 r/	310 r/	544 r/	658	710
Laos e/	10	10	9	8 r/	9
Latvia	244	203	325	246	366 2/
Lebanon e/	3,450	3,538 2/	3,700	2,703 r/	4,000
Liberia e/	3 r/	5 r/	15 r/	7 r/	10
Libya	3,800 r/	3,210	3,550	2,524 r/	3,000
Lithuania	736	649	600 e/	714 r/	788 2/
Luxembourg	711	714	667	650 r/ e/	650
Macedonia	486	524	491	500 e/	500
Madagascar e/	40 r/	40 r/	80 r/	120 r/	120
Malawi	122	139	91 r/	176 r/	175
Malaysia	9,928	10,713	12,349	12,668 r/	10,397 2/
Mali e/	15	13	12 r/	10 r/	10
Martinique e/	220	220	220	220	220
Mauritania e/	374	120	100 r/	80 r/	50
Mexico	29,700	24,043 r/	25,366	27,548	27,744 2/
Moldova	39	49	40	122	74 2/
Mongolia	86	109	106	112	109 2/
Morocco	6,350	6,401	6,585 r/	7,184 r/	7,200
Mozambique e/	60	60	180 r/	220 r/	290
Namibia e/	20	20	20	20	20
Nepal 3/	316	327	309	225 r/	280
Netherlands	3,180	3,180 r/	3,140 r/	3,230 r/	3,200
New Caledonia e/	90	100	100	100	100
New Zealand	900 e/	950 e/	974	976	975
Nicaragua	309	324	360 r/	310 r/	336 2/
Niger e/	29 r/	30	29 r/ 2/	36 r/	35
Nigeria	2,627 r/	2,602 r/	2,545 r/	2,520 r/	2,700
Norway	1,444	1,613	1,664	1,724 r/	1,676 2/
Oman	1,200 e/	1,177	1,260	1,264 r/	1,300
Pakistan	8,100	8,586	8,900 e/	9,001 r/	8,901 2/
Panama	615	615	647	700 r/	750 2/
Paraguay	659 r/	635	613 r/	620	556 2/
Peru	3,177 r/	3,792 r/	3,848	4,300 r/	4,340 2/
Philippines	9,571 r/	10,554 r/	12,429 r/	14,681 r/	13,338 2/
Poland	13,834	13,914 r/	13,959 r/	15,003 r/	14,970 2/
Portugal	7,977	8,123	8,455 r/	9,395 r/	9,500
Qatar	469	475	690	692 r/	700
Réunion	321	313	299	277	300
Romania	6,676 r/	6,842	6,956	7,298	7,000
Russia	37,200	36,500	27,800	26,700 r/	26,000
Rwanda e/	10	10 r/	15 r/	15 r/	15
Saudi Arabia	15,000 e/	15,773	16,437	15,400	14,500
Senegal e/	685 r/	694 r/	811 r/	854 r/	1,000
Serbia and Montenegro	1,612	1,696	2,205 r/	2,011 r/	2,300
Sierra Leone e/	100	100	160	50	100
Singapore e/	3,100	3,200	3,300	3,300	3,300
Slovakia e/	2,700 r/	2,902 r/	2,802 r/	3,017 r/	3,000
Slovenia	898	991	1,026 r/	1,113 r/	1,100
Somalia e/	25	25	-- r/	-- r/	--
South Africa	7,905	9,071	9,000 e/	9,500 r/ e/	9,500

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1994	1995	1996	1997	1998 e/
Spain (including Canary Islands)	25,150	26,423	25,157	27,632	27,943 2/
Sri Lanka e/	925 2/	894 r/	928 r/	965 r/	1,100
Sudan e/	160 r/	391 2/	380	291 r/	300
Suriname e/	60 r/	60 r/	60 r/	65 r/	65
Sweden	2,153	2,539 r/	2,447	2,253 r/	2,105 2/
Switzerland e/	4,370 r/	4,024 r/	3,638 r/	3,568 r/	3,600
Syria e/	4,500	4,463 2/	4,500	4,460 r/ 2/	4,500
Taiwan	22,722	22,478	21,537	21,522	19,538 2/
Tajikistan	200	100	50	36 r/	18 2/
Tanzania	315 r/	320 r/	300 r/	275 r/	300
Thailand e/	29,900	34,900	38,600 r/	37,309 r/	30,000
Togo e/	286 r/	440 r/	413 r/	421 r/	565
Trinidad and Tobago	583	559	617	653	690 2/
Tunisia	4,606	4,938	4,567	4,431	4,590 2/
Turkmenistan	700	437	451	450 e/	450
Turkey	29,493	33,153	35,214	36,035	38,200 2/
Uganda	36 r/ e/	85 e/	180 r/	203 r/	210
Ukraine	11,400	7,600	5,017 r/	5,098 r/	5,589 2/
United Arab Emirates e/	5,000	5,918 2/	6,000	5,250 r/	6,000
United Kingdom	12,307	11,805	12,214	12,638 r/	12,409 2/
United States (including Puerto Rico) 6/	79,353	78,320	80,818	84,255	85,522 2/
Uruguay	707 r/	585 r/	685	781 r/	960 2/
Uzbekistan	4,800	3,400	3,300 r/	3,300 r/	3,400
Venezuela	6,927	7,672	7,556	7,600 e/	7,867
Vietnam e/	4,700	5,200	6,600 r/	7,500 r/	6,000
Yemen	800 e/	1,088	1,040	1,229 r/	1,200
Zambia	280	312 r/	348 r/	384 r/	400
Zimbabwe	1,070	968 r/	1,000 r/ e/	1,100 r/ e/	1,100
Total 7/	1,370,000 r/	1,444,000 r/	1,493,000 r/	1,540,000 r/	1,519,000

e/ Estimated. p/ Preliminary. r/ Revised.

1/ Table includes data available through September 22, 1999. Data may include clinker exports for some countries.

2/ Reported figure.

3/ Data for year ending June 30 of that stated.

4/ Formerly Zaire.

5/ Sales data for years 1994 and 1995 only.

6/ Portland and masonary cement only.

7/ Data may not add to totals shown because of independent rounding.

CEMENT

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Eric A. Seavey, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Hydraulic cement is the binding agent in concrete and mortars and, as such, is of fundamental importance to the construction sector of any country. This report provides tabulated data on U.S. cement production, consumption and trade, primarily for the years 1998-99; however, table 1 gives a summary of such data for the years 1995-99. In 1999, U.S. production of portland and masonry cements, combined, reached almost 86 million metric tons (Mt), a new record; 95% of this was portland cement. Production of clinker—the intermediate product of cement manufacture—reached a new record of 76 Mt. The United States was the world's third largest cement producer in 1999, having been displaced from second place by India and remaining well behind China. World production in 1999 totaled about 1.6 billion metric tons (Gt).

In 1999, domestic consumption of cement also reached new record levels. Apparent consumption (calculated as production plus imports minus exports minus the change in yearend stocks) rose 5.2% to 108.9 Mt (table 1), and consumption measured as sum of monthly sales to final domestic customers increased 5.0% to 108.5 Mt (table 9). Imports of cement and clinker again rose significantly to meet the large excess demand and appear to have helped constrain overall unit price increases to only about 2%. Exports of cement remained relatively insignificant. The total ex-factory value of annually reported cement shipments from mills and terminals to final domestic customers rose 9% to $8.1 billion (table 1), but if applied to the larger monthly derived tonnages in table 9, the overall value becomes $8.5 billion, up 7.6%. By using typical cement-in-concrete mix ratios, the delivered value of concrete, excluding mortar, in the United States was estimated to be at least $35 billion in 1999.

Hydraulic cements are those that can set and harden under water. Most of the hydraulic cement produced and used in the United States and throughout the world fits under either the portland or masonry cement categories as broadly defined in common industry practice. Portland and masonry cements are based on portland cement clinker, which consists mostly of calcium silicates and is made by controlled high-temperature burning in a kiln of a measured blend of calcareous rocks (usually limestone) and, as needed, lesser quantities of siliceous, aluminous, and ferrous materials. The clinker is finely ground together with a small (generally about 5%) amount of calcium sulfate in the form of gypsum and/or anhydrite to make (straight) portland cement. Straight portland cement can be sold directly to concrete manufacturers or other customers, converted at the cement (or the concrete) plant into a blended (portland) cement product of similar properties by adding other cementitious or pozzolanic (siliceous materials requiring added lime to become cementitious) extenders, or can be mixed with plasticizing materials such as ground limestone or lime to make masonry-type cements used in mortar. A full listing of cement varieties included within the portland cement designation in this report is given in table 16. Excluded from the portland and masonry categories, and from this report, are hydraulic cement varieties such as pure pozzolan cements and aluminous cements; these cements contain no portland cement clinker and, cumulatively, make up only a small fraction of the U.S. cement market. Although included within the portland cement designation in this report, data showing blended cements separately from the other forms of portland cement are available within the monthly U.S. Geological Survey (USGS) Mineral Industry Surveys series publications, for the months of January 1998 onwards.

The bulk of this report, including tables 3 through 8 and 11 through 16, incorporates and discusses data compiled from USGS annual questionnaires sent to individual cement and clinker manufacturing plants and associated distribution facilities and import terminals. Some of the terminals are independent of U.S. cement manufacturers. In 1999, responses were received from 139 of 141 facilities canvassed, including all but 1 small producer, and covering more than 99% of total U.S. production and sales. In 1998, responses were received from 134 of 138 facilities canvassed, including all but 3 small producers; the respondents still accounted for more than 99% of total U.S. cement production and shipments. Tables 9 and 10 of this report are based on monthly shipments surveys of the cement-producing companies and importers, and for these, the response rate was 100% for both 1998 and 1999.

All annual forms are checked for accuracy and completeness upon receipt. For those found to be deficient in one or both of these aspects, and for nonrespondents, follow up inquiries are made, after which estimates are derived and incorporated for any remaining missing or problem data. Estimates for most information categories constituted only very small percentages of the aggregated totals and, thus, the introduced estimation errors are considered to be insignificant. Two important exceptions, however, continue to be the data for values shown in tables 1 and 12 through 14, where a significant but declining number of facilities routinely omit or incorrectly report the information, and the data for portland cement shipments by customer (user) type, shown in table 15, where the cement producers readily admit to having incomplete knowledge and where there is some overlap among the user categories.

For 1999 data, as in past years, there is a significant tonnage discrepancy (5.3 Mt in 1999) between the annual (survey) shipments totals for portland cement shown in tables 1 and 11 through 16, and the larger, monthly survey-based totals shown in tables 9 and 10. A major reason for the discrepancies over the years appears to be in the mechanics of the two (annual versus monthly) survey types. Because cement companies rely upon the monthly survey data for their market share analyses, the companies have undertaken to assist the completeness (and timeliness) of the USGS monthly surveys, insuring, in particular, that they include the activities of all relevant shipping terminals. Further, for several large companies, the monthly responses are submitted as consolidated forms, sent in from headquarters or other central locations, covering many or all of the company's facilities on a single form. In contrast, the annual questionnaires target individual production facilities and independent terminals. In 1999, great effort was made to reconcile differences in total shipments data between the two survey types for specific facilities, with the result that the total discrepancy was reduced by 1.2 Mt from that of the 1998 surveys. Both years, however, show comparable (5.1 Mt to 5.2 Mt) discrepancies in portland cement imports between the annual surveys and the U.S. Department of Commerce trade data. This, in turn, supports a conclusion that about 5 Mt of imported cement is being sold annually by unidentified (and hence missed on the annual survey) terminals that, although owned by the same companies, act independently of the manufacturing facilities. The comparable discrepancy for masonry cement is insignificant, likely because little of this material is imported. Because the (monthly-based) data in tables 9 and 10 are more complete, they are preferred as a measure of overall cement consumption. Integration of the data from tables 9 and 10 with those from the other tables has not been done to avoid creating additional internal inconsistencies.

In some tables, State data are combined within State groupings or districts, generally corresponding to Census Districts or subsets thereof, where required to protect proprietary information. To provide additional market information, some major cement-producing States have been subdivided along county lines; the county breakouts are given in table 2.

Tables 17 through 22 show nonproprietary trade data from the U.S. Census Bureau in lieu of the proprietary data collected through the USGS monthly questionnaires. The world hydraulic cement production data shown in table 23 were derived by USGS country specialists from a variety of sources.

A number of important ownership changes took place in 1999 within the U.S. cement industry. In July, Heidelberger Zement AG of Germany purchased Scancem Industries, Inc. of Norway; the purchase had been initially announced as a 50-50 joint effort with Heidelberger's Belgian subsidiary, Cimenteries CBR, S.A. (Cimenteries CBR, S.A., 2000, p. 4). Scancem owned Allentown Cement Co. in Pennsylvania, the Continental Cement Co. import terminal in Florida, and the importer NorVal, Inc. in New York. The purchase would put these three U.S. entities under the control of Heidelberger's U.S. subsidiary, Lehigh Portland Cement Co. (Cement Americas, 1999b). In April, Dyckerhoff AG of Germany sold to Heidelberger (through Lehigh) a 50% share in the Glens Falls, NY, cement plant. The plant was to be operated as a joint venture under the name Glens Falls Lehigh Cement Co. Lehigh contributed its Cementon, NY, and Providence, RI, terminals to the joint venture (Cimenteries CBR, S.A., 2000, p. 35). In September, Dyckerhoff announced its purchase of Lone Star Industries Inc., a major U.S. producer with five cement plants and one slag-grinding facility in the United States (Lone Star, Inc., 1999). Late in the year, Buzzi Unicem SpA of Italy purchased the 33% of Texas producer Alamo Cement Co. that it did not already own. Buzzi also owned RC Cement Co., headquartered in Pennsylvania, and through it owned Heartland Cement Co., Kansas; Hercules Cement Co., Pennsylvania; River Cement Co., Missouri; and Signal Mountain Cement Co., Tennessee (Portland Cement Association, 1999f). In November, Giant Cement Holding, Inc., which owns plants in Harleyville, SC, and, through Keystone Cement Co., in Bath, PA, was purchased by Cementos Portland S.A. of Spain. Cementos Portland already owned Dragon Products Co., Inc., a cement producer in Maine, and a New England importer, Coastal Cement Corp. (International Cement Review 1999b). In November, Tarmac plc of the United Kingdom agreed to be purchased by Anglo American plc. Tarmac's subsidiary, Tarmac America Inc., owned Pennsuco Cement Co. of Florida, and, in joint venture with Titan Cement Co. of Greece, Roanoke Cement Co. of Virginia (Portland Cement Association, 1999d). In late November, Hanson plc of the United Kingdom purchased Pioneer International of Australia, thus gaining Pioneer's 50% share of North Texas Cement Co., L.P.; a joint venture with Ash Grove Cement Co. of Kansas (Cement Americas 2000a). In a move that continued the industry trend in the 1990's of U.S. cement producers gaining control of hitherto independent import terminals, Southdown, Inc., in October, purchased an import terminal in Brunswick, GA, and secured the marketing rights to imports by another, in Mobile, AL (Southdown, Inc., 1999a). There were a few companies that changed their names during the year. In January, Kaiser Cement Corp., a Hanson subsidiary, was renamed Hanson Permanente Corp. Sunbelt Cement Co., owned by Cemex S.A. of Mexico, was renamed Cemex USA, as were several of its U.S. subsidiary import companies. The U.S. import subsidiary of the RMC Group of the United Kingdom changed its name from RMC Lonestar Inc. to RMC Pacific Materials Inc.

Legislation and Government Programs

Economic Issues.—Government economic policies and programs affecting the cement industry chiefly are those affecting cement trade, interest rates, and public sector construction spending. In terms of trade, the major issue in 1999 remained that of antidumping tariffs against Japan and Mexico, and a related voluntary restraint (import price) agreement with Venezuela, that were imposed in 1990 and 1992 following complaints in the late 1980's by a large coalition of U.S. producers. The main Mexican company involved has repeatedly appealed the tariffs, but the appeals to date have all been turned down and the tariffs reaffirmed. In March 1999, the U.S. Department of Commerce released its determination for the (seventh) review period covering August

1996-July 1997; the dumping margin for the period was set at 49.58% (Southern Tier Cement Committee, 1999). In line with a World Trade Organization (WTO) agreement, which became effective in 1995, antidumping tariffs can be imposed only for a period of 5 years, after which a “sunset” review must be done to determine whether or not a need (determination that dumping is occurring and is causing injury) remains for the tariffs. In the case of the antidumping tariffs on cement, which were imposed prior to the WTO agreement, the requisite sunset review was to start in August 1999 (Dorn, 1999), with determinations from the Department of Commerce (as to whether dumping would continue if the tariffs were revoked) and the U.S. International Trade Commission (as to whether the U.S. cement industry would suffer injury if cement were dumped) expected in mid- to late 2000.

In terms of Government funding of construction projects, the cement industry was anticipating much higher spending levels in 1999 on road and related infrastructure repair and construction as a result of the signing into law in June 1998 of the Transportation Equity Act for the 21st Century (TEA-21). This law authorized $216.3 billion in funding for the 6-year period 1998 to 2003 for the purpose of upgrading the country’s transportation infrastructure. The level of funding exceeds previous spending levels by about 44% on a State average basis, and the bill contains substantial funding guarantees. Funding provided for various facets of highways, including new roads and bridges and existing infrastructure upgrades and repair, totals about $173 billion, of which about 95% is guaranteed. Estimates vary as to how much added cement consumption will result from full-level TEA-21 spending; most of the studies have agreed on the range of 6 to 8 million metric tons per year (Mt/yr) (e.g. Kasprzak, 1999). Again, this is at full funding levels; it was recognized that much of the Federal funding will be through State-operated and cofunded projects, subject to State funding or authorization delays and project design lag times.

Environmental Issues.—Cement production involves both mining and manufacturing processes. In the United States, almost 140 Mt of nonfuel raw materials are directly or indirectly mined (see table 6) each year for cement manufacture, generally from open pit operations close to the cement plant. Environmental issues affecting this activity are mostly local and common to most surface mines and include potential problems with dust, increased sediment loads to local streams, noise, and ground vibrations from blasting. Of greater concern, however, are the environmental impacts of the cement manufacturing process itself, most of which stem from the manufacture of clinker. In 1999, U.S. clinker kilns burned about 14 Mt of fossil and/or other organic fuels (table 7) in the pyroprocessing of calcareous and other rocks to form clinker minerals.

In the debate over climatic change, the impact of greenhouse gases on atmospheric warming is a major issue. The most common greenhouse gas is carbon dioxide (CO_2), and fuel combustion and calcination of carbonate (limestone) feed in the clinker kilns both generate large quantities of this gas; calcination basically through the equation: $CaCO_3 \rightarrow CaO + CO_2\uparrow$. Although precise determinations of the CO_2 emissions by the U.S. industry are as yet unavailable from the companies themselves, reasonable (within 5% to 10%) estimates of the emissions for the industry overall can be made on the basis of certain assumptions of the composition of the raw materials and fuels consumed and of the clinker produced; these assumptions are explained more thoroughly in recent past editions of this report. Assuming an average lime (CaO) content in clinker of 65.0% and, importantly, that all of the CaO is derived from $CaCO_3$, the calcination reaction releases 0.51 ton of CO_2 per ton of clinker. The emissions from fuel consumption are more complicated, given that many of the common fuels have a wide range of carbon contents and the amount of fuel consumed is kiln technology-dependent (wet kilns burn more fuel than dry kilns). But on the basis of the mix of fuels shown in table 7, the combustion component may be estimated at 0.44 to 0.5 ton of CO_2 per ton of clinker. Thus, as a first approximation, a total of about 1 ton of CO_2 is released per ton of clinker produced. Adding a few percent gypsum in the grinding plant would reduce this emissions factor slightly on a straight portland cement (produced) basis, and it would be significantly less, depending on the actual amount of cementitious and/or plastic additives used in the recipe, for blended cements and masonry-type cements because the additives do not involve a release of CO_2 by the cement industry. By using the clinker data in table 5, release of CO_2 by cement manufacture in the United States is estimated at about 77 Mt in 1999. Also, U.S. cement plants consumed electricity (table 8) equivalent to about 7 to 8 Mt of CO_2, but this “emission” generally would be assigned to the electrical power industry.

The concern of the cement industry with CO_2 emissions continues to be the possibility that the Government will seek to reduce emissions by such means as the imposition of carbon taxes, enactment of emissions quotas, or requiring low(er) emissions production technologies. At the United Nations Framework Convention on Climate Change held in December 1997 in Kyoto, Japan, measures were agreed to that would have so-called developed countries reduce their emissions of greenhouse gases to levels below those of 1990; for the United States, the Kyoto Protocol reduction requirement for CO_2 was 7% below 1990 levels, to be achieved by 2012. Current U.S. emissions of greenhouse gases are substantially higher than the 1990 levels, although estimates of the margin vary. The U.S. Environmental Protection Agency (EPA) indicated a margin of about 11% in 1998; the EPA data suggest that if the 1990-98 growth trend continues unabated, by 2012 the margin for CO_2 would be in the range of 20% to 35% (U.S. Environmental Protection Agency, 2000). Consequently, the Kyoto targeted reduction for the United States is substantial. At least initially, developing countries would be encouraged, but not required, to reduce their emissions of greenhouse gases. Although the United States signed the Kyoto Protocol in November 1998, Congress has yet to ratify the agreement, which is nonbinding until this happens. Detailed methodologies were being developed by the Intergovernmental Panel on Climate Change (IPCC) to estimate, on a national basis (but adaptable to specific plant use) the amount of CO_2 and other greenhouse gases emitted by cement and other industries, based, to the degree possible, on readily obtainable product output data.

These methodologies, to augment those published earlier (Intergovernmental Panel on Climate Change, 1997), were expected to be released in 2000.

A review of the Kyoto Protocol and its implications for cement companies is given in Nisbet (1999). One implication is that mandated reductions in CO_2 could lead to substantially higher cement production costs, which would make U.S. cement, absent protective tariffs, increasingly uncompetitive against imports from countries lacking mandated emissions reductions. For the U.S. cement industry, mandated major reductions in CO_2 emissions could require the shutdown of a number of older plants, especially those operating wet kilns, and/or the upgrading of plant equipment to more efficient technologies. Upgrading, for various reasons, is already underway at many plants, but is an expensive process. Mandated emissions reductions could force plants to burn less carbon-intensive fuels; for example, natural gas rather than coal. Many U.S. cement plants are already able to switch among a variety of fuels, but large-scale shifts of cement plants and other fuel-intensive facilities (e.g. powerplants) to natural gas could lead to local shortages and price increases for that fuel. An alternative emissions-reduction strategy, market permitting, would be to increase the output of blended cements and perhaps to allow the addition of small amounts of inert extenders (as bulking agents) in straight portland cement. Either strategy would reduce the clinker (and hence emissions) component of the finished cement, which in turn would reduce total emissions by the cement industry or at least constrain emissions increases if cement demand (and output) grows. A major shift to blended cements could lead to local shortages of suitable pozzolans as well as increased prices for them. The U.S. concrete industry is itself a significant direct consumer of pozzolans, which are used as a partial substitute for portland cement in ready-mixed and some other concrete mixes.

Another approach to reducing emissions from clinker manufacture is to use a noncarbonate source for some of the CaO in the kiln feed. A process patented by Texas Industries, Inc. (TXI) and known as CemStar makes use of substitution for some of the kiln feed by low cost ferrous, particularly steel, slag. As noted in a review by Perkins (2000), the slag, apart from merely supplying needed CaO (and SiO_2, and Fe_2O_3) from a noncarbonate source, already has a mineralogy similar to clinker. Its addition is said to produce a weight of clinker equivalent to that of the slag. Further, because the slag melts easily (and at relatively low temperature) and reacts exothermally, its use lowers the overall fuel consumption by the kiln. These factors combine to reduce the overall residence time in the kiln and increase clinker output by as much as 10% or more, with commensurate reductions in unit CO_2 emissions. The process has been licensed to a number of plants.

Another major waste product of clinker manufacturing is cement kiln dust (CKD), made up of fine particles of clinker, incompletely reacted raw materials and solid fuels, and material eroded from the kiln's refractory brick lining. In the U.S. industry, virtually all CKD is captured and/or recycled. On a national average, about 70% is recycled to the kilns as part of the raw meal, and another 5% or so is used for other purposes, commonly as a soil conditioner (liming agent) or for road bases, or in the product line as additives in masonry cements or even as a pozzolan. The remaining CKD is removed to landfills; this is required for CKD that contains contaminants (e.g., excessive alkalis, chromium, vanadium, and toxic organic compounds) at concentrations that preclude recycling. On August 20, the EPA published revised CKD regulations pertaining to the handling and storage of CKD (U.S. Environmental Protection Agency, 1999b); the cement industry successfully petitioned for an extension to the public comment period to mid-February 2000. Weiss (2000b) provides a cement industry commentary on the regulations.

Government proposals to reduce cement industry emissions of nitrogen oxides (NOx) and sulfur oxides (SOx), dioxins and furans, and other contaminants are of concern to the industry, particularly because changing emission limits may necessitate changes in testing procedures, equipment, and operating practices. These limits also affect the ability of plants to use waste fuels cheaply because the emissions are largely a function of fuel type and combustion conditions within the kiln. The Government has for some years been moving towards regulating kiln emissions of hazardous air pollutants (toxic metals, dioxins, furans, and other toxic organic compounds) within the regulatory National Emission Standards for Hazardous Air Pollutants (NESHAP) framework, which set forth emissions limits and monitoring methods based on the average of those of the least polluting plants. On June 14, the EPA published the NESHAP for portland cement (U.S. Environmental Protection Agency, 1999a); the regulations would apply immediately for new or reconstructed plants and in mid-June 2002 for existing plants. Petitions for review to the NESHAP were filed in August by cement and lime industry associations as well as by environmental groups. An EPA rule to dramatically lower the threshold reporting limits for emissions of persistent bioaccumulative toxics (PBTs), was approved late in the year by the Office of Management and Budget but was undergoing further review by the EPA at yearend. Pleus (2000) gives a more detailed review of cement plant strategies to manage toxic compound emissions. A general review of the foregoing and other environmental issues facing the cement industry is given by Weiss (2000a).

Production

Portland and/or masonry cement was produced at 118 plants in 1999, although the yearend plant count stood at 119 as a result of a new plant coming on-line in December. The cement plants were in a total of 37 States and in Puerto Rico and, with the exception of 1 State-owned facility, all were in the private sector. At yearend 1999, about 68% of U.S. cement production and capacity was foreign owned. In addition to the cement plants, there were some granulated blast furnace slag grinding plants, not covered in this report, that have the potential to grind clinker and so make portland cement.

One new cement plant opened in 1999, and one plant reopened after an 18-month hiatus. Plans were also announced for two new plants to be built. In December, Florida Rock Industries, Inc. brought on-line its new 0.68-Mt/yr integrated plant at Newberry, FL (Cement Americas, 2000b); full production levels were expected to be reached in 2000. The plant operates a single dry kiln. Noting the explosive growth in cement consumption in the State and the high percentage of demand currently being met by imports, the company applied for permits to build another 0.68-Mt/yr plant, this to be at Brooksville, FL (Cement Americas, 1999e), and mooted plans for yet a third plant of the same size in the State. Suwannee American Cement Co. applied for permits to build a 0.68-Mt/yr integrated plant near Branford, FL; the facility was planned to come on-line in 2001 or 2002 (World Cement, 1999d). Florida Crushed Stone Co. revived plans for an additional kiln line at its Brooksville, FL, plant (Cement Americas, 1999e). Holnam, Inc. announced that it had purchased extensive property along the Mississippi River in St. Genevieve Co., MO, and would begin a feasibility study for a greenfields 3-Mt/yr- plant there (Cement Americas, 1999d). In August, Royal Cement Co., Inc. resumed production at its integrated plant in southern Nevada; the facility had been closed since March 1998.

Plant upgrades were underway or being initiated at a large number of U.S. cement plants; the upgrades were to increase capacity and/or improve production efficiencies and environmental performance. Among the major capacity expansion projects announced or completed during the year, Southdown, Inc. completed its 0.159 Mt/yr capacity expansion (to 0.694 Mt/yr) project at its Clinchfield, GA, facility (Southdown, Inc., 1999b). The company awarded a contract during the year for the upgrade, to 1.6 Mt/yr capacity, of the kiln line at the Kosmos Cement plant in Louisville, KY; the plant is joint ventured with Lone Star. The kiln line was expected to be operational in mid-2000 (International Cement Review, 1999a). Plans were approved to add another kiln line at the company's plant at Victorville, CA, to expand capacity to 2.8 Mt/yr by mid-2001, and a smaller project, to expand the Charlevoix, MI, plant's capacity by 0.12 Mt/yr, was also approved (Portland Cement Association, 1999a). Work commenced in 1999 at Ash Grove Cement Co.'s plant at Chanute, KS, to expand capacity to 4,200 metric tons per day (t/d) of clinker; the project was expected to be completed by mid-2000 (World Cement, 2000). A contract was awarded by RC Cement for a new 2,000 t/d cement line at its Signal Mountain plant in Tennessee (World Cement, 1999a). In August, Holnam, Inc. resumed its feasibility study and then approved a project to build a new, dry, kiln line at its Holly Hill, SC, plant. The new line would almost double the plant's capacity to 2 Mt/yr (International Cement Review, 2000). Also, Holnam began work at its Florence, CO, plant to more than double capacity to 1.9 Mt/yr by 2001 (Cement Americas, 1999c). Holnam's sister company, St. Lawrence Cement, Inc., began work on a grinding plant at Camden, NJ. The facility was to grind imported granulated blast furnace slag for sale, primarily, to ready-mixed concrete companies as a cement extender. Initial design capacity was 0.5 Mt/yr, with the potential to be doubled. The plant was expected to start grinding in early 2000 (World Cement, 1999a). Work was underway at Lafarge Corp.'s Sugar Creek plant in Missouri. The upgrade included a new limestone mine, unusual because it will be underground. The mine was expected to start production in mid-2000, with the new 2,350 t/d line coming on-line a few months later (World Cement, 1999b).

Upgrade work began at Lone Star, Inc.'s Greencastle, IN, plant, to increase kiln capacity from 0.680 Mt/yr to 1.17 Mt/yr. The project was unusual because it involved a conversion from wet kiln to semidry, rather than dry, pyroprocessing technology. When completed in mid-2000, Greencastle would be the only plant in the country with a semidry kiln line (Mining Engineering, 2001). National Cement Co. completed its upgrade, from long dry to short preheater type, of the kiln at its Lebec, CA, plant, thereby realizing a 60% capacity increase to 0.9 Mt/yr (World Cement, 1999c). The company announced that it was planning to increase the grinding capacity of its Ragland, AL, plant to 1.4 Mt/yr (Portland Cement Association, 1999d). Lehigh was upgrading its Union Bridge, MD, plant by replacing the existing four kilns with a single kiln of 5,000 t/d capacity (World Cement, 1999f). Capitol Aggregates, Ltd., early in the year commissioned its project to upgrade the preheater/precalciner at its plant in San Antonio, TX, thereby achieving a 33% capacity increase to 1,650 t/d (World Cement, 1999e). Blue Circle America Inc. announced plans to double the capacity of its Calera, AL, plant to 1.5 Mt/yr; the project was expected to be completed in 2002 (Portland Cement Association, 1999e).

Recognizing the continuing importance of imported cement, several companies were either buying or building import terminals for ships. As mentioned earlier, Southdown acquired existing terminals in Brunswick, GA, and Mobile, AL. Blue Circle Cement, in joint venture with Kinder Morgan Energy Partners LP, commenced constructing a large cement terminal at an existing Kinder Morgan facility at the port of Charleston, SC; the terminal was to become operational in 2000. Storage capacity was planned at 82,000 t (Cement Americas, 1999a). Lafarge Corp. opened a cement terminal, of 33,000 t capacity, in south Chicago (Portland Cement Association, 1999b). Giant Cement Holding, Inc. purchased a deepwater terminal at Portsmouth, VA (Portland Cement Association, 1999c).

Portland Cement.—In the United States and Puerto Rico, portland cement was manufactured in 1999 at 116 plants out of 117 claiming clinker-grinding capacity (the remaining plant only reported masonry cement production). Six of the portland-producing facilities were dedicated clinker-grinding plants; some of these also ground slag. The regional distribution of these plants, cement production and capacities, and yearend cement stockpiles are listed in table 3.

Production of portland cement rose 2% in 1999 to about 81.6 Mt, a new record but still well below total consumption (table 9). The production shortfall was met by a large increase in imports (tables 18-22); indeed, the ready availability of imported cement allowed some cement (clinker-grinding) capacity to be used instead to grind granulated blast furnace slag. As shown in table 3, production increases were noted in about two-thirds of the districts. The top five producing States continued to be, in descending order, California, Texas, Pennsylvania, Michigan, and Missouri.

Reported cement capacity increased 3.6% to 97.6 Mt, reflecting capacity upgrades at a number of facilities and the inclusion of the Florida Rock Industries plant that came on-line in December. Capacity utilization was everywhere at generally very high levels. The apparent poor performance by Florida is an artifact of Florida Rock Industries' yearend capacity not being balanced by actual production during the year. The facility's yearend startup is also the chief reason for the slight fall in the national utilization average in 1999, to 83.6%. The capacity utilization statistic is somewhat misleading because it is calculated using only the production of portland cement, whereas the grinding capacity itself includes that for masonry cement. If masonry cement production (table 4) is included, capacity utilization in 1999 climbs to 88.1%, compared with 89.1% for 1998. Given the fact that reported capacities take into account shutdowns only for routine maintenance, the capacity utilization rates shown are likely at or close to full practical operational levels. As usual, district and National grinding capacities generally exceed the corresponding clinker production capacities shown in table 5. This reflects the fact that it is relatively easy and inexpensive to add grinding capacity to allow the use of imported clinker, and the fact that some plants grind but do not produce clinker. In the case of Michigan, the exceptionally large excess grinding capacity also reflects restricted cement-shipping capabilities of one plant during the winter—all of its cement must be made (ground) and shipped during the open water months.

A few districts showed declines in grinding capacity. If real, these declines likely represent temporary shutdowns during upgrade projects, the permanent closure of obsolete grinding equipment, and a transfer of some capacity to slag-grinding.

Portland cement stockpiles at yearend 1999 were 0.9 Mt higher than at yearend 1998, but the significance of this change is unclear. The yearend date has no particular market significance, and shifts in stockpiles can result from changes in sales volumes, delays in arrival or offloading of imported cement, buildups and drawdowns related to planned shutdowns of mills for maintenance and/or upgrades, and the coming on-line of new or upgraded capacity. An increase in stocks could also include mass changes associated with conversion to other types of cement, such as a "straight" portland cement being converted to a larger tonnage of blended or masonry cement. Finally, stockpiles appear to be prone to accounting inconsistencies, as evidenced by the fact that, for many facilities, December 31st stocks for one year do not equate to January 1st stocks for the next year.

Data are not collected on the production of specific types of portland cement (e.g., Type I vs. Type III), but it is likely that production by type, at least of the major varieties, is proportional to the reported shipments by type shown in table 16. Assuming this to be true, production of gray portland cement Types I and II in 1999 again accounted for about 90% of total output.

Portland cement producers in the United States ranged from companies operating a single plant with less than 0.3% of total U.S. capacity to large, multiplant corporations having in excess of 15% of total capacity. The ranking of these companies in terms of production and capacity is complicated by the fact that some companies are subsidiaries of common parents and some plants are jointly owned by two or more companies. Linking those companies having common parents under the larger subsidiary's name, and apportioning the joint ventures, the top 10 companies in 1999 were, in descending order of production, Holnam; Southdown; Lafarge; Lehigh; Blue Circle; Ash Grove; Essroc Cement Corp.; RC Cement; Lone Star; and California Portland Cement Co. These, combined, accounted for about 72% of U.S. portland cement production capacity in 1999; of these top companies, all but Southdown and Ash Grove were foreign owned as of yearend.

Masonry Cement.—As shown in table 4, production of masonry cement in 1999 rose 9.7% to 4.4 Mt; this increase was similar to that experienced in 1998. Unlike the case with portland cement, production of masonry cement was in balance with consumption (table 9), although both sets of data underrepresent true levels because masonry cement—particularly the portland lime variety—is easily blended at the job site using purchased portland cement and lime. The strong increase in masonry output reflected continued strength in the housing construction market. Masonry cement was reported manufactured in 76 plants in 1999, significantly fewer than in 1998. The reason for this decline is unclear, although the growth shown in some districts may represent rationalization of production among plants owned by the same company; some plants reported significant production increases in 1999. Similarly, the growth in yearend stockpiles shown may indicate greater reliance of supply on material resident at central terminals. In 1999, about 93% of masonry cement was made directly from clinker rather than from finished portland cement; this ratio has changed very little in recent years.

Clinker.—Another record was reached in 1999 as clinker production rose 2% to 76.0 Mt. The increase was spread over a majority of districts; only a few (Maine and New York; Indiana; Iowa, Nebraska, and South Dakota; Maryland; Alabama; Arkansas and Oklahoma) showed declines, mostly small. District-level information on clinker production, capacity, capacity utilization, and yearend stockpiles is given in table 5. Including those in Puerto Rico, clinker was produced by a total of 111 integrated cement plants, operating 201 kilns. Two-thirds of the plants used dry-process kiln technology.

The top five clinker-producing States continued to be, in descending order, California, Texas, Pennsylvania, Missouri, and Michigan. Depending on the ownership combinations used, the top 5 companies had about 42% of total U.S. clinker production and capacity, and the top 10 companies had about 70% of both. In terms of ranked clinker production, the order of the top 10 companies is ownership-dependent. Consolidating companies having the same parent corporations, and apportioning joint ventures, the rank of companies was, in declining order of clinker production, Holnam, Southdown, Lafarge, Lehigh, Ash Grove, Blue Circle, Essroc, RC Cement, Lone Star, and TXI.

Apparent annual clinker capacity rose 3.8% to 85.8 Mt. Capacity utilization, overall, fell slightly to 88.5% (from 90.1% in 1998); few districts had utilization levels below 85%. The low utilization rate in Florida (73.3%) was artificial because of the inclusion of Florida Rock Industries, a new facility that only started production in December. With few exceptions, the clinker capacity utilization rates in table 5 show an industry at full practicable output levels.

Small percentage variations over the years in annual capacity utilization are of little statistical significance because the utilization statistic is heavily dependent on how the component plants report their kiln downtimes. For each kiln, apparent annual capacity is calculated as the daily capacity multiplied by the normal operating year, which in turn is defined as 365 days minus the days of downtime for routine maintenance. The differentiation by the plant of downtime for routine maintenance from that for other reasons (including plant upgrades) is critical, but this reporting is prone to errors. As with the 1997 and 1998 surveys, plants originally reporting more than 30 days of routine maintenance downtime on a kiln in 1999 were contacted to verify the correctness of the data. In most such cases, the reported routine maintenance downtimes had been overstated and the "other" downtimes had been understated; corrected distributions were then obtained. When the routine maintenance is overstated, the apparent (calculated) annual capacity will be too low and the utilization rate too high. Plants that reported 30 or fewer days of routine downtime were assumed to have reported correctly, but this may not, in fact, be the case. Apart from these considerations, the daily and annual capacity data in table 5 are particularly vulnerable to propagation of rounding errors.

In 1999, average plant capacity was 0.79 Mt, up 2.5% and average kiln capacity was 0.43 Mt. Plants operating only dry process kilns produced 73.7% of the clinker (table 7), those operating only wet kilns had 24.5% of total output, and plants operating both types of technology accounted for the remainder. These ratios are substantially unchanged from those in 1998.

Data on clinker stockpiles, first collected (but not shown) with the 1998 survey, are shown in table 5 (for 1999) for the first time. Yearend 1999 stockpiles amounted to 3.8 Mt, up from 2.9 Mt at yearend 1998. As with cement stockpiles, the significance of stocks on any particular date is debatable. Clinker stocks are accumulated by plants ahead of planned kiln shutdowns so that the grinding circuits can be kept running; the timing of these shutdowns varies. Clinker is also imported at varying times. Overall, the amount of clinker produced in the United States, plus that imported (table 22), was in balance with that needed for the U.S. output of portland and masonry cements, even accounting for the apparent growth in clinker stockpiles.

Raw Materials and Energy Consumed.—The nonfuel raw materials used to produce clinker and cement are shown in table 6. Limestone and other calcareous rocks made up about 81% of the total raw materials mix. As in previous years, approximately 1.6 to 1.7 tons of raw materials, including 1.3 to1.4 tons of calcareous rocks, was consumed per ton of cement produced. The mass ratios among various major raw materials and the ratios of these materials to clinker and cement produced were essentially the same for 1999 and 1998. The categorization of materials under headers like "Calcareous" and "Siliceous" is to some degree artificial because many of the raw materials provide more than one oxide. Shales, for example, are shown as contributors of alumina (Al_2O_3), but are also important sources of silica (SiO_2) and iron (as Fe_2O_3), and, to a lesser degree, CaO. Ferrous slags provide a lot of silica, but also can be an important source of calcium oxide and iron. Fuel materials (table 7) can provide some of the nonfuel feed components as well as heat. In particular, coal can provide silica (from the ash content) and iron and sulfur (from pyrite); sulfur can also be provided by fuel oil, petroleum coke and natural gas. Steel belting in waste tires can supply iron.

The splitouts shown in table 6 between raw materials used to make clinker from those added subsequently in the finish grinding mill to make cement represents a differentiation that was not available prior to the 1998 survey. The differentiation is primarily of environmental interest; materials used to make clinker are burned in the kiln and are associated with various chemical changes and emissions; those used in the finish mill are merely comminuted. However, the industry remains not yet fully accustomed to provide data split out this way. In particular, the substantial increases for some of the raw materials—particularly the calcareous feeds—in the "Cement" column in 1999 probably represent improved reporting rather than actual significant increases in use for finished cement. Thus, for example, the limestone and cement rock (2.6 Mt) in the 1999 "Cement" column would be in reasonable balance with the output of 4.4 Mt of masonry cement (table 4) using common masonry cement recipes, whereas these materials were clearly underreported (including material shown as "Withheld") in the 1998 column. Some materials appear to be still underreported. In particular, lime for "Cement" in 1999 probably is still too low. Given the fact that many kiln lines (especially dry process) automatically recycle cement kiln dust (CKD) to the kilns, the amount of CKD shown in the "Clinker" columns is substantially too low; the industry does not routinely measure this material flow. In contrast, the use of CKD for "Cement" (either in masonry cement or as a pozzolan in blended cement), may be approximately correct.

The siliceous materials category includes a number of cementitious or pozzolanic additives, but some of these appear to be out of proportion to the likely production of blended cements, as evidenced by cement sales (table 16). In the case of ground granulated blast furnace slag (GGBFS), the volume of slag shown as consumed to make cement exceeds the volume of slag-blended cements sold, whereas it should be in the range of approximately 15% to 50% of the sales (as proxy for production) volume. The explanation for the excess slag is that this material is commonly also used in the finish grinding mills as a grinding aid for ordinary portland cement (e.g. Type I); some States allow the inclusion of a small amount (1% to 3%) of GGBFS for this use or as a cementitious extender within the straight, as opposed to blended, portland cement designation. The volume of natural pozzolans consumed (including some within the "Other pozzolans" category) appears to be underreported relative to natural pozzolan blended cement sales. On the other hand, the "cement" use of fly ash (1.4 to 1.5 Mt) appears to be in balance with fly ash-blended cement sales. It is clear that most of the overall consumption of fly ash by the cement industry is as kiln feed. However, given that the American Coal Ash Association (1999) reports that the cement and concrete industries (combined) consumed about 10 Mt/yr of fly ash for the period 1998-99 (including about 1.2 Mt indicated as being for clinker), it is clear that the major consumer of this material is the concrete industry itself, likely as a pozzolan extender. The growing use of steel furnace slag as kiln feed appears to reflect the increasing popularity of the CemStar process developed by TXI, discussed in the Environmental section above.

Table 7 shows the consumption of fuels by type of kiln process. Many cement plants can switch fairly easily among a variety of primary fuel types and many routinely burn a mix of fuels. Coal and coke consumption increased only slightly in 1999, but the use of petroleum coke, waste tires, and other solid wastes showed significant increases. The increase in fuel oil consumption appears to have offset the decrease in consumption of liquid waste fuels. As in past years, liquid waste fuels were used mostly by plants operating wet process kilns.

Electricity consumption by the cement industry is given in table 8, differentiated by process type. Both wet process and the more electricity-intensive dry process plants show a slight reduction in 1999 in unit electricity consumption, which may reflect improved efficiencies at a few plants.

The reduced unit electricity consumption by grinding plants in 1999 could represent either improved efficiencies, the grinding of relatively more clinker vs. harder-to-grind granulated blast furnace slag at facilities handling both materials, or better differentiation of power consumption of clinker (vs. slag) grinding facilities by the survey respondents.

Consumption

Consumption of portland and masonry cements is shown as (total cement) apparent consumption in table 1, and as sales to final customers in tables 9 and 10. As noted in the Introduction, apparent consumption of portland plus masonry cement rose 5.2% in 1999 to 108.9 Mt. Although apparent consumption is a standard statistic for comparing consumption of cement to that of many other commodities, the measure of consumption preferred (because it is available monthly and the data are sourced directly from the cement companies) by the cement industry for its market analyses is that of cement sales or shipments to final customers. Shipments from one cement producer to another are not counted; the materials are considered to have been sold when the receiving cement producer transfers it to a final customer. Likewise, shipments between plants and terminals within a single company are not counted. The definition of final customer is left to the reporting cement producer, but is generally understood to include concrete manufacturers, building supply dealers, construction contractors, and the like. The designation ignores the possibility that a customer might put some cement into stockpiles extending beyond yearend or might resell cement to other users. No data on such storage or transfers are available, but they are believed to be small, probably no more than 5% of any single month’s shipments, and would likely balance out over a period of months.

The USGS collects data monthly on the shipments of cement to final customers by State of destination and by State or country of origin; that is, manufacture. The monthly destination data are the best available for cement consumption in the United States and are shown totaled for 1998 and 1999 in tables 9 and 10. The annualized portland data for 1998-99 include data for blended cements; however, these are listed separately on the monthly surveys themselves.

Tables 11 through 16 list various data on, or derived from, shipments of cement reported by cement producers and import terminals as canvassed in the annual surveys. Some of the data, especially those in tables 12 and 13, look superficially similar to the data in tables 9 and 10, but there are important differences between the two data sets, particularly for portland cement. As discussed in the Introduction, there are significant differences in total U.S. portland cement sales between the two table sets. Tables 9 and 10 show the larger totals and these data are believed to be more complete (especially regarding imported cement) and thus a better measure of true consumption levels. Also, tables 9 and 10 show the true location of the sales (customers) for the cement; however, the cement could have been sourced elsewhere. In contrast, the regional information in tables 12 through 16 reflect the location of the reporting facilities, not the customers. As an example of the interpretational differences between the two data sets, customers in Florida are shown as having consumed 7.09 Mt of portland cement in 1999 (table 9), but Florida cement plants are shown as having shipped 6.79 Mt of portland cement to final domestic customers (table 12), not necessarily all in Florida. This shows Florida to be a net importer of portland cement. Missouri is shown as consuming 2.59 Mt of portland cement in 1999 (table 9), and Missouri plants shipped 6.38 Mt (table 12) of portland cement to customers, including those out of State. Missouri was thus a net exporter of portland cement. There is far better numerical agreement between total U.S. masonry cement sales among the two table types; this reflects the trivial import component of masonry cement sales and the more local consumption pattern of this type of cement.

National Consumption.—Portland cement consumption grew 5.0% in 1999 to a new record of 104.2 Mt (table 9). The cement import component of this grew 23.4% to 22.5 Mt, or almost 22% of total consumption. However, this understates the importance of imports, because some of the cement produced in the United States was, in fact, ground from imported clinker. Clinker imports totaled almost 4.6 Mt (table 22) in 1999, equivalent to an additional 4.8 Mt of portland cement. Not counting the apparent growth of clinker stockpiles noted earlier, the portland (equivalent) import dependence is thus closer to 25%. Masonry cement consumption reached a record 4.4 Mt in 1999, up 6.1%; the import component of this was minor.

Cement being a key material of the construction industry, growth in cement consumption reflects trends in construction spending. Compared with levels (revised) in 1998, construction spending overall increased by 3.2% in 1999 to $692.5 billion (constant 1996 dollars), according to U.S. Census Bureau data quoted by the Portland Cement Association (2000). Within this total, residential construction grew by 6.0% to $315.8 billion, of which single-family dwellings accounted for $201.2 billion, up 6.6%. This growth reflected continued very low mortgage rates, and followed a 10.9% spending increase in 1998 relative to levels in1997. Private nonresidential construction fell 1.5% to $175.0 billion in 1999, compared with a 6.5% growth in spending in 1998. The decline in 1999 was largely because of a 17.2% drop in industrial spending to $31.2 billion, compared with growth in this subsector in 1998 of 6.5%. In contrast, office construction grew 5.9% to $41.6 billion, compared with 18.7% growth in 1998; and other commercial construction grew 2.4% to $51.1 billion in 1999, compared with an essentially stagnant 1998. Public sector construction grew by a modest 4.4% in 1999 to $156.9 billion, compared with a 0.5% increase (trend revised) in 1998. The important road construction component of this rose 6.3% to $48.8 billion, following an 8.0% rise in 1998. This modest increase in road construction spending was of concern, as it (and related construction) had been expected to increase more than this owing to the 1998 passage of TEA-21, which mandated large increases in highway funds for road repairs and improvements, averaging about 44% per State. It was evident that much of the TEA-21 funding had yet to materialize, at least in part due to delays in State funding of projects that involved joint funding sources.

As in recent previous years, the growth rate in overall construction spending in 1999 was less than that of cement consumption (in tons). This can partly be attributed to the modest cement prices increases (see Values section below), but is mainly due to a recent trend of more cement being consumed per dollar of construction spending. The reasons for this improved “penetration rate” of cement are not entirely clear, but may reflect promotional efforts by the cement and concrete industries.

State-level consumption is shown in table 9. All but a dozen States showed portland cement consumption increases in 1999 and about 40% of the States showed increases of 5% or more relative to levels in 1998. Overall, however, the percentage increases tended to be smaller than in 1998. In terms of portland cement, the 10 largest consuming States were, in declining order, California, Texas, Florida, Ohio, Illinois, Michigan, Pennsylvania, Georgia, Arizona, and North Carolina. Of these, only Georgia showed a decrease for the year. As will be discussed in the Cement Customer Types section below, most portland cement was sold to various concrete companies.

Masonry cement consumption was up in all but a few States, but the data are not as useful an indicator of true consumption as those for portland cement because it is not uncommon for masonry cement—particularly portland lime—to be mixed from components at the job site rather than being brought in as a finished product. Also the data exclude the output of a small number of small masonry cement blending plants, which are treated instead as final customers for portland cement.

Table 11 lists portland cement shipments to final customers in terms of transportation method. As in previous years, bulk deliveries by truck directly from plants or via terminals continued to dominate deliveries to customers. In contrast, railroad and waterborne transport were the most important methods of shipping cement from plants to terminals.

Values.—Tables 12 through 14 show mill net values provided by the plants and import terminals for their total shipments to domestic final customers of gray portland cement, white cement, and masonry cement. Because value data are highly proprietary and some companies express misgivings about providing value data of any type, values are not requested for shipments by individual types of portland cement, although the tonnages, by type, are reported and are listed in table 16. No distinction is made between bulk and container (bag) shipments; however, container shipments would be expected to have higher unit values. Except in table 14, data for white cement have been lumped with those for gray portland cement. About one-tenth of the respondents did not provide value data for the 1999 survey. For those respondents, values supplied by other plants in the same market area were averaged and applied as an estimate; the number of plants so averaged varied regionally.

Mill net values, for integrated plants, can be defined as the (sales) value at, or “free on board” (f.o.b.), the manufacturing plant, including any packaging charges, but excluding any discounts and shipping charges to the final customers. For independent terminals, particularly import terminals, the equivalent statistic sought would be the “terminal net” value. In the case of imports, this would essentially represent the “cost, insurance, and freight” (c.i.f.) value of the imports plus unloading and storage costs plus the terminal’s markup.

Given that the values shown contain more than one type of portland cement, and include both bulk and bag shipments, readers are cautioned that the values shown, although unrounded, are merely estimates, and the mill net value is better viewed as a price index, suitable for crude comparisons among regions and over time. Most especially, the unit value data cannot be viewed as regional shopping prices for cement. The data for portland cement are assumed to be dominated by bulk sales of the Types I and II varieties. The average mill net value of portland cement rose 2.2% in 1999 to $77.18 per ton, which, combined with a 6.6% increase in shipment tonnage (per table 12), led to a 9.0% increase in total value of shipments to $7.64 billion. The same average value applied to the larger shipments tonnage in table 9 yields a total value of $8.04 billion, up 7.2%.

Given the large increase in consumption, the small increase in mill net unit value in 1999 is most likely due to the ready availability of large volumes of inexpensive imported cement and clinker. The average c.i.f. price of imported cement and clinker (combined) in 1999 was $49.39 per ton, virtually unchanged from that in 1998, although the volume of imports grew almost 22% (table 18). For gray portland cement alone, import volumes rose almost 25% but the average unit value fell 1.9% to $47.77 per ton (table 20). Another possible constraint on portland cement prices was that ready-mixed concrete companies (customers) were increasingly using a proportion of lower cost pozzolanic extenders in their mixes (Colin Lobo, National Ready Mixed Concrete Assoc., oral commun., 1999), which they would blend themselves, and were thus buying less straight or blended portland cement than they would have otherwise.

Table 13 lists masonry cement sales and values in terms of the location of the reporting facilities. The average unit value of sales reported in table 13 rose 5.3% to $103.19 per ton. Total sales rose 1.4% to $402 million ($449 million for the volume in table 9). It should be noted, however, that the mill net value data for masonry cement contain more component estimates than those for portland and are thus even less reliable.

Table 14 is a summary of cement unit values for the country. The data for white cement should be viewed with caution because there are only a few producers and importers of this product and a significant share of sales to final customers is as (marked up) resales by gray cement companies. Also, white cement involves a larger component of relatively costly package shipments. The 2.9% unit mill net value increase in 1999 to $166.04 per ton is modest compared with the 22.2% increase in c.i.f. unit values for white cement imports (table 21) to $124.84 per ton. By comparison with total sales volumes, by type, in table 16, it is evident that a very high proportion of white cement sales is of imported material, the availability of which appears to have significantly constrained sales price increases.

The only data for domestic delivered prices for cement are those for Type I portland (per short ton) and masonry cement (per 70-pound bag) published monthly by the journal Engineering News Record. The data represent a survey of customers, likely to be ready-mixed concrete producers for portland cement and building supply depots for masonry, in 20 U.S. cities. The 20-city average delivered price in 1999 for Type I portland converts to $87.27 per (metric) ton, up 2.3%. The average price ranged by only $1.92 per ton over the year. The $10.86 per ton difference between the Engineering News Record price and the average mill net unit value in table 14 (gray portland) is an indicator of the approximate average delivery charge. This is a slight increase from the $10.55 differential in 1998 and is likely due to higher gasoline and diesel prices in 1999. The District variations in mill net unit values in table 12 do not correspond well with Engineering News Record values for individual cities, possibly reflecting local transportation (e.g. fuel prices) or other delivery-related variables. The Engineering News Record 20-city average masonry cement price for the year was $4.95 per bag, which literally converts to $155.90 per ton. The large difference in "price" per ton between this and the $103.19 per ton in tables 13 and 14 probably reflects a large component of packaging and handling in addition to delivery charges.

Cement Customer Types.—Data are collected, and shown in table 15, on cement usage in terms of the types of customers to whom the cement is sold, rather than on the direct usage itself. The distinction is that a given customer, though classified by the cement company as one-type of user, might well use the cement for a variety of applications. As with the shipments data in table 12, the regional splitouts are those of the respondents, not the customers.

The data in table 15, as with values, should be viewed as approximations. The main reason for this is that the surveys request more details (user categories) than many respondents are able to provide. In many cases, the companies either do not track their customers by user type at all, or do so only very broadly. However, in 1999, more respondents than before attempted to provide breakout estimates where they lacked hard data, thus saving the USGS the estimation task. A remaining problem is that of overlap or underlap of categories. The most common example of this is where the customer is a ready-mixed concrete producer also engaged in road paving. The dilemma for the respondent is whether to assign the sales to the "Ready-mixed concrete" or to the "Contractors—road paving" category on the form, or whether to attempt an apportionment.

Commonly, responses are provided in exact tonnages that are, however, based on crude estimated percentage breakouts; some of these appear to have been guided by past published tabulations. Further, for cases where estimated breakouts are provided, it is common to skip the minor usage categories; thus, these are underrepresented. Finally, for several user categories, a subset called "Other" is provided on the form to capture true miscellaneous usages, but this subset commonly gets used as a catch-all instead.

Despite these limitations, table 15 clearly shows the dominance of ready-mixed concrete producers in the cement market. Ready-mixed concrete companies purchased about 72 Mt of portland cement in 1999, or about 73% of total sales, and probably overlap to some degree with the almost 6 Mt assigned to road paving companies (table 15, footnote 5) and with the 1 Mt classed within the "Government and miscellaneous" categories. This apportionment is in accord with those of recent past years, as is that of the other major user category tonnages. Although detailed evaluation is equivocal, some comments are warranted. Sales to road paving contractors in 1999 were 29% higher than those listed for 1998, and this is slightly higher as a percent of total sales as well. This is in accord with higher levels of public sector spending on roads during the year, but could in part simply reflect the fact that the "other or unspecified" contractor subcategory shrank by 0.4 Mt in 1999. Sales to building materials dealers increased by about 1.2 Mt or an added 1% of total sales in 1999. This appears to reflect the growth in residential construction noted earlier and the increased tonnage of bag (container) sales noted in table 11. The general category "Oil well, mining, waste" lumps minor categories that are prone to underrepresentation. Nevertheless, the 21% decline in sales to oil (and gas) well drillers (table 15, footnote 6) is curious. The large general increase in crude petroleum prices in 1999 would normally have been expected to have spurred additional exploration drilling but, as evidenced by lower exploration drill rig counts during the year (Oil & Gas Journal, 2000), this did not happen. However, cement recorded as sold to oil well drillers may understate cement use for this activity because shallow wells can use ordinary grades of portland cement, and these grades, for respondents lacking breakout data, are more likely to be assigned to the major user categories. Cement sold to mining companies in 1999 fell 84% to only 0.1 Mt. Although this is in accord with generally low metal prices (particularly for gold) during the year, it is not fully in accord with trends for some commodities (e.g. gold) towards underground mining to access relatively small, high-grade orebodies. Underground mining uses relatively large amounts of cement, commonly mixed with tailings and/or fly ash, as backfill for stopes. Fly ash sales to the mining industry (backfill and grout) fell about 20% in 1999 to about 1.4 Mt (American Coal Ash Association, 1999), so, while this additional evidence of an overall mining decline, the smaller percentage decline for fly ash may also suggest that fly ash is being substituted for portland cement at some mines. In any case, the potential error in the mining use data is high because of the small tonnages involved. The 32% decline in sales of cement for waste stabilization is not statistically significant, again because of the very low tonnages reported and because this category is probably significantly underreported.

Types of Portland Cement Consumed.—Sales to final customers of varieties falling within the broad definition of portland cement are listed in table 16. As in past years, about 90% of sales in 1999 were of the general use categories Types I and II, and Types I through V (the "straight" portland varieties) again accounted for more than 96% of sales. Among Types I through V, there were no significant changes as proportions of total portland sales.

Blended cement sales continued to represent only 1.2% of total portland sales, although the tonnage in 1999 increased 6.5% to 1.2 Mt. This is in line with the proportion of blended cement sales on the monthly surveys and has remained substantially unchanged over the past 5 years despite anecdotal evidence that concrete (particularly ready-mixed concrete) producers have increased their use of cementitious extenders over this period. Evidently, although "blended cement" paste is becoming more popular with the concrete producers and their customers for cost and performance reasons, the concrete companies find it cheaper to do their own blending rather than purchasing blended cements from the cement companies. For the sales shown in table 16, although the total proportion of blended cements has not changed, the ratio among the specific blended cements listed has changed. Sales of blends with GGBFS increased 81%, and miscellaneous blends (with, for example, CKD or silica fume) went up 47%. In contrast, blends using natural pozzolans (e.g. pozzolana, burned shales and clays, diatomite) declined 19%, and those with fly ash declined 27%. With respect to fly ash, the blended cement sales volumes shown would likely only contain 0.10 to 0.15 Mt of actual fly ash—a tiny fraction of the approximately 9 Mt of fly ash (other than for clinker) reported sold to the combined cement and concrete industries (American Coal Ash Association, 1999).

Block and white cement sales increased modestly, which is in accord with a strong residential construction sector during the year. Oil well cement sales fell substantially, in line with reduced drilling levels noted in the Types of Customers section above.

Foreign Trade

Trade data from the U.S. Census Bureau are shown in tables 17 through 22. Exports (table 17) of hydraulic cement and clinker again declined in 1999, and again the unit value of these exports increased, but the overall volume of exports continued to be so small as to be of almost no consequence to the U.S. cement economy. The bulk of the exports continued to be to Canada.

Total imports of hydraulic cement and clinker are listed in tables 18 and 19. Imports rose 21.9% in 1999 to 29.4 Mt (including Puerto Rico), equivalent to 26.5% of total consumption (per table 9). This large increase in imports followed on an almost 37% increase in 1998 and a 24% increase in 1997. After falling about 5% in 1998, the average unit c.i.f. value of imports remained virtually stagnant in 1999 at $49.39 per ton. However, the c.i.f. value in 1999 actually had a larger shipping cost component (due to higher fuel prices), as evidenced by the fact that the Customs value fell 2.4% to $38.99 per ton.

The hydraulic cement component of total imports (data in table 18 minus those for clinker in table 22) was 24.8 Mt, up 24.2%. Gray portland cement imports were 95.5% of this total in 1999, and were up 24.7% (table 20). The c.i.f. value of gray portland imports fell 1.9% to $47.77 per ton in 1999, but the Customs value component of this fell 4.7% to $37.42 per ton; again, the difference between the two values was the shipping (and insurance) cost, which increased almost 10% to $10.35 per ton. Customs values for gray portland imports ranged from $25.01 per ton for cement from Australia to $49.93 per ton from Canada, and c.i.f. values ranged from $39.43 per ton for Mexican cement to $53.51 per ton for Canadian material.

Canada continued to be the largest single supplier of gray portland cement to the United States, at 4.1 Mt, up 8%. China was second, supplying 3.7 Mt, up 11%; and Thailand was third, at 3.1 Mt, up 12-fold. Other major suppliers, in descending order, were Greece, 1.8 Mt, down 6%; Spain, 1.8 Mt, down 12%; Venezuela, 1.7 Mt, up 30%; the Republic of Korea, 1.5 Mt, up almost 36-fold; Colombia, 1.1 Mt, up 16%; and Mexico, 1.1 Mt, down almost 5%. Imports from Mexico were burdened by antidumping tariffs. In terms of major suppliers, c.i.f. prices were lower in 1999 for portland cement from China, Colombia, Greece, the Republic of Korea, and Spain; and higher from Canada, Mexico, Thailand, and Venezuela.

White cement imports grew 22.5% to almost 0.8 Mt (table 21). Imports from Canada fell almost 40% to under 0.2 Mt, dropping Canada from first to third largest supplier to the United States. The largest supplier in 1999 was Denmark, at 0.2 Mt, up 71%; followed by Mexico. Thailand became a significant supplier in 1999.

Imports of clinker were up 10.6% in 1999 to 4.6 Mt, at an average cost of $42.35 (c.i.f.) or $33.64 (Customs). These unit values were up slightly from those in 1998. However, these figures include very expensive aluminous cement clinker from France. If these are subtracted, total clinker imports become 4.4 Mt, up 14%, and at a value of $39.26 per ton (c.i.f.) or $30.59 (Customs); both values were essentially unchanged from those in 1998. Thailand replaced Canada as the largest clinker supplier to the United States, almost quadrupling its sales to just under 2 Mt, while those from Canada fell 26% to 1.2 Mt. Most Canadian imports came into Detroit, and about 64% of the total decline in Canadian clinker sales to the United States could be accounted for by competition at this entry point by material from Thailand and, to a lesser extent, Morocco. Thailand clinker was, on average, much cheaper ($32.28 per ton c.i.f.) than Canadian material ($49.36 per ton); importantly, the Canadian price was much higher than it had been in 1998 ($38.32 per ton).

Imports of cement and clinker, by Customs District of entry, are shown in table 19. New Orleans continued to be by far the busiest entry point, although, for the clinker component alone, Detroit was the busiest port. Much of the material coming into

New Orleans was destined to be transferred onto barges for transport up the Mississippi River system. In terms of serving local markets, the largest cement-importing States were California and Florida.

World Review

Individual country cement production data are listed in table 23. The data for some countries may include their exports of clinker. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may not be all inclusive. Because data for many countries are estimated, the annual world totals (which have been rounded) must be viewed as estimates. World hydraulic cement production increased approximately 4% in 1999 to about 1.6 Gt.

China continued to be overwhelmingly the largest cement producer in the world, with more than one-third of the total. Although precise data are lacking, India appears to have overtaken the United States as the world’s second largest producer, a gain that had been anticipated for some time. Japan remained in fourth place, behind the United States. The remaining top 15 producers were, in descending order of production, the Republic of Korea, Brazil, Germany, Italy, Thailand, Turkey, Spain, Mexico, Russia, Indonesia, and Egypt. The top 15 countries accounted for about 77% of total world production and most of the growth in world production in the 1990's. China’s growth has been dramatic, up about 20% or almost 100 Mt since 1995.

On a regional basis, Asia accounted for about 58% of the world total. This region (other than China) had experienced significant stagnation and/or declines in production ever since the onset of the economic crisis in late 1997. Production and local consumption of cement began to recover slowly in 1999; China’s production increase was large. Much of Southeast Asia had excess cement production capacity and thus surplus material for export at low prices. Europe continued to be the second largest producing region. Western Europe continued to have 12% of total world output and Eastern Europe 2.5%. North America (including Mexico) was the third largest producing region, with 8% of the world total. Latin America and the Caribbean had almost 6% of the world total, and the countries of the former Soviet Union contributed almost 5%. Africa produced only 4% of the world total in 1999, although North Africa has several large (country) producers.

A large number of cement plant construction projects were underway throughout the world, spurred by privatization programs in Asia, Africa, and the former Soviet Union, and the interest of about a dozen major international cement companies headquartered in Europe (one is in Mexico) in expanding throughout the world and in making both their existing and new facilities more efficient and environmentally friendly. Many of the new plants being built were very large.

Outlook

Construction demand for cement was expected to continue strong in 2000 at, however, a more modest rate of growth than in 1999. At yearend 1999, growth predictions for 2000 ranged from about 3% to 6%, based on various scenarios of higher consumption for public sector projects, mainly the long-awaited highway projects related to the TEA-21 program, offsetting reductions in residential construction expected in light of predicted higher interest rates. Medium- to long-term growth in cement annual consumption was expected to be at somewhat lower rates, with even some mild, short duration, declines thought probable.

Various compendia of new plants and/or capacity expansion projects planned or underway total in excess of 20 Mt of new capacity coming on-line by 2005. Whether or not all of these projects come to fruition, significant capacity additions are certain. These additions likely will reduce the need for imported cement unless demand grows well in excess of that expected. As the economies of Southeast Asian countries recover, it can be expected that Asian demand for cement will rise and will reduce some of the surplus production capacity as well as the availability of ships for exporting cement to the United States. Likewise, the price of Asian cement exports to the United States could be expected to rise, especially if fuel price increases cannot be constrained, and if competition for ships raises hiring rates significantly. An import factor of concern to many U.S. cement producers was the outcome of the “sunset” review, expected in 2000, of the antidumping tariffs against Mexico and Japan, and the related pricing remedy against Venezuela. It was unclear if Japan could resume large-scale exports of cement to the United States if the tariffs were dropped, given the closure, for economic and environmental reasons, of numerous cement plants in Japan in the last few years. However, both Mexico and Venezuela were in a position to significantly increase their sales to the United States. Although most U.S. companies were arguing for a continuation of the tariffs, one major initial proponent of the original tariffs, Southdown, Inc., announced in October that it was withdrawing its support for antidumping sanctions (Southdown, Inc., 1999a). Southdown cited its own and overall record sales and overall domestic production shortfalls in recent years, and the dominant domestic producer control of most imports, as evidence that the U.S. cement market no longer needed the tariffs.

Apart from market factors, future growth of U.S. cement production or capacity may be constrained by restrictive environmental regulations that increase production costs or the ability to permit new projects.

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[1]Prior to January 1996, published by the U.S. Bureau of Mines.

TABLE 1
SALIENT CEMENT STATISTICS 1/

(Thousand metric tons, unless otherwise specified)

		1995	1996	1997	1998	1999
United States: 2/						
Production 3/		76,906	79,266	82,582	83,931	85,952
Production of clinker		69,983	70,361	72,686	74,523	76,003
Shipments from mills 3/ 4/		78,518	83,963	90,359 r/	96,857	103,271
Value 3/ 5/	thousands	$5,329,187	$5,952,203	$6,637,464 r/	$7,404,394 r/	$8,083,247
Average value per ton 3/ 6/		$67.87	$70.89 r/	$73.46 r/	$76.45 r/	$78.27
Stocks at mills, yearend 3/		5,814	5,488	5,784	5,393	6,367
Exports 3/ 7/		759	803	791	743	694
Imports for consumption:						
Cement 8/		10,969	11,565	14,523	19,878	24,578
Clinker		2,789	2,402	2,867	3,905	4,164
Total		13,758	13,967	17,390 r/	23,783	28,742
Consumption, apparent 9/		86,003	90,355	96,018	103,457	108,862
World, production e/ 10/		1,445,000 r/	1,495,000 r/	1,547,000 r/	1,545,000 r/	1,606,000

e/ Estimated. r/ Revised.
1/ Portland and masonry cements only, unless otherwise indicated.
2/ Excludes Puerto Rico.
3/ Includes cement produced from imported clinker and imported cement shipped by mills and import terminals.
4/ Shipments are to final customers. Includes imported cement. Data are based on annual survey of plants and may differ from tables 9 and 10, which are based on consolidated monthly shipments data from companies.
5/ Value at mill (or import terminal) of portland (all types) and masonry cement shipments to final domestic customers. Although presented unrounded, the data contain estimates for survey nonrespondents.
6/ Total value at mill or import terminal of cement shipments to final customers divided by total tonnage of same. Although presented unrounded, the data contain estimates for survey nonrespondents.
7/ Hydraulic cement (all types) plus clinker.
8/ Hydraulic cement, all types.
9/ Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in stocks.
10/ Total hydraulic cement. May incorporate clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties further north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties further south.
Chicago, metropolitan	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties further east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties further west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties further east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties further west.
Texas, northern	Angelina, Bell, Concho, Crane, Falls, Houston, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties further north.
Texas, southern	Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties further south.

TABLE 3
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/ 2/

(Thousand metric tons, unless otherwise specified)

District	1998 Plants active 5/	1998 Production 6/	1998 Capacity 3/ Finish grinding	1998 Capacity 3/ Percentage utilized	1998 Stocks 4/ at mills, yearend	1999 Plants active 5/	1999 Production 6/	1999 Capacity 3/ Finish grinding	1999 Capacity 3/ Percentage utilized	1999 Stocks 4/ at mills, yearend
Maine and New York	4	3,236	3,756	86.2	215	4	3,285	3,756	87.5	237
Pennsylvania, eastern	7	4,782	5,156	92.7	185	7	4,710	5,205	90.5	263
Pennsylvania, western	4	1,952	2,168	90.0	130	4	1,980	2,222	89.1	107
Illinois	4	2,691	3,204	84.0	106	4	2,939	3,507	83.8	193
Indiana	4	2,500	2,840	88.0	127	4	2,511	3,052	82.2	190
Michigan	5	5,707	6,980	81.8	325	5	5,813	7,663	75.8	418
Ohio	2	1,113	1,515	73.4	52	2	1,132	1,515	74.7	65
Iowa, Nebraska, South Dakota	5	4,241	5,531	76.7	303	5	4,092	5,452	75.1	342
Kansas	4	1,802	1,805	99.8	84	4	1,974	2,085	94.7	133
Missouri	5	4,569	5,186	88.1	404	5	4,910	5,330	92.1	589
Florida	6	3,472	5,334	65.1	207	7	3,497	6,355	55.0	411
Georgia, Virginia, West Virginia	4	2,734	3,382	80.8	110	4	2,712	3,396	79.8	190
Maryland	3	1,756	1,837	95.6	82	3	1,728	1,837	94.1	97
South Carolina	3	2,640	3,311	79.7	81	3	2,610	3,335	78.3	80
Alabama	5	4,305	4,990	86.3	219	5	4,301	5,005	85.9	267
Kentucky, Mississippi, Tennessee	4	2,364	2,574	91.9	132	4	2,361	2,631	89.8	172
Arkansas and Oklahoma	4	2,598	3,162	82.2	175	4	2,650	3,162	83.8	183
Texas, northern	6	4,114	4,742	86.8	272	6	4,203	4,878	86.2	242
Texas, southern	5	4,319	4,781	90.3	167	5	4,479	4,840	92.6	212
Arizona and New Mexico	3	2,240	2,563	87.4	48	3	2,238	2,336	95.8	83
Colorado and Wyoming	4	2,138	2,445	87.4	163	4	2,128	2,428	87.7	147
Idaho, Montana, Nevada, Utah	7	2,605	3,196	81.5	218	7	2,781	3,306	84.1	222
Alaska and Hawaii	1	251	499	50.2	40	1	254	499	50.9	49
California, northern	3	2,768	2,835	97.6	125	3	2,770	2,862	96.8	159
California, southern	8	7,249	7,888	91.9	306	8	7,519	8,315	90.4	395
Oregon and Washington	4	1,796	2,491	72.1	207	4	1,999	2,598	77.0	238
Total or average 7/	114	79,942	94,170	84.9	4,981 8/	115	81,577	97,568	83.6	5,902 8/
Puerto Rico	2	1,591	1,831	86.9	24	2	1,825	2,065	88.4	34

1/ Includes Puerto Rico.
2/ Includes data for three white cement facilities located in California, Pennsylvania, and Texas.
3/ Reported grinding capacity based on fineness necessary to grind individual plants' normal product mix, making allowance for downtime required for routine maintenance.
4/ Includes imported cement.
5/ Includes one plant that reported portland cement (clinker) grinding capacity, but no production of portland cement.
6/ Includes cement produced from imported clinker.
7/ Data may not add to totals shown because of independent rounding.
8/ Total stocks include inventory, not included on a district basis, held by independent importers.

TABLE 4
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons, unless otherwise specified)

District	1998 Plants active	1998 Production 3/	1998 Stocks 2/ at mills, yearend	1999 Plants active	1999 Production 3/	1999 Stocks 2/ at mills, yearend
Maine and New York	4	108	14	4	122	18
Pennsylvania, eastern	6	202	27	6	219	35
Pennsylvania, western	4	117	16	4	111	13
Indiana	4	W	46	4	W	51
Michigan	5	294	42	5	283	31
Ohio	2	74	18	2	85	17
Iowa, Nebraska, South Dakota	4	W	10	3	W	6
Kansas	3	W	W	2	W	W
Missouri	1	W	W	1	W	W
Florida	4	442	25	4	494	40
Georgia, Virginia, West Virginia	5	343	29	5	370	46
Maryland	3	W	12	3	110	19
South Carolina	3	W	30	3	421	32
Alabama	4	371	44	4	429	56
Kentucky, Mississippi, Tennessee	3	90	10	3	W	W
Arkansas and Oklahoma	4	126	15	4	138	13
Texas, northern	4	124	8	4	153	10
Texas, southern	4	93	8	3	108	7
Arizona and New Mexico	3	W	W	3	W	6
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	2	W	1	--	--	(4/)
Alaska and Hawaii	1	3	1	1	3	(4/)
California, northern	2	W	W	2	W	W
California, southern	3	W	W	4	417	14
Oregon and Washington	3	W	W	--	--	--
Total 5/	83	3,989 6/	412 7/	76	4,375 6/	466 7/

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
1/ Excludes Puerto Rico (did not produce any masonry cement).
2/ Includes imported cement.
3/ Includes cement produced from imported clinker.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding. Includes Districts indicated by W.
6/ Production directly from clinker accounted for almost 94% of the total. Production from portland cement accounted for the remainder.
7/ Total stocks include inventory, not shown on a district basis, held by independent importers.

TABLE 5
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 1999, BY DISTRICT

District	Active plants 1/ Process used Wet	Dry	Both	Total	Number of kilns	Daily capacity (thousand metric tons)	Average number of days routine mainte-nance	Apparent annual capacity 2/ (thousand metric tons)	Produc-tion (thousand metric tons)	Percentage utilized	Yearend stocks 3/
Maine and New York	3	1	--	4	5	10.2	25.0	3,476	3,102	89.2	29
Pennsylvania, eastern	2	5	--	7	14	15.3	21.6	5,148	4,581	89.0	207
Pennsylvania, western	3	1	--	4	8	6.1	24.9	2,093	1,909	91.2	95
Illinois	--	4	--	4	8	8.3	16.1	2,859	2,561	89.6	140
Indiana	2	2	--	4	8	8.5	24.5	2,872	2,481	86.4	94
Michigan	1	2	--	3	8	13.3	19.9	4,562	4,252	93.2	242
Ohio	1	1	--	2	3	3.4	17.7	1,170	1,062	90.8	32
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.6	27.8	4,580	3,893	85.0	201
Kansas	2	2	--	4	11	5.6	30.5	1,880	1,735	92.3	86
Missouri	2	3	--	5	7	14.2	24.0	4,773	4,526	94.8	200
Florida	2	3	--	5	8	11.7	16.5	4,081	2,990	73.3	102
Georgia, Virginia, West Virginia	1	3	--	4	7	10.6	27.7	3,581	2,685	75.0	157
Maryland	1	2	--	3	7	5.5	16.6	1,920	1,635	85.1	34
South Carolina	2	1	--	3	7	8.6	16.9	2,956	2,358	79.8	90
Alabama	--	5	--	5	6	13.6	18.0	4,707	3,990	84.8	189
Kentucky, Mississippi, Tennessee	2	2	--	4	5	6.8	19.6	2,364	2,279	96.4	196
Arkansas and Oklahoma	2	2	--	4	10	7.7	14.6	2,695	2,462	91.3	40
Texas, northern	3	3	--	6	14	12.8	20.6	4,425	4,084	92.3	153
Texas, southern	--	4	1	5	6	13.4	24.2	4,582	4,136	90.3	152
Arizona and New Mexico	--	3	--	3	9	6.5	16.4	2,259	2,226	98.5	113
Colorado and Wyoming	1	3	--	4	7	6.9	16.4	2,379	1,996	83.9	108
Idaho, Montana, Nevada, Utah	3	4	--	7	9	8.5	15.8	2,971	2,652	89.3	149
Alaska and Hawaii	--	--	--	--	--	--	--	--	--	--	37
California, northern	--	3	--	3	3	8.7	23.0	2,969	2,813	94.7	126
California, southern	--	8	--	8	17	25.1	24.2	8,532	7,832	91.8	701
Oregon and Washington	1	2	--	3	3	5.9	24.3	2,002	1,766	88.2	108
Total or average 4/	34	73	2	109	199	251.0	21.3	85,838	76,003	88.5	3,778
Puerto Rico	--	2	--	2	2	5.9	37.5	1,943	1,334	68.6	221

-- Zero.
1/ Includes white cement plants.
2/ Calculated on a per-kiln basis using 365 days minus reported days for routine maintenance multiplied by the reported unrounded daily capacity.
3/ Includes imported clinker and clinker held by importers.
4/ Data may not add to totals shown because of independent rounding.

TABLE 6
RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT
IN THE UNITED STATES 1/ 2/ 3/

(Thousand metric tons)

Raw materials	1998		1999	
	Clinker	Cement	Clinker	Cement
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	87,077	707 4/	91,021	1,138
Cement rock (includes marl)	22,642	W	22,631	1,499
Cement kiln dust 5/	196	W	305	112
Lime 4/	--	16	10	46
Aluminous:				
Clay	4,513	--	4,770	23
Shale	3,726	--	3,679	--
Other (includes staurolite, bauxite, aluminum dross, alumina, volcanic material, other)	443	--	387	--
Ferrous: iron ore, pyrites, millscale, other	1,253	--	1,259	--
Siliceous:				
Sand and calcium silicate	2,834	--	2,959	4
Sandstone, quartzite, other	860	--	745	--
Fly ash	1,432	99	1,521	85
Other ash, including bottom ash	793	--	760	--
Granulated blast furnace slag	--	285	--	349
Other blast furnace slag	--	--	97	--
Steel slag	307	--	591	--
Other slags	75	(6/)	45	--
Natural rock pozzolans 7/	--	52	--	16
Other pozzolans 8/	43	1	38	4
Other:				
Gypsum and anhydrite	--	4,408	--	4,643
Clinker, imported 9/	--	5,016	--	4,607
Other, n.e.c.	369	57	--	51
Total 10/	126,563	10,641	130,819	12,577

W Withheld to avoid disclosing company proprietary data; included in "Other: Other, n.e.c." -- Zero.
1/ Includes Puerto Rico.
2/ Nonfuel materials only.
3/ Includes portland, blended, and masonry cements.
4/ Data are probably underreported on the basis of reported volumes of masonry cements.
5/ Data are probably underreported.
6/ Less than 1/2 unit.
7/ Includes pozzolana and burned clays and shales.
8/ Includes diatomite, other microcrystalline silica, silica fume, and other pozzolans, whether or not used as such.
9/ Outside purchases by domestic plants; excludes purchases of domestic clinker.
10/ Data may not add to totals shown because of independent rounding.

TABLE 7
CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY
IN THE UNITED STATES, BY PROCESS 1/ 2/

	Clinker produced			Fuel consumed					Waste fuel		
Kiln process	Plants active	Quantity (thousand metric tons)	Percentage of total	Coal 3/ (thousand metric tons)	Coke (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
1998:											
Wet	34	18,905	24.9	2,536	122	323	23,443	174,974	86	52	1,172,357
Dry	74	55,481	73.2	6,305	310	853	49,483	456,429	171	23	95,809
Both	2	1,457	1.9	226	--	21	--	88,765	12	--	--
Total 4/	110	75,842	100.0	9,066	432	1,197	72,926	720,168	269	74	1,268,166
1999:											
Wet	34	18,912	24.5	2,394	123	410	25,313	137,105	90	241	819,209
Dry	75	57,014	73.7	6,610	220	1,183	56,751	433,682	586	575	86,319
Both	2	1,411	1.8	202	--	29	--	82,349	9	--	--
Total 4/	111	77,337	100.0	9,206	343	1,622	82,064	653,136	685	816	905,527

-- Zero.
1/ Includes portland and masonry cement. Excludes grinding plants.
2/ Includes Puerto Rico.
3/ Virtually all bituminous.
4/ Data may not add to totals shown because of independent rounding.

TABLE 8
ELECTRIC ENERGY USED AT CEMENT PLANTS
IN THE UNITED STATES, BY PROCESS 1/

	Electric energy used							
	Generated at plant		Purchased		Total			
Plant process	Number of plants	Quantity (million kilowatt-hours)	Number of plants	Quantity (million kilowatt-hours)	Quantity (million kilowatt-hours)	Percentage	Finished cement 2/ produced (thousand metric tons)	Average consumption (kilowatt-hours per ton of cement produced)
1998:								
Integrated plants:								
Wet	--	--	34	2,831	2,831	23.6	21,296	133
Dry	4	496	74	8,421	8,917	74.4	60,221	148
Both	--	--	2	242	242	2.0	1,584	153
Total or average 3/	4	496	110	11,494	11,990	100.0	83,101	144
Grinding plants 4/	--	--	5	142	142	--	2,275	69
Exclusions 5/	--	--	2	--	--	--	145	--
1999:								
Integrated plants:								
Wet	--	--	34	2,859	2,859	23.5	21,789	131
Dry	4	486	75	8,601	9,087	74.6	61,804	147
Both	--	--	2	238	238	2.0	1,652	144
Total or average 3/	4	486	111	11,699	12,185	100.0	85,245	143
Grinding plants 4/	--	--	5	154	154	--	2,368	65
Exclusions 5/	--	--	3	--	--	--	165	--

-- Zero.
1/ Includes Puerto Rico.
2/ Includes portland and masonry cements. Excludes portland cement used to produce masonry cement.
3/ Data may not add to totals shown because of independent rounding.
4/ Excludes plants that reported production only of masonry cement.
5/ Tonnage of cement produced by plants that reported production of masonry cement only. Two of these plants reported portland cement grinding capacity and so are included in table 3.

TABLE 9
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1998	Portland cement 1999	Masonry cement 1998	Masonry cement 1999
Destination:				
Alabama	1,503	1,514	144	155
Alaska	121	120	--	--
Arizona	2,921	3,199	99	112
Arkansas	1,050	994	56	59
California, northern	3,896	4,309	49	60
California, southern	6,349	7,432	300	367
Colorado	2,358	2,476	27	30
Connecticut 3/	751	785	14	15
Delaware 3/	287	230	11	11
District of Columbia 3/	98	133	--	(4/)
Florida	6,887	7,094	570	553
Georgia	3,535	3,386	265	301
Hawaii	256	251	4	4
Idaho	488	536	(4/)	1
Illinois, excluding Chicago	1,539	1,612	32	28
Chicago, metropolitan 3/	2,105	2,297	48	57
Indiana	2,260	2,311	99	103
Iowa	1,759	1,766	11	10
Kansas	1,530	1,545	16	16
Kentucky	1,320	1,425	101	106
Louisiana 3/	1,912	1,874	54	59
Maine	235	219	5	6
Maryland	1,216	1,237	79	83
Massachusetts 3/	1,562	1,585	26	24
Michigan	3,411	3,486	161	160
Minnesota 3/	1,887	1,987	31	32
Mississippi	963	1,016	58	63
Missouri	2,359	2,590	39	42
Montana	314	334	1	1
Nebraska	1,060	1,114	13	10
Nevada	1,946	1,844	29	30
New Hampshire 3/	288	280	7	8
New Jersey 3/	1,966	1,836	71	75
New Mexico	732	777	7	5
New York, eastern	598	602	24	25
New York, western	887	915	38	37
New York, metropolitan 3/	1,473	1,552	50	55
North Carolina 3/	2,703	2,733	323	336
North Dakota 3/	321	336	4	4
Ohio	4,002	4,171	197	199
Oklahoma	1,364	1,376	42	48
Oregon	1,145	1,053	1	1
Pennsylvania, eastern	2,169	2,134	63	60
Pennsylvania, western	1,208	1,261	74	73
Rhode Island 3/	151	178	3	4
South Carolina	1,274	1,357	140	141
South Dakota	372	401	3	3
Tennessee	2,108	2,264	217	236
Texas, northern	5,030	5,463	168	194
Texas, southern	5,236 r/	6,064	93	121
Utah	1,493	1,509	1	(4/)
Vermont 3/	124	138	3	3
Virginia	2,002	2,074	153	154
Washington	1,877	2,020	5	3
West Virginia	430	406	30	30
Wisconsin	2,220	2,363	37	36
Wyoming	221	228	1	1
U.S. total 5/	99,274 r/	104,195	4,101	4,353
Foreign countries 6/	321	315	1	(4/)
Puerto Rico	1,581	1,810	--	(4/)
Grand total 5/	101,177 r/	106,320	4,101	4,353

See footnotes at end of table.

TABLE 9--Continued
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1998	Portland cement 1999	Masonry cement 1998	Masonry cement 1999
Origin:				
United States	81,376 r/	82,032	4,043	4,296
Puerto Rico	1,581	1,810	--	--
Foreign countries 7/	18,220 r/	22,478	58	56
Total shipments 5/	101,177 r/	106,320	4,101	4,353

r/ Revised. -- Zero.
1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers and other importers.
2/ Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 11, 12, 13, 15, and 16, which are from annual surveys of individual plants and importers.
3/ Has no cement plants.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.
6/ Includes shipments to U.S. possessions and territories.
7/ Imported cement distributed in the United States by domestic producers and other importers.

TABLE 10
CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT) 1/ 2/

Region and census district	Portland cement: Thousand metric tons 1998	Portland cement: Thousand metric tons 1999	Portland cement: Percentage of U.S. total 1998	Portland cement: Percentage of U.S. total 1999	Masonry cement: Thousand metric tons 1998	Masonry cement: Thousand metric tons 1999	Masonry cement: Percentage of U.S. total 1998	Masonry cement: Percentage of U.S. total 1999
Northeast:								
New England 3/	3,111	3,185	3	3	58	60	1	1
Middle Atlantic 4/	8,302	8,300	8	8	277	325	7	7
Total 5/	11,413	11,485	11	11	335	385	8	9
South:								
South Atlantic 6/	18,432	18,650	19	18	1,571	1,609	38	37
East South Central 7/	5,894	6,219	6	6	520	560	13	13
West South Central 8/	14,592 r/	15,771	14 r/	15	413	481	10	11
Total 5/	38,918 r/	40,640	39	39	2,504	2,650	61	61
Midwest:								
East North Central 9/	15,537	16,240	16	16	574	583	14	13
West North Central 10/	9,288	9,739	10 r/	9	117	117	3	3
Total 5/	24,825	25,979	26 r/	25	691	700	17	16
West:								
Mountain 11/	10,473	10,903	10 r/	10	165	180	4	4
Pacific 12/	13,644	15,185	14	15	237	435	6	10
Total 5/	24,117	26,088	24	25	402	615	10	14
U.S. total 5/	99,274 r/	104,195	100	100	4,101	4,353	100	100

r/ Revised.
1/ Includes imported cement shipped by importers. Excludes Puerto Rico and exported cement.
2/ Data are based on table 9.
3/ New England includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
4/ Middle Atlantic includes New Jersey, New York, and Pennsylvania.
5/ Data may not add to totals shown because of independent rounding.
6/ South Atlantic includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.
7/ East South Central includes Alabama, Kentucky, Mississippi, and Tennessee.
8/ West South Central includes Arkansas, Louisiana, Oklahoma, and Texas.
9/ East North Central includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.
10/ West North Central includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.
11/ Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.
12/ Pacific includes Alaska, California, Hawaii, Oregon, and Washington.

TABLE 11

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER 1/

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total
	In bulk	In containers 2/	In bulk	In containers 2/	In bulk	In containers 2/	shipments to consumer 3/ 4/
1998:							
Railroad	11,285	38	5,301	380	1,182	(6/)	6,863
Truck	4,118	151	51,144 r/	1,810	33,424 r/	613	86,991 r/
Barge and boat	8,423	--	143 r/	--	3 r/	--	146 r/
Other 5/	--	--	153	(6/)	251	2	406
Total 3/	23,826	189	56,742	2,190	34,860	615	94,408
1999:							
Railroad	11,137	47	2,851	562	800	45	4,259
Truck	4,132	122	55,101	2,071	38,582	565	96,319
Barge and boat	9,993	--	149	--	(6/)	--	149
Other 5/	--	--	--	--	20	--	20
Total 3/	25,262	169	58,101	2,634	39,402	611	100,746

r/ Revised. -- Zero.

1/ Includes Puerto Rico. Includes imported cement and cement made from imported clinker.

2/ Includes bags and jumbo bags.

3/ Data may not add to totals shown because of independent rounding.

4/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

5/ Includes cement used at plant.

6/ Less than 1/2 unit.

TABLE 12
PORTLAND CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

	1998			1999		
	Quantity	Value 4/		Quantity	Value 4/	
District 5/ 6/	(thousand metric tons) 7/	Total (thousands)	Average per metric ton	(thousand metric tons) 7/	Total (thousands)	Average per metric ton
Maine and New York	3,631	$245,768	$67.69	3,653	$267,464	$73.21
Pennsylvania, eastern	4,916	321,819	65.46	4,709	323,732	68.74
Pennsylvania, western	1,768	131,601	74.43	1,788	141,769	79.30
Illinois	2,726	210,145	77.08	2,862	208,919	73.00
Indiana	2,878	202,334	70.31	2,986	211,572	70.86
Michigan	5,747	437,621	76.15	5,922	447,474	75.56
Ohio	1,196	92,977	77.71	1,275	102,203	80.18
Iowa, Nebraska, South Dakota	4,374	339,304	77.58	4,764	369,329	77.52
Kansas	1,648	126,617	76.83	1,754	131,952	75.23
Missouri	5,889	415,897	70.62	6,377	459,575	72.07
Florida	6,126	456,559	74.53	6,790	505,609	74.47
Georgia, Virginia, West Virginia	2,932	222,079	75.74	3,042	236,815	77.85
Maryland	1,785	124,858	69.95	1,645	118,248	71.87
South Carolina	2,606	207,586	79.66	2,804	219,892	78.41
Alabama	4,375	358,430	81.93	4,303	348,740	81.05
Kentucky, Mississippi, Tennessee	2,624	201,087	76.63	2,676	210,448	78.63
Arkansas and Oklahoma	2,621	190,086	72.53	2,924	216,170	73.92
Texas, northern	4,319	339,463	78.59	4,904	384,512	78.40
Texas, southern	5,364	373,097	69.56	5,718	421,881	73.78
Arizona and New Mexico	3,465	301,763	87.09	3,668	339,823	92.66
Colorado, Wyoming	2,219	181,686	81.87	2,385	194,784	81.66
Idaho, Montana, Nevada, Utah	2,721	229,257	84.26	2,965	253,987	85.66
Alaska, Hawaii	318	32,346	101.63	335	32,558	97.12
California, northern	2,573	194,317	75.51	3,052	261,235	85.60
California, southern	6,850	508,011	74.16	8,485	654,767	77.16
Oregon and Washington	2,784	227,446	81.69	3,040	240,578	79.13
Independent importers, n.e.c. 8/	4,352	335,423	77.07	4,105	331,593	80.78
Total or average 9/	92,809	7,007,577	75.51	98,933	7,635,631	77.18
Puerto Rico	1,599	W	W	1,814	W	W

r/ Revised. W Withheld to avoid disclosing company proprietary data.
1/ Includes cement produced from imported clinker.
2/ Includes imported cement shipped by producers.
3/ Includes data for three white cement facilities located in California, Pennsylvania, and Texas.
4/ Values represent ex-plant (f.o.b -plant) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00.
5/ Includes shipments by independent importers where district assignation is possible.
6/ The district location is that of the reporting facility. Shipments may include material sold into other districts.
7/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.
8/ Shipments by importers for which district assignations were not possible.
9/ Data may not add to totals shown because of independent rounding.

TABLE 13
MASONRY CEMENT SHIPPED BY PRODUCERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

	1998			1999		
	Quantity	Value 4/		Quantity	Value 4/	
District 5/ 6/	(thousand metric tons) 7/	Total (thousands)	Average per metric ton	(thousand metric tons) 7/	Total (thousands)	Average per metric ton
Maine and New York	109	$9,538	$87.79	130	$12,516	$96.65
Pennsylvania, eastern	220	20,892	95.06	233	25,429	108.98
Pennsylvania, western	109	11,219	102.48	109	11,635	106.94
Illinois, Indiana, Ohio	499	49,248	98.77	525	52,667	100.34
Michigan	286	27,222	95.10	293	29,049	99.05
Iowa, Nebraska, South Dakota	51	4,753	94.05	44	4,071	92.38
Kansas and Missouri	132	8,942	67.86	145	9,918	68.42
Florida	426	39,132	91.76	477	49,187	103.09
Georgia, Virginia, West Virginia	367	39,622	108.11	311	40,948	131.51
Maryland	92	9,292	100.89	85	7,770	90.91
South Carolina	401	46,869	116.84	387	45,401	117.46
Alabama	379	39,972	105.37	458	50,836	111.01
Kentucky, Mississippi, Tennessee	90	7,782	86.15	94	9,212	97.89
Arkansas and Oklahoma	124	9,268	74.60	140	12,670	90.29
Texas	203	19,207	94.79	242	27,335	112.84
Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming	128	12,096	94.44	152	15,071	99.21
Alaska and Hawaii	3	342	101.95	3	331	96.98
California, Oregon, Washington	417	40,393	96.78	469	38,757	82.62
Independent importers, n.e.c. 8/	12	1,029	85.75	39	4,812	122.09
Total or average 9/	4,048	396,817	98.03	4,338	447,616	103.19

1/ Shipments are to final domestic customers and include shipments of imported cement and cement made from imported clinker.
2/ Includes data for three white cement facilities located in California, Pennsylvania, and Texas.
3/ Excludes Puerto Rico (did not produce any masonry cement).
4/ Values are mill net and represent ex-plant (f.o.b. plant or import terminal) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators, accurate to no better than the nearest $0.50 or even $1.00 per ton.
5/ Includes shipments by independent importers where district assignation is possible.
6/ The district location is that of the reporting facility. Shipments may include material sold into other districts.
7/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.
8/ Shipments by importers for which district assignations were not possible.
9/ Total includes imports shipped by independent importers.

TABLE 14
AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES 1/ 2/

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
1998	74.76	161.40	75.51	98.03	76.45
1999	76.41	166.04	77.18	103.19	78.27

1/ Excludes Puerto Rico. Mill net value is the actual value of sales to customers, f.o.b. plant or import terminal, less all discounts and allowances, less any freight charges from U.S. producing plant to distribution terminal and to final customers.
2/ Although unrounded, the data incorporate estimates for some plants and are accurate to no better than two significant figures.

TABLE 15

PORTLAND CEMENT SHIPMENTS IN 1999, BY DISTRICT AND TYPE OF CUSTOMER 1/

(Thousand metric tons)

District 2/ 3/	Ready-mixed concrete	Concrete product manufacturers 4/	Contractors 5/	Building material dealers	Oil well, mining, waste 6/	Government and miscellaneous 7/	District total 8/ 9/
Maine and New York	2,992	277	289	87	(10/)	9	3,653
Pennsylvania, eastern	2,880	817	481	452	4	75	4,709
Pennsylvania, western	1,229	215	212	61	5	66	1,788
Illinois	2,121	365	94	31	177	74	2,862
Indiana	2,379	425	57	108	13	4	2,986
Michigan	4,426	564	487	408	25	12	5,922
Ohio	980	143	103	45	--	4	1,275
Iowa, Nebraska, South Dakota	3,605	670	398	46	44	(10/)	4,764
Kansas	1,392	177	142	26	16	1	1,754
Missouri	4,468	773	895	191	--	50	6,377
Florida	4,606	1,530	149	426	30	49	6,790
Georgia, Virginia, West Virginia	2,197	267	255	313	--	--	3,042
Maryland	1,169	255	179	20	(10/)	21	1,645
South Carolina	2,201	465	43	79	1	15	2,804
Alabama	3,146	662	218	238	30	8	4,303
Kentucky, Mississippi, Tennessee	2,284	235	99	33	4	21	2,676
Arkansas and Oklahoma	2,101	205	516	28	70	4	2,924
Texas, northern	3,159	401	1,014	82	208	40	4,904
Texas, southern	4,160	392	729	223	196	18	5,718
Arizona and New Mexico	2,510	506	318	164	45	125	3,668
Colorado and Wyoming	1,387	250	648	82	19	--	2,385
Idaho, Montana, Nevada, Utah	2,310	244	163	34	86	127	2,965
Alaska and Hawaii	266	34	17	18	--	--	335
California, northern	2,394	274	126	246	--	12	3,052
California, southern	6,245	1,280	281	548	67	65	8,485
Oregon and Washington	2,458	262	116	49	--	154	3,040
Independent importers, n.e.c. 11/	3,110	509	149	203	18	116	4,105
Total 9/	72,178	12,195	8,175	4,242	1,071	1,071	98,933
Puerto Rico	908	245	87	572	--	2	1,814

-- Zero.

1/ Includes shipments of imported cement. Data, other than district totals, are presented unrounded but incorporate estimates for some plants and are likely accurate to only two significant figures.

2/ District location is that of the reporting facility. Shipments may include material sold into other districts.

3/ Includes shipments by independent importers, where district assignations were possible.

4/ Shipments to concrete product manufacturers include brick-block--5,585; precast--2,560; pipe--1,581; and other or unspecified--2,713.

5/ Shipments to contractors include airport--569; road paving--5,888; soil cement--1,222; and other or unspecified--583.

6/ Shipments to oil well, mining, and waste include oil well drilling--829; mining--108; and waste stabilization--123.

7/ Includes shipments for which customer types were not specified.

8/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated monthly data.

9/ Data may not add to totals shown because of independent rounding.

10/ Less than 1/2 unit.

11/ Shipments by independent importers for which district assignations were not possible.

TABLE 16

PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE 1/

(Thousand metric tons)

Type	1998	1999
General use and moderate heat (Types I and II), (Gray)	85,066	90,891
High early strength (Type III)	3,151	3,297
Sulfate resisting (Type V)	2,757	3,046
Block	594	632
Oil well	797	578
White	790	848
Blended:		
Portland--natural pozzolans	284	230
Portland--granulated blast furnace slag	165	299
Portland--fly ash	438	319
Other blended cement 2/	234	345
Total 3/	1,120	1,193
Expansive and regulated fast setting	53	85
Miscellaneous 4/	79	175
Grand total 3/ 5/	94,408	100,746

1/ Includes imported cement. Includes Puerto Rico.

2/ Includes blends with cement kiln dust and silica fume.

3/ Data may not add to totals shown because of independent rounding.

4/ Includes waterproof and low heat (Type IV).

5/ Shipments are derived from an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

TABLE 17

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1998		1999	
Country of destination	Quantity	Value 2/	Quantity	Value 2/
Aruba	6	327	5	255
Australia	5	239	(3/)	20
Bahamas, The	15	1,222	9	1,294
Canada	565	39,205	533	37,795
Colombia	(3/)	141	4	337
Dominica	13	806	(3/)	6
Dominican Republic	5	299	6	1,410
Germany	15	676	10	473
Indonesia	1	343	9	415
Japan	4	206	2	678
Korea, Republic of	(3/)	22	4	150
Latvia	4	145	2	68
Mexico	54	6,846	44	7,017
Netherlands	3	1,267	6	337
Panama	15	764	4	265
Singapore	4	169	2	74
Spain	2	74	4	169
Taiwan	2	176	7	325
Trinidad and Tobago	1	131	8	363
United Arab Emirates	1	87	4	164
Venezuela	4	611	3	313
Other	24 r/	2,802 r/	28	3,262
Total 4/	743	56,558	694	55,190

r/ Revised.

1/ Includes portland and masonry cements.

2/ Free alongside ship (f.a.s.) value. The value of exports at the U.S. seaport or border port of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of explortation. The value excludes the cost of loading.

3/ Less than 1/2 unit.

4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country of origin	1998 Quantity	1998 Value Customs 2/	1998 Value C.i.f. 3/	1999 Quantity	1999 Value Customs 2/	1999 Value C.i.f. 3/
Australia	155	3,986	6,663	388	8,520	15,079
Belgium	285	12,438	14,921	182	6,163	8,449
Bulgaria	26	715	1,032	264	10,161	13,129
Canada	5,957	255,893	286,146	5,511	280,812	303,271
China	3,489	132,926	168,024	3,836	123,507	163,169
Colombia	1,165	49,945	61,873	1,250	51,348	63,762
Cyprus	161	6,196	7,844	81	3,044	3,712
Denmark	580	26,126	36,537	643	33,914	45,853
France	361	24,149	28,441	129	18,912	20,255
Greece	2,124	83,757	106,183	2,086	80,366	101,404
Italy	736	26,780	35,252	665	25,588	33,710
Korea, Republic of	260	5,576	9,731	1,529	43,200	67,045
Mexico	1,280	48,518	61,495	1,286	55,216	67,416
Morocco	--	--	--	177	6,800	8,956
Norway	322	11,867	15,252	332	12,125	15,227
Saudi Arabia	185	5,815	8,151	25	934	934
Spain	2,204	94,578	123,737	1,900	80,403	103,170
Sweden	937	30,389	40,539	791	26,777	34,463
Thailand	757 r/	17,989	24,937	5,140	144,546	217,925
Turkey	1,070	40,324	52,774	767	30,575	37,760
United Kingdom	118	5,814	7,138	60	3,688	4,793
Venezuela	1,781	72,193	87,420	2,073	84,273	102,818
Other	133 r/	6,693 r/	7,971 r/	238	13,653	17,523
Total 4/	24,086 r/	962,667	1,192,061	29,351	1,144,525	1,449,823

r/ Revised. -- Zero.

1/ Includes portland, masonry, and other hydraulic cements. Includes Puerto Rico.

2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Anchorage, AK:						
Canada	7	305	305	2	81	84
China	74	2,836	3,485	88	3,113	4,497
Total 4/	83	3,141	3,790	90	3,194	4,582
Baltimore, MD:						
Bahamas, The	26	967	967	--	--	--
Colombia	--	--	--	64	2,905	4,108
Germany	3	16	16	(3/)	14	14
Netherlands	(3/)	126	132	(3/)	98	107
Thailand	13	568	769	--	--	--
Turkey	27	1,018	1,018	27	990	991
Venezuela	190	8,190	8,193	234	10,206	10,575
Total 4/	258	10,884	11,094	325	14,213	15,795
Boston, MA:						
Canada	24	677	687	--	--	--
Netherlands	(3/)	135	150	(3/)	138	146
Venezuela	--	--	--	85	3,705	5,293
Total 4/	25	812	837	86	3,843	5,439
Buffalo, NY:						
Canada	774	34,018	36,382	626	32,195	33,928
Denmark	--	--	--	2	271	273
United Kingdom	(3/)	10	10	1	209	301
Total 4/	774	34,028	36,393	630	32,675	34,502
Charleston, SC:						
Australia	--	--	--	97	1,893	3,470
China	12	474	633	173	5,289	7,093
Colombia	--	--	--	6	234	322
France	27	896	1,159	--	--	--
Indonesia	--	--	--	32	1,261	1,891
Italy	54	305	793	--	--	--
Saudi Arabia	20	298	595	--	--	--
Spain	253	9,911	13,363	366	13,142	17,816
Sweden	64	3,087	3,904	14	300	360
Thailand	62	1,026	1,690	121	2,457	4,624
United Kingdom	31	1,145	1,430	(3/)	151	198
Venezuela	77	3,025	3,815	21	876	1,085
Total 4/	601	20,166	27,383	830	25,602	36,860
Chicago, IL:						
Croatia	(3/)	4	4	--	--	--
Denmark	--	--	--	(3/)	2	4
Japan	(3/)	17	19	(3/)	25	27
United Kingdom	(3/)	6	9	--	--	--
Total 4/	(3/)	26	32	(3/)	28	31
Cleveland, OH:						
Canada	966	43,807	45,364	903	47,501	48,975
Italy	(3/)	45	54	--	--	--
United Kingdom	(3/)	196	235	(3/)	60	83
Total 4/	967	44,048	45,653	903	47,560	49,058
Columbia-Snake, OR-WA, China	427	17,175	22,496	455	15,837	21,042
Detroit, MI:						
Belgium	129	6,477	6,527	--	--	--
Canada	2,130	79,382	94,347	1,734	87,694	96,112
Denmark	--	--	--	(3/)	51	54
France	11	920	930	--	--	--
Greece	54	2,297	2,327	--	--	--
Morocco	--	--	--	96	3,761	5,614
Netherlands	(3/)	92	97	--	--	--
Thailand	27	1,467	1,477	160	7,241	7,311
United Kingdom	--	--	--	(3/)	170	214
Total 4/	2,351	90,634	105,705	1,991	98,916	109,305
Duluth, MN, Canada	327	14,312	16,564	362	17,956	20,764

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
El Paso, TX, Mexico	583	19,776	26,107	426	17,490	21,952
Great Falls, MT, Canada	200	9,575	11,393	166	7,313	9,014
Honolulu, HI:						
Australia	103	2,617	4,256	56	1,064	1,981
China	113	3,164	3,842	147	3,579	4,589
Thailand	--	--	--	66	1,062	1,721
United Kingdom	(3/)	12	15	--	--	--
Total 4/	217	5,794	8,114	270	5,704	8,292
Houston-Galveston, TX:						
Canada	(3/)	5	7	--	--	--
China	--	--	--	27	698	1,175
Colombia	58	2,304	3,499	111	4,652	6,804
Denmark	204	7,779	10,019	26	964	1,261
France	(3/)	130	144	(3/)	93	102
Germany	(3/)	8	10	--	--	--
Greece	411	15,068	20,278	290	10,593	14,182
Italy	15	589	757	--	--	--
Japan	(3/)	54	66	(3/)	45	56
Korea, Republic of	84	1,937	3,490	1,513	42,531	66,135
Mexico	--	--	--	15	456	694
Philippines	--	--	--	26	604	1,061
Saudi Arabia	68	2,701	3,343	--	--	--
Spain	487	19,925	27,903	287	11,136	13,567
Switzerland	34	1,333	1,638	--	--	--
Thailand	114	1,794	3,229	504	11,149	18,723
Turkey	250	9,079	12,811	56	2,214	3,190
United Kingdom	(3/)	8	10	31	816	1,357
Venezuela	57	2,404	2,922	42	1,793	2,263
Total 4/	1,786	65,120	90,126	2,928	87,746	130,571
Laredo, TX, Mexico	92	9,703	10,509	137	15,413	16,117
Los Angeles, CA:						
Australia	(3/)	4	4	(3/)	7	8
China	1,499	56,559	70,279	1,690	54,905	70,357
Germany	--	--	--	(3/)	3	4
Japan	15	561	702	29	1,097	1,328
Mexico	--	--	--	(3/)	8	9
Spain	203	7,627	11,271	--	--	--
Thailand	41	1,892	2,042	--	--	--
United Arab Emirates	--	--	--	(3/)	12	15
United Kingdom	3	394	590	(3/)	18	20
Total 4/	1,759	67,036	84,887	1,719	56,049	71,741
Miami, FL:						
Belgium	(3/)	403	427	4	488	517
China	--	--	--	165	4,184	6,377
Colombia	(3/)	43	56	11	553	703
Denmark	26	908	1,199	59	2,042	2,651
Mexico	11	849	1,104	5	450	529
Saudi Arabia	63	1,657	2,665	--	--	--
Spain	689	31,590	39,909	889	40,803	52,077
Sweden	626	18,458	24,581	518	16,712	21,447
Thailand	--	--	--	55	1,359	2,092
United Kingdom	(3/)	83	104	(3/)	80	102
Venezuela	153	5,950	7,662	190	7,829	10,024
Total 4/	1,569	59,941	77,708	1,896	74,501	96,519
Milwaukee, WI, Canada	83	3,832	4,735	50	2,801	3,401
Minneapolis, MN, Germany	--	--	--	(3/)	6	8
Mobile, AL:						
Australia	--	--	--	70	1,172	2,410
Bulgaria	26	715	1,032	--	--	--
China	34	1,180	1,596	--	--	--
Colombia	31	743	832	25	1,054	1,054

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Mobile, AL--Continued:						
Indonesia	--	--	--	28	1,336	1,564
Korea, Republic of	103	2,566	3,791	--	--	--
Taiwan	--	--	--	24	342	423
Thailand	100	1,855	2,319	293	6,171	10,747
United Kingdom	(3/)	7	7	--	--	--
Venezuela	27	950	1,230	--	--	--
Total 4/	322	8,015	10,806	440	10,074	16,197
New Orleans, LA:						
Belgium	148	4,971	6,952	172	5,210	7,133
Bulgaria	--	--	--	130	5,093	6,652
China	885	32,800	43,076	25	577	615
Croatia	5	1,122	1,318	22	4,921	5,516
Cyprus	--	--	--	27	1,154	1,490
France	77	4,054	4,883	12	2,239	2,600
Greece	751	30,630	39,270	797	30,989	38,338
Italy	548	21,367	28,093	649	24,904	32,969
Korea, Republic of	35	486	1,049	--	--	--
Norway	34	1,227	1,674	--	--	--
Spain	133	5,369	6,864	--	--	--
Sweden	247	8,844	12,054	259	9,765	12,657
Thailand	158	3,690	4,762	2,859	80,942	124,384
Turkey	241	10,027	12,666	146	7,833	9,232
Venezuela	186	7,364	8,917	231	9,515	11,885
Total 4/	3,450	131,950	171,576	5,330	183,144	253,469
New York City, NY:						
Colombia	--	--	--	(3/)	6	10
Croatia	--	--	--	(3/)	151	168
Denmark	65	3,557	4,256	170	10,459	12,051
Germany	(3/)	174	175	--	--	--
Greece	419	16,447	19,409	394	14,828	18,958
Italy	77	3,015	3,824	--	--	--
Liechtenstein	--	--	--	(3/)	16	17
Netherlands	(3/)	159	169	(3/)	166	180
Norway	288	10,639	13,578	332	12,125	15,227
Turkey	277	10,230	11,892	265	9,567	11,180
United Kingdom	(3/)	57	66	(3/)	72	84
Venezuela	--	--	--	27	1,076	1,188
Total 4/	1,127	44,280 r/	53,370 r/	1,188	48,465	59,064
Nogales, AZ, Mexico	566	17,105	22,366	656	19,725	25,879
Norfolk, VA:						
Bulgaria	--	--	--	109	4,092	5,401
Cyprus	134	5,382	7,027	--	--	--
Denmark	168	6,396	8,449	223	8,857	11,841
France	61	11,998	13,076	90	15,768	16,502
Greece	354	14,395	18,514	464	19,246	23,647
Netherlands	--	--	--	(3/)	34	36
Tunisia	11	468	603	--	--	--
United Kingdom	1	247	272	2	516	629
Venezuela	90	3,031	4,097	8	248	337
Total 4/	819	41,918	52,039	896	48,761	58,394
Ogdensburg, NY:						
Canada	208	7,374	7,984	178	6,637	7,033
Croatia	--	--	--	(3/)	42	44
Germany	(3/)	3	4	--	--	--
Total 4/	209	7,376	7,987	178	6,679	7,077
Pembina, ND, Canada	232	10,684	13,228	341	16,917	19,044
Philadelphia, PA:						
Colombia	27	972	1,220	--	--	--
Germany	(3/)	8	9	1	605	720
Korea, Republic of	39	587	1,401	--	--	--

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Philadelphia, PA--Continued:						
Thailand	164	2,863	4,017	339	7,448	8,974
United Kingdom	--	--	--	(3/)	22	24
Total 4/	230	4,430	6,647	340	8,075	9,718
Port Arthur, TX, Thailand	--	--	--	30	539	539
Portland, ME:						
Canada	30	2,477	2,583	66	5,988	6,171
Saudi Arabia	--	--	--	25	934	934
Switzerland	31	965	1,246	--	--	--
Total 4/	61 r/	3,443	3,829	92	6,922	7,105
Providence, RI:						
Canada	24	629	653	--	--	--
Colombia	30	1,527	1,652	24	956	1,373
Greece	21	941	1,026	--	--	--
Spain	216	11,146	13,124	247	11,142	14,562
Venezuela	--	--	--	73	2,936	3,929
Total 4/	290	14,244	16,455	345	15,034	19,863
San Diego, CA:						
China	160	5,989	7,229	551	18,443	24,014
Mexico	28	1,038	1,332	45	1,446	1,888
Total 4/	188	7,026	8,561	596	19,890	25,902
San Francisco, CA:						
China	215	9,909	11,813	354	11,315	16,343
Japan	(3/)	3	3	--	--	--
Switzerland	--	--	--	16	654	1,203
Thailand	40	1,865	2,780	407	18,562	26,203
Turkey	24	852	1,692	--	--	--
Total 4/	279	12,629	16,288	777	30,531	43,750
San Juan, PR:						
Belgium	7	586	1,014	6	464	799
Bulgaria	--	--	--	25	977	1,077
Colombia	30	975	1,024	13	851	878
Cyprus	26	814	817	54	1,890	2,222
Denmark	14	1,182	2,136	33	1,974	3,503
France	27	819	1,075	26	812	1,051
Italy	41	1,460	1,731	16	677	730
Japan	(3/)	71	107	(3/)	97	144
Mexico	1	47	77	3	229	347
Morocco	--	--	--	80	3,039	3,342
Spain	67	2,435	2,734	34	1,170	1,233
Thailand	--	--	--	40	640	1,390
Turkey	10	373	580	111	3,843	5,090
Venezuela	80	2,607	3,159	168	5,395	6,040
Total 4/	303	11,369	14,455	609	22,058	27,847
Savannah, GA:						
Australia	52	1,365	2,403	33	574	1,166
China	--	--	--	5	180	231
Colombia	93	5,145	5,919	49	2,301	2,926
Denmark	18	1,326	1,920	18	1,594	2,332
France	158	5,332	7,174	--	--	--
Italy	--	--	--	(3/)	6	11
Saudi Arabia	34	1,159	1,548	--	--	--
Taiwan	--	--	--	15	330	645
Thailand	39	969	1,853	129	3,422	5,240
United Kingdom	83	3,628	4,365	25	1,574	1,779
Venezuela	48	2,090	2,523	87	3,689	4,063
Total 3/	526	21,014	27,705	362	13,670	18,393

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Seattle, WA:						
Australia	--	--	--	132	3,810	6,044
Canada	779	38,362	40,187	833	40,654	42,182
China	56	2,256	2,851	126	4,449	5,618
Colombia	234	9,749	13,727	--	--	--
Japan	6	372	493	1	238	344
Total 4/	1,076	50,739	57,257	1,090	49,152	54,188
St. Albans, VT, Canada	171	10,453	11,728	250	15,076	16,564
Tampa, FL:						
China	15	585	724	28	938	1,217
Colombia	660	28,486	33,945	946	37,835	45,584
Denmark	83	4,977	8,558	112	7,700	11,882
Greece	112	3,979	5,359	141	4,710	6,278
Spain	156	6,575	8,569	79	3,010	3,914
Switzerland	--	--	--	38	1,261	1,675
Thailand	--	--	--	136	3,555	5,978
Turkey	241	8,745	12,116	161	6,128	8,077
Venezuela	720	30,215	36,558	752	30,765	37,918
Total 4/	1,989	83,563	105,829	2,395	95,902	122,523
U.S. Virgin Islands:						
Panama	--	--	--	5	156	187
Trinidad and Tobago	(3/)	1	2	--	--	--
Venezuela	51	2,121	2,545	53	1,964	2,357
Total 4/	51	2,122	2,548	57	2,120	2,543
Wilmington, NC:						
Korea, Republic of	--	--	--	16	669	910
Netherlands	(3/)	38	40	--	--	--
United Kingdom	(3/)	22	25	--	--	--
Venezuela	101	4,245	5,798	103	4,275	5,861
Total 4/	101	4,304	5,863	118	4,944	6,771
Grand total 4/	24,086 r/	962,667	1,192,061	29,351	1,144,525	1,449,823

r/ Revised. -- Zero.
1/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
2/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry. It is computed by adding "freight" to the "customs value."
3/ Less than 1/2 unit.
4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	--	--	--	228	5,703	9,514
Belgium	148	4,971	6,952	74	2,605	3,463
Bulgaria	--	--	--	238	9,185	12,053
Canada	3,745	166,444	179,797	4,057	202,552	217,108
China	3,307	127,254	160,882	3,678	119,504	157,973
Colombia	942	41,705	51,823	1,096	45,329	56,701
Cyprus	134	5,382	7,027	27	1,154	1,490
Denmark	459	17,852	23,182	438	16,861	21,960
France	124	4,926	6,134	--	--	--
Greece	1,957	77,481	98,496	1,843	71,910	90,203
Italy	709	25,746	33,886	665	25,529	33,625
Korea, Republic of	43	1,302	2,040	1,529	43,200	67,045
Mexico	1,131	32,586	43,948	1,080	31,948	42,586
Norway	314	11,048	14,352	332	12,125	15,227
Saudi Arabia	150	4,656	6,603	26	934	934
Spain	2,034	83,568	111,178	1,795	70,193	91,577
Sweden	937	30,383	40,532	789	26,387	33,949
Thailand	253	7,061	9,198	3,089	91,438	139,770
Turkey	1,071	40,324	52,774	767	30,575	37,760
United Kingdom	111	4,414	5,260	48	1,563	2,135
Venezuela	1,326	55,033	66,376	1,725	72,309	88,758
Other	95 r/	3,761 r/	4,425 r/	148	4,712	7,030
Total 4/	18,990	745,897	924,865	23,672	885,716	1,130,861

r/ Revised. -- Zero.
1/ Includes imports into Puerto Rico.
2/ The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Belgium	8	989	1,441	10	952	1,316
Canada	285	22,530	24,176	180	21,035	21,757
China	--	--	--	5	202	327
Colombia	(4/)	43	56	2	265	337
Denmark	120	8,264	13,344	205	17,054	23,893
Indonesia	--	--	--	3	744	871
Mexico	135	14,699	16,177	183	21,267	22,555
Norway	8	819	900	--	--	--
Spain	87	8,199	9,252	105	10,206	11,586
Thailand	--	--	--	80	9,663	14,523
United Kingdom	5	271	475	8	793	960
Venezuela	1	131	139	15	635	836
Other	(4/)	298 r/	318 r/	(4/)	263	1,596
Total 5/	649	56,243	66,278	795	83,079	99,249

r/ Revised. -- Zero.
1/ Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1998			1999		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	155	3,982	6,659	159	2,810	5,557
Belgium	129	6,477	6,527	--	--	--
Bulgaria	26	715	1,032	26	977	1,077
Canada	1,657	49,841	63,491	1,221	53,203	60,268
China	182	5,672	7,142	153	3,776	4,843
Colombia	223	8,197	9,994	151	5,754	6,723
Cyprus	26	814	817	54	1,890	2,222
France	233	16,979	19,837	127	17,853	19,112
Greece	167	6,276	7,687	141	4,710	6,278
Italy	26	989	1,312	--	--	--
Korea, Republic of	218	4,274	7,691	--	--	--
Morocco	--	--	--	177	6,800	8,956
Saudi Arabia	34	1,159	1,548	--	--	--
Spain	66	2,175	2,461	--	--	--
Switzerland	31	965	1,246	39	1,261	1,675
Taiwan	--	--	--	24	342	423
Thailand	504	10,928	15,740	1,971	43,445	63,632
Venezuela	453	16,908	20,739	328	11,014	12,883
Other	4 r/	2 r/	-- r/	2	--	1
Total 4/	4,134	136,353	173,923	4,573	153,834	193,650

r/ Revised. -- Zero.
1/ For all types of hydraulic cement. Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 23
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1995	1996	1997	1998	1999 e/
Afghanistan e/	115	116	116	116	116
Albania e/	200	200	150	150	150
Algeria	6,822	6,900	7,096 r/	7,800 e/	7,500
Angola e/	200	270	301 2/	350	350
Argentina	5,447	5,117	6,858	7,091 r/	7,187 2/
Armenia	228	282	297	300 r/	300 2/
Australia e/	6,500	6,500	6,500	6,500	6,500
Austria	3,843	3,874	3,852	3,850 e/	3,950
Azerbaijan	196	223	315	201	200 2/
Bahrain	197	192 r/	172	230	230
Bangladesh e/ 3/	280	650	865 r/	900	950
Barbados	75	107	173	259	260
Belarus	1,235	1,467	1,876	2,035	2,000 2/
Belgium	8,223	7,857	8,052	8,000 e/	8,000
Benin e/	579 2/	360	450	520	520
Bhutan e/	140	160	160	150	150
Bolivia	892	934	1,035	1,167 r/	1,202 2/
Bosnia and Herzegovina e/	226 2/	150	200	300	300
Brazil	28,256	34,597	38,096 r/	39,942 r/	40,270 2/
Brunei	--	100 e/	400 e/	216 r/	214 2/
Bulgaria	2,070	2,137	1,656	1,700 e/	1,700
Burkina Faso e/	30	30	40	40	50
Burma	517	505	516	365	338 2/
Cambodia e/	100	200	200	300	300
Cameroon	552	305 r/	350 r/	400 r/	500
Canada	10,440	11,587	12,015	12,124 r/	12,604 p/
Chile	3,275	3,634	3,735	3,888 r/	3,300
China	475,910	491,190	511,730	536,000 r/	573,000 p/
Colombia	9,407	8,907	8,446	9,190	9,200
Congo (Brazzaville)	96	50 e/	--	--	--
Congo (Kinshasa)	235	241 r/	125 r/	100 r/ e/	100
Costa Rica	865	830	940	1,085 r/	1,100
Côte d'Ivoire e/	1,000	1,000	1,100	650	650
Croatia	1,708	1,842	2,134	2,295 r/	2,712 2/
Cuba	1,470	1,453	1,713	1,800 e/	1,800
Cyprus	1,021	1,000 r/ e/	910	1,200	1,200
Czech Republic	4,825	5,015	4,877	4,604 r/	4,400 2/
Denmark 4/	2,584	2,629	2,683	2,528	2,500
Dominican Republic	1,453	1,642	1,835	1,885	2,000
Ecuador	2,616	3,028 r/	2,900 r/ e/	2,900 r/ e/	3,000
Egypt	17,665	18,700	19,700 r/	21,000 r/ e/	22,000
El Salvador	890	948	1,020	1,065 r/	1,130
Eritrea	50	47	50 r/ e/	45 r/ e/	45
Estonia	417	388	423	321	358 2/
Ethiopia e/	611 2/	690 r/	752 r/	784 r/	775
Fiji	91	84	96 r/	90 r/	95
Finland	907	975	905	903 e/	900
France	19,692	19,514	19,780	19,500 e/	19,527 2/
French Guiana	60	52	51	50 e/	50
Gabon	154	185	200 e/	196	200
Georgia	100 e/	85	91	200 r/	300
Germany	33,302	31,533	35,945	36,610	38,099 2/
Ghana e/	1,300	1,500	1,700	1,630 r/ 2/	1,870 2/
Greece	14,480	14,700 e/	14,982	15,000 e/	15,000
Guadeloupe e/	230	230	230	230	230
Guatemala	1,152	1,090	1,280	1,500	1,600
Guinea e/	250	260	260	260	250
Honduras	721	952	980 e/	1,250	3,000 p/
Hong Kong	1,913	2,027	1,925	1,539	1,387 2/
Hungary	2,875	2,747	2,811	2,999	2,978 2/
Iceland	82	88	101	119 r/	115 2/
India e/	62,000	75,000	80,000	85,000	90,000
Indonesia	23,129	24,646 r/	27,505 r/	22,341 r/	23,925 2/

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1995	1996	1997	1998	1999 e/
Iran	16,300 e/	18,350 r/	19,250 r/	19,500 r/ e/	20,000
Iraq e/	2,108 2/	1,600 r/	1,700 r/	2,000 r/	2,000
Ireland	1,730	1,933	2,100	2,000 e/	2,000
Israel e/	6,204 2/	6,700	5,400	5,100 r/	5,100
Italy	33,715	33,327	33,721	35,512 r/	36,000
Jamaica	522	557	588 r/	558	504 2/
Japan	90,474	94,492	91,938	81,328	80,120 2/
Jordan	3,508	3,610 r/	3,250 r/	1,386	1,400
Kazakhstan	2,616	1,120	661 e/	600 e/	800
Kenya	1,566	1,816	1,506	1,200 e/	1,300
Korea, North e/	17,000	17,000	17,000	17,000	16,000
Korea, Republic of	55,130	58,434	60,317	46,091 r/	48,157 2/
Kuwait e/	1,950 2/	2,000	2,000	2,000	2,000
Kyrgyzstan	310	544	658	709 r/	386 2/
Laos e/	10	9	8	9	9
Latvia	203	325	246	W r/	W
Lebanon	3,538	3,700 e/	2,703	4,100 r/ e/	4,000
Liberia e/	5	15	7	10	15
Libya	3,210	3,550	2,524	3,000 e/	3,000
Lithuania	649	600 e/	788 r/	788	666 2/
Luxembourg	714	667	683 r/	700 r/ e/	700
Macedonia	524	491	500 e/	461 r/	520 2/
Madagascar e/	40	80	120	120	120
Malawi	139	91	176	175 e/	175
Malaysia	10,713	12,349	12,668	10,397	10,105 2/
Mali e/	13	12	10	10	10
Martinique e/	220	220	220	220	220
Mauritania e/	120	100	80	50	50
Mexico	24,043	25,366	27,548	27,744	29,413 2/
Moldova	49	40	122	74	50 2/
Mongolia	109	106	112	109	104 2/
Morocco	6,401	6,585	7,236 r/	7,200 e/	7,200
Mozambique e/	60	180	220	290	400
Namibia e/	20	50 r/	100 r/	150 r/	150
Nepal 3/	327	309	225	280 e/	290
Netherlands	3,180	3,140	3,230	3,200 e/	3,200
New Caledonia e/	100	100	100	-- r/ 2/	-- 2/
New Zealand	950 e/	974	976	975 e/	975
Nicaragua	324	360	377 r/	377 r/	350
Niger e/	30	29 r/ 2/	30 r/	30 r/	30
Nigeria	2,602	2,545	2,520	2,700 e/	2,500
Norway	1,613	1,664	1,724	1,676	1,700
Oman	1,177	1,260	1,264	1,300 e/	1,300
Pakistan	8,586	8,900 e/	9,001	8,901	9,300
Panama	615	647	700	750	760
Paraguay	635	613	675 r/ e/	730 r/ e/	730
Peru	3,792	3,848	4,301 r/	4,340	3,799 2/
Philippines	10,554	12,429	14,681	12,888 r/	12,556 2/
Poland	13,914	13,959	15,003	14,970	15,345 2/
Portugal	8,123	8,455	9,395	9,500 e/	9,500
Qatar	475	690	692	700 e/	700
Réunion	313	299	277	300 e/	300
Romania	6,842	6,956	7,298	7,300 r/	6,252 2/
Russia	36,500	27,800	26,700	26,000	28,400 2/
Rwanda e/	10	15	15	15	15
Saudi Arabia	15,773	16,437	15,400	14,500 e/	14,000
Senegal	694	811	854	1,000	1,000
Serbia and Montenegro	1,696	2,205	2,011	2,253 r/	1,575 2/
Sierra Leone e/	100	160	50	100	100
Singapore e/	3,200	3,300	3,300	3,300	3,250
Slovakia	2,902	2,802	3,017	3,000 e/	3,000
Slovenia	991	1,026	1,113	1,149 r/	1,100
Somalia e/	25	--	--	--	--
South Africa e/	9,071 2/	9,000	9,500	9,500	8,900

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1995	1996	1997	1998	1999 e/
Spain (including Canary Islands)	26,423	25,157	27,632	27,943	30,800 p/
Sri Lanka e/	894	928	965	1,100	1,150
Sudan	391	380 e/	291	300 e/	350
Suriname e/	60	60	65	65	65
Sweden	2,539	2,447	2,253	2,105	2,100
Switzerland	4,024	3,638	3,568	3,600 e/	3,600
Syria	4,463	4,500 e/	4,460	4,500 e/	4,500
Taiwan	22,478	21,537	21,522	19,652 r/	18,283 2/
Tajikistan	100	50	36	18	30 2/
Tanzania	596 r/	1,332 r/	1,150 r/ e/	1,200 r/	1,300
Thailand e/	34,900	38,600	37,309	28,800 r/	34,500
Togo	350 r/	413	421	565	560
Trinidad and Tobago	559	617	653	690	688 2/
Tunisia	4,938	4,567	4,431	4,590	4,600
Turkmenistan	437	451	450 e/	450 e/	450
Turkey	33,153	35,214	36,035	38,200	34,403 2/
Uganda e/	85	180	203	210	210
Ukraine	7,600	5,017	5,098	5,591 r/	5,828 2/
United Arab Emirates e/	5,918 2/	6,000	5,250	6,000	6,000
United Kingdom	11,805	12,214	12,638	12,409	12,900
United States (including Puerto Rico) 5/	78,320	80,818	84,255	85,522	87,777 2/
Uruguay	600 r/	685	781	872 r/	995 2/
Uzbekistan	3,400	3,300	3,300	3,400 e/	3,300
Venezuela	7,672	7,556	7,600 e/	7,867	8,000
Vietnam	5,828 r/	6,586 r/	8,019 r/	9,390 r/	12,300
Yemen	1,088	1,028 r/	1,235 r/	1,201 r/	1,454 2/
Zambia	312	348	384	351 r/	350
Zimbabwe e/	968 2/	1,000	1,100	1,100	1,000
Total 6/	1,445,000 r/	1,495,000 r/	1,547,000 r/	1,545,000 r/	1,606,000

e/ Estimated. p/ Preliminary. r/ Revised. W Withheld to avoid disclosing proprietary data; included in "Total." -- Zero.
1/ Table includes data available through September 22, 2000. Data may include clinker exports for some countries.
2/ Reported figure.
3/ Data for year ending June 30 of that stated.
4/ Sales data for year 1995 only.
5/ Portland and masonary cements only.
6/ Data are rounded to four significant digits.

CEMENT

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Nicholas Muniz, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

As the binding agents in concrete and mortars, hydraulic cements are key construction materials. Hydraulic cements are those that can set and harden under water and are dominated by varieties that can be loosely grouped as portland cement and masonry cement. Only portland and masonry cements are covered in this report. In 2000, U.S. production of portland and masonry cements, combined, continued a multiyear trend of new annual records with a 2.2% increase to 87.8 million metric tons (Mt) (table 1). Output of clinker—the unground intermediate product of cement manufacture—increased by almost 3% to a new record of 78.1 Mt. The United States continued to rank third in the world in overall hydraulic cement output, behind China (about 36% of the world's total) and India; world output was about 1.6 billion metric tons (Gt).

Domestic consumption of cement again reached new record levels, but the growth in 2000 was significantly slower than annual rates over the period 1995-99 and reflected weakness in the overall U.S. economy. Apparent consumption of cement in 2000 (calculated as production plus imports minus exports minus the change in yearend stocks) rose only by 1.5% to 110.5 Mt; it had grown by 5.2% in 1999 (table 1). Cement consumption measured as sales to final domestic customers increased by 1.0% to 109.7 Mt (table 9); the growth rate was only one-fifth of that of the previous year. The large production shortfall in 2000, as in previous years, continued to be met by imports of cement and clinker but at a slightly lower level overall; it was the first decline since 1992. Exports, in contrast, rose in 2000 but remained an almost insignificant component of total cement commerce. Cement prices were virtually unchanged during the year. The total ex-factory value of annually reported cement sales to final domestic customers rose by 2.6% to $8.3 billion (table 1). If the unit value of the cement is applied to the larger, monthly-based sales tonnages in table 9, the total rises to $8.6 billion but is an increase of only 1.2%. By using typical cement-in-concrete mix ratios, the delivered value of concrete, excluding mortar, in the United States was estimated to be at least $37 billion in 2000.

Portland and masonry cements are based upon portland cement clinker, made up mostly of calcium silicates and manufactured by controlled high-temperature burning in a kiln of a measured blend of calcareous rocks (usually limestone) and, as needed, lesser quantities of siliceous, aluminous, and ferrous materials. The clinker is finely ground together with a small (generally about 5%) amount of calcium sulfate in the form of gypsum and/or anhydrite to make (straight) portland cement. Straight portland cement can be sold directly to concrete manufacturers or other customers, converted at the cement (or concrete) plant into a blended (portland) cement product of similar properties by adding other cementitious or pozzolanic (siliceous materials requiring added lime to become cementitious) extenders, or mixed with such plasticizing materials as ground limestone or lime to make masonry-type cements used in mortar. A full listing of cement varieties included within the portland cement designation as used in this report is given in table 16. Although included within the portland cement designation in this report, data showing blended cements separately from the other forms of portland cement are available within the monthly cement reviews of the

Cement in the 20th Century

In 1900, the hydraulic cement industry of the United States was less than a century old, and until that year, its output had been dominated by natural and pozzolanic cements. Portland cement had been manufactured domestically since only the early 1870s, and by 1900, its output of 1.46 million metric tons had just exceeded that of natural and pozzolanic cements (1.22 million tons, combined) for the first time. In 1900, hydraulic cement production was valued at $19.4 million. Cement was being manufactured at 114 plants, 50 of which produced portland cement. Total world cement production was probably only about 60 million tons, of which 44 million tons was in Europe. Cement consumption in the United States totaled 3.07 million tons in 1900, or about 24 kilograms per person. About 13% of the total cement consumed was imported, mostly from Europe. Most of the consumption was for concrete blocks and mortars.

In 2000, production of cement reached 87.8 million tons, valued at about $6.9 billion; about 95% of output was portland cement. Output was from 116 plants, most of which were owned by European-based multinational corporations. Consumption of cement totaled 109.7 million tons, or about 380 kilograms per person; the 22-million-ton production deficit was met by imports from around the world. The dramatic increase in production and consumption during the course of the century reflected increasing diversity of use of concrete in large office buildings, houses, roads, bridges, sewers, and dams. Except for major disruptions during the Great Depression and World War II, production had risen fairly continuously, reaching about 30 million tons by 1928 and again by 1947, surging through the 1950s onwards to about 78 million tons in 1973, fluctuating at lower levels over the period 1974-93, and resuming steady growth thereafter. World production in 2000 totaled about 1.6 billion tons, almost 60% of which was from Asia; China and India together contributed 40%.

U.S. Geological Survey (USGS) Mineral Industry Surveys series, starting with January 1998. Excluded from the portland and masonry categories and from this report are such hydraulic cement varieties as pure pozzolan cements [especially so-called slag cement, which is simply ground granulated blast furnace slag (GGBFS)] and aluminous cements. These cements contain no portland cement clinker and, cumulatively, make up only a small fraction of the U.S. cement market.

The bulk of this report incorporates data compiled from USGS annual questionnaires sent to individual cement and clinker manufacturing plants and associated distribution facilities and import terminals (some independent of U.S. cement manufacturers). For 2000, responses were received from 143 of 144 facilities canvassed, which included all producers, covering 100% of actual production and more than 99% of sales. For 1999, responses were received from 139 of 141 facilities canvassed, including all but 1 small producer, and covering more than 99% of total U.S. production and sales. Two tables (9 and 10) of this report are based on monthly shipment surveys of the cement-producing companies and importers, for which the response rate was 100% for both years. Trade data are from the U.S. Census Bureau. The world hydraulic cement production data (table 23) were derived from data collected by USGS country specialists from a variety of sources.

As in previous years, significant tonnage differences exist between the annual (survey) sales totals for portland cement listed in tables 1 and 11 through 16 and the larger monthly-survey-based totals listed in tables 9 and 10. The differences, amounting to 5.3 Mt in 1999 and 4.0 Mt in 2000, likely represent imported cement handled by certain terminals acting independently of the manufacturing plants; although incorporated within the monthly data set, some of these terminals' sales appear to be missing from the annual survey. Accordingly, the monthly data are believed to be the more complete measure of cement consumption. The equivalent discrepancy for masonry cement is insignificant, likely because little of this material is imported.

Where required to protect proprietary information, State data are combined within groupings or districts, generally corresponding to census districts or subsets thereof. To provide additional market information, some major cement-producing States have been subdivided along county lines; the county breakouts are given in table 2.

There were three significant ownership changes within the U.S. cement industry in 2000. In June, Australian-owned CSR America, Inc. (owner of Miami, FL, cement producer CSR Rinker Materials, Inc.) purchased Florida Crushed Stone Co., which operates a dry plant at Brooksville, FL. Two months later, Greek producer Titan Cement S.A. purchased the assets of Anglo American plc's subsidiary Tarmac America, Inc., thereby gaining full control of Roanoke Cement Co. in Virginia (in which Titan was already a joint-venture partner) and Pennsuco Cement Co. in Florida. Titan also owned Essex Cement Co., a New Jersey-based cement importer. By far the most important ownership transfer, however, took place at the end of September, when Cemex S.A. de C.V. of Mexico (CEMEX) announced its purchase of Southdown, Inc., the second largest U.S. cement producer and (hitherto) the largest U.S.-owned cement company. Prior to this purchase, CEMEX's only production facility in the United States was the Balcones Plant (formerly operated under the name Sunbelt Cement Co.) in Texas, and the company owned large import terminals in California and Arizona. With the purchase of Southdown, CEMEX gained control of a dozen more plants spread throughout the country—namely at Brooksville, FL; Charlevoix, MI; Clinchfield, GA; Demopolis, AL; Fairborn, OH; Knoxville, TN; Kosmosdale, KY; Lyons, CO; Odessa, TX; Pittsburgh, PA; Victorville, CA; and Wampum, PA—as well as a number of terminals. The Kosmosdale and Pittsburgh plants were joint ventures with Lone Star Industries, Inc. (25%).

Early in the year, Lafarge, the world's second largest cement producer, launched a well publicized hostile takeover bid for British company Blue Circle Industries, a major rival world and U.S. cement producer. Had it been successful, the merger would have made Lafarge the largest cement producer in the world and the United States. The bid failed when, in May, Blue Circle shareholders rejected Lafarge's bid.

Legislation and Government Programs

Economic Issues.—Government economic policies and programs affecting the cement industry chiefly are those affecting cement trade, interest rates, and public sector construction spending. In terms of trade, the major issue in 2000 remained that of antidumping tariffs against Japan and Mexico and a related voluntary restraint (import price) agreement with Venezuela that were imposed in the early 1990s following complaints in the late 1980s by a large coalition of U.S. producers. On March 6, 2000, the U.S. Department of Commerce (DOC) released its determination for the (eighth) review period covering August 1997 to July 1998; the dumping margin for the period was set at 45.84% (Southern Tier Cement Committee, 2000a). Pursuant to a World Trade Organization agreement, which became effective in 1995 and which required a sunset review after 5 years to determine the necessity of continued antidumping tariffs, a review was begun in mid-1999 of the antidumping remedies imposed on Japan, Mexico, and Venezuela. On June 27, 2000, the DOC issued the results of its part of the sunset review (as to whether dumping would continue or resume if tariffs were removed). The determination was that dumping would continue/resume at high margins by all three countries (Southern Tier Cement Committee, 2000b). The second investigation under the sunset review process was conducted by the U.S. International Trade Commission (ITC) and was to determine whether or not dumping, if continued or resumed, would cause injury to the U.S. cement industry. On October 5, the ITC concluded its investigation, determining, on a majority vote, that injury would occur if dumping resumed or continued by Japan and Mexico. Accordingly, the antidumping remedies against these two countries would be maintained for another 5 years. However, in a unanimous vote, the ITC terminated the antidumping remedy (pricing agreement) against Venezuela (Southern Tier Cement Committee, 2000c). The ruling on Mexico was a surprise to some analysts who had speculated that continued injury to the industry from Mexican cement imports would be difficult to prove following the withdrawal in late 1999 of Southdown, Inc., a major proponent of the original tariffs, from the industry coalition that was supporting the continuation of the antidumping remedies. Southdown had cited the strong U.S. cement market conditions in recent years and substantial control of imports by U.S.

producers as evidence that the tariffs were no longer needed. It was unclear whether CEMEX, the main Mexican company targeted by the antidumping order on Mexican cement, would appeal the ITC ruling based on a change of circumstances following its purchase of Southdown.

In terms of Government funding of construction projects, the cement industry had anticipated much higher spending levels in 1999 and 2000 on road and related infrastructure repair and construction as a result of the signing into law in June 1998 of the Transportation Equity Act for the 21st Century (TEA-21). This law authorized $216.3 billion in funding for the 6-year period from 1998 to 2003 for the purpose of upgrading the country's transportation infrastructure. The level of funding exceeded previous spending levels by an average of about 44% per State, and the bill contained substantial funding guarantees. Funding provided for various facets of highways, including new roads and bridges and existing infrastructure upgrades and repair, totals about $173 billion, of which about 95% was guaranteed. Estimates varied as to how much added cement consumption [typically 6 million to 8 million metric tons per year (Mt/yr)] would result from full-level TEA-21 spending, but nowhere near this level of added consumption had materialized as of yearend 2000. It appeared that the impact of delays in State funding (for cofunded projects) and of lag times between project initiation and actual cement consumption was greater than had been anticipated.

Environmental Issues.—Both mining and manufacturing are involved in cement production. As shown in table 6, approximately 140 Mt/yr of raw materials are directly or indirectly mined in the United States to produce cement, and the clinker that is imported converts to another almost 8 Mt/yr of raw materials, albeit mined outside the country. Calcareous feeds, such as limestone, make up about 85% of the raw materials mined by the cement companies themselves; most of the remaining materials are obtained locally as well. In addition, as shown in table 7, the cement industry burns significant quantities of fossil fuels. Most mines and quarries supplying the cement industry are open pit operations. Environmental issues affecting mining of cement raw materials are mostly local and are common to most surface mines; they include potential problems with dust, increased sediment loads to local streams, noise, and ground vibrations from blasting. Of greater concern, however, are the environmental impacts of the cement manufacturing process itself, most of which stem from the manufacture of clinker.

In 2000, U.S. clinker kilns burned about 15 Mt of fossil and/or other organic fuels (table 7). In the debate over climate change, the impact of greenhouse gases on atmospheric warming is a major issue. The most common greenhouse gas is carbon dioxide (CO_2), and fuel combustion and calcination of carbonate (limestone) feed in the clinker kilns both generate large quantities of this gas. Calcination basically follows the equation: $CaCO_3 \rightarrow CaO + CO_2\uparrow$. Although precise determinations of CO_2 emissions by the U.S. industry are unavailable from the companies themselves, reasonable estimates (within 5% to 10%) of the emissions for the industry overall can be made based on certain assumptions as to the composition of the raw materials and fuels consumed and the clinker produced. These assumptions are explained in more detail in the 1999 and earlier editions of this report, but generally, the production of 1 metric ton (t) of clinker releases 0.51 t of CO_2, and the combustion of fuels releases on the order of 0.4 to 0.5 t of CO_2, depending on the types of fuel consumed and the pyroprocessing technology used. Thus, approximately 1 t of CO_2 is released per ton of clinker, and very slightly less (because of the added gypsum) per ton of straight (unblended) portland cement. Based on the clinker production shown in table 5, the U.S. industry released about 77 Mt of CO_2 in 2000. Additionally, U.S. cement plants consumed electricity (table 8) equivalent to about 7 to 8 Mt of CO_2, but this "emission" generally would be assigned to the electrical power industry.

Although dwarfed by the collective CO_2 emissions of powerplants and motor vehicles, the cement industry is one of the largest remaining industrial sources of this gas and is perhaps the largest single industrial source (or possibly second to the iron and steel industry) of CO_2 not derived from the combustion of fuels. Because of this ranking, the cement industry receives more attention concerning its CO_2 emissions than it would like, notwithstanding the fact that its CO_2 emissions are only about 1.5% of the U.S. total (U.S. Environmental Protection Agency, 2001, p. ES-4). The concern of the cement industry with CO_2 continues to be the possibility that the Government, either under the obligations of international environmental treaties or by its own volition, will seek to substantially reduce the cement industry's emissions by such means as the imposition of carbon taxes, the enactment of emissions quotas, or the requirement that low(er) emissions production technologies be used.

As discussed in more detail in the 1999 edition of this report, the Kyoto Protocol, signed at the United Nations Framework Convention on Climate Change held in Kyoto, Japan, in 1997, calls for reductions in CO_2 output by countries to levels substantially below those in 1990, to be achieved by 2012. As of yearend 2000, the U.S. Congress had not ratified the protocol nor had most of the other signatories. To meet its Kyoto Protocol target (7% below 1990 emissions levels), the United States would need to reduce its emissions by 20% or more by 2012 from what they would potentially be at current emissions growth rates. Roughly similar reductions would apply to other countries bound by the protocol. Given that the overwhelming majority of nonagricultural emissions of CO_2 are from the burning of fossil fuels, any major reductions in CO_2 emissions would have to be through proportional reductions in energy consumption, and the economic ramifications of this could be substantial. Most objections to the Kyoto Protocol revolved around the fact that only the so-called developed countries would be bound by it (although all the others would be encouraged to reduce emissions), leaving them at economic disadvantage to countries not so bound. Various proposals for emissions trading, and receiving credit for so-called carbon-sinks, have been debated to reduce the potential economic impacts. In late November, the Sixth Conference of the Parties to the United Nations Framework Convention on Climate Change was held in the Hague (a followup meeting to that in Kyoto in 1997) to discuss these proposals, but no agreement was achieved.

There has been substantial interest in developing precise and auditable inventories of CO_2 and other greenhouse gas emissions to aid emissions reduction strategies. In mid-2000, the Intergovernmental Panel on Climate Change released its so-called good practices methodologies, designed to calculate national emissions levels (Intergovernmental Panel on Climate

Change, 2000).

For the U.S. cement industry, mandated major reductions in CO_2 emissions could require shutting a number of older plants, especially those operating wet kilns, and/or upgrading plant equipment to more efficient technologies. Upgrading, for various reasons, is already underway at many plants but is an expensive process. Mandated emissions reductions could force plants to burn less carbon-intensive fuel, for example, natural gas rather than coal. Many U.S. cement plants already are able to switch among a variety of fuels, but large-scale shifts of cement plants and other fuel-intensive facilities (e.g., powerplants) to natural gas could lead to local shortages and price increases for that fuel. An alternative emissions-reduction strategy, market permitting, would be to increase the output of blended cements and perhaps allow the addition of small amounts of inert extenders (as bulking agents) in straight portland cement. Either strategy would reduce the clinker (and hence emissions) component of the finished cement, which in turn would reduce total emissions by the cement industry or at least constrain emissions increases if cement demand (and output) grows. A major shift to blended cements could lead to local shortages of suitable pozzolans, as well as increased prices for them. The U.S. concrete industry is itself a significant direct consumer of pozzolans, which are used as a partial substitute for portland cement in ready-mixed concrete and some other concrete mixes. A recent review of CO_2 emissions reduction strategies, focusing on reductions of specific energy consumption, is given in Martin, Worrell, and Price (1999). Cement kilns are considered to be an environmentally benign way of burning a variety of hazardous and nonhazardous wastes, owing to the very high temperatures at which clinker is made and the long residence times of materials in the kiln. A waste fuel that has received recent attention in Europe is bone meal, which has become abundant through the necessity of slaughtering vast numbers of diseased livestock and which, from such contaminated sources, is unusable for most other applications (Whitehorn, 2001).

Another approach to reducing emissions from clinker manufacture is to use a noncarbonate source for some of the CaO in the kiln feed. A process patented by Texas Industries, Inc. (TXI), and known as CemStar, makes use of ferrous (particularly steel) slag as a CaO raw material in the kiln feed. As noted in a review by Perkins (2000), use of CemStar increases clinker output by as much as 10% or more, with commensurate reductions in unit CO_2 emissions. The process has been licensed to a number of plants and is reflected in the steel slag consumption data in table 6.

Other emissions of the cement industry include cement kiln dust (CKD), nitrogen and sulfur oxides (NOx and SOx, respectively), and dioxins and furans. The U.S. Environmental Protection Agency issued regulations concerning these and other emissions from the industry in 1999, but most of these regulations were still under one form or another of review or debate in 2000. Except for CKD (virtually all of which is captured and a majority of which is recycled to the kilns), the cement industry is not considered a major source of these pollutants compared with a number of other industries. The cement industry is nonetheless concerned about new emissions limits and prescribed monitoring methods, namely the degree that they can or cannot be realistically implemented and/or the emissions controlled. Many plants are already improving their burning systems to reduce NOx emissions; a review of methods to do this is given by Wahlquist (2000).

Production

In 2000, cement was produced in 37 States and in Puerto Rico. All of the facilities were in the private sector with the exception of one plant (Dacotah Cement Co.) that was State-owned. At yearend 2000, about 79% of U.S. portland cement output and 85% of its production capacity were foreign-owned, a major increase from the 68% foreign ownership status at yearend 1999 and mostly owing to the CEMEX purchase of Southdown. In addition to the portland and masonry cement plants, there were several grinding facilities that produced GGBFS from unground slag from domestic or foreign sources. When ground, this material (GGBFS) is sold to the cement and concrete industries as a cementitious additive; it is also known as “slag cement,” but the use of this term is confusing as it already refers to a specific type of high GGBFS-content blended portland cement. GGBFS plants will not be dealt with in this report except to the extent that their product makes its way into blended cements, and with respect to the fact that all or most of them could grind clinker instead, should market conditions so warrant.

Although, technically, there were no new (greenfields) plant openings in 2000, a facility in Florida that had commenced clinker production in late December 1999 had its first output and sales of portland cement in January 2000 and reached full capacity production levels (clinker and cement) later during the year. One small grinding facility that had in recent years only been operated as a terminal resumed grinding on an intermittent basis. New plants are planned or are under construction in Colorado, Florida, Missouri, New York, and Texas.

Following the startup of clinker production at yearend 1999, Florida Rock Industries, Inc., had its first production and sales of portland cement from its new 0.68-Mt/yr Newberry, FL, plant in January 2000, a project reviewed by Cohrs (2001). The facility reached full output levels after several months of ramp-up operations. Suwannee American Cement Co. received some of its environmental permits to construct a greenfields plant near Branford, FL (Portland Cement Association, 2000b).

Many existing plants had expansion projects completed during the year or which were within 1 to 2 years of completion. A few of the larger projects will be mentioned here. Ash Grove Cement Co. was replacing the two wet kilns at its Chanute, KS, facility with a single dry kiln of about 1.5 Mt/yr capacity; the work was expected to be completed by mid-2001 (Ash Grove Cement Co., 2001). Blue Circle was adding a new kiln line at its Calera, AL, plant, with a completion date anticipated for 2002 (World Cement, 2000). The company also commissioned a new slag grinding mill at its Detroit, MI, clinker-grinding plant. Early in the year, Holnam, Inc., fired up its newly constructed second kiln line at its Midlothian, TX, plant. The new line doubled the plant’s existing capacity to 2 Mt/yr (Arthur, 2000). Essroc Cement Corp. was planning to expand the capacity of its Speed, IN, plant by 75% by converting its long dry kiln to short dry technology. The work was anticipated to be completed around yearend 2001 (International Cement Review, 2000a). At yearend, Holnam broke ground for a new 2,000 Mt/yr dry kiln to replace the existing pair of wet kilns at its Holly Hill, SC, plant. The kiln was expected to come online in mid-2003. Holnam was also constructing a new 1.9 Mt/yr dry kiln line to replace the three existing wet lines (total capacity 0.77 Mt/yr) at its Florence, CO, facility; the new line was targeted to start production in early to mid-2001. At yearend, Holnam announced its decision to proceed with a project to build a 4 Mt/yr greenfields cement plant in St. Genevieve County, MO. This would be the largest single kiln line in the country (Cement Americas, 2001). Lehigh Portland Cement Co. was replacing the four long dry kilns at its Union Bridge, MD, plant with a new, single, dry precalciner kiln. The new line was due to be fired in early 2001 (Barzoloski, 2000). At midyear, Lone Star completed the conversion of its Greencastle, IN, wet kiln to semidry technology, thereby almost doubling its capacity to 1.17 Mt/yr. This was the first semidry line in the country (Mining Engineering, 2001). In August, RC Cement Co. brought online a new finish mill at its Signal Mountain Cement Co. subsidiary in Tennessee; the project's new 0.72-Mt/yr kiln line was due to be fired up in early 2001, at which time the existing pair of wet kilns would be shut down (Maranzana, 2000). RC's subsidiary River Cement Co. was planning to expand the capacity of its Selma, MO, plant by about 0.4 Mt/yr (Portland Cement Association, 2000a). Late in the third quarter, Southdown, Inc. (prior to its takeover by CEMEX), completed the kiln line upgrade of the Kosmos Cement plant in Louisville, KY; announced in 1999; the plant is a joint ventured with Lone Star. Work on the new finish mill at TXI's Midlothian, TX, was completed late in the year and the company expected to have the plant's new kiln fired in January 2001. This will increase the plant's capacity to about 2.5 Mt/yr (International Cement Review, 2000b).

Portland Cement.—Portland cement was manufactured in the United States in 2000 at a total of 115 plants out of 116 claiming clinker grinding capacity (the remaining plant produced only GGBFS). There were also two portland cement plants in Puerto Rico. Seven of the portland-cement-producing facilities were only grinding plants (that did not produce their own clinker); one of these was operated only intermittently during the year, and several also ground slag in addition to clinker. The regional distribution of these plants, cement production and capacities, and yearend cement stockpiles are listed in table 3.

In 2000, production of portland cement rose by 2.4% to 83.5 Mt, a new record but still well below total consumption (table 9). Further, the production was slightly enhanced (0.27%) by the added production day (2000 was a leap year). The production shortfall continued to be met by imports (tables 18-22). As shown in table 3, portland cement production increases were noted in all but 10 districts. The decreases were all in districts accessible to imported cement. The top five producing States, in descending order, continued to be California, Texas, Pennsylvania, Michigan, and Missouri.

Cement (grinding) capacity increased by 6.0% to 103.4 Mt as a result of upgrades at several plants; large increases were reported in a dozen districts, and only four districts showed decreases. Capacity utilization was high virtually everywhere, although it fell slightly (to 80.7% utilization) for the country overall. Where the annual utilization rates appeared to be low or had fallen significantly, the cause was generally the coming on-stream of additional capacity, which was fully counted but not fully used during the year. Florida remained a case in point, with a new plant starting its grinding mill in January 2000 (clinker production commenced at yearend 1999) and upgrades coming on-line at other facilities. The capacity utilization figure is understated because it is calculated using only the production of portland cement, whereas the grinding capacities reported by the plants include that for masonry cement. If masonry cement production (table 4) is included, national grinding capacity utilization in 2000 recalculates to 84.9%, compared with 88.1% in 1999. Given the fact that reported capacities take into account shutdowns only for routine maintenance, the capacity utilization rates shown are likely close to full practical operational levels.

The 2000 district and national annual grinding capacities exceeded, sometimes by large amounts, the corresponding clinker production capacities listed in table 5. This is owing to a number of factors. Some districts have dedicated grinding facilities that import all of their clinker. It is generally easier and cheaper for an integrated plant to add grinding capacity than to add clinker capacity. Extra grinding capacity allows a plant to quickly increase product output and to change cement formulations by the expedient of importing clinker and/or cementitious additives. The exceptionally large excess grinding capacity in Michigan in part reflects restricted cement-shipping capabilities of one plant during the winter—all of its cement must be made (ground) and shipped during the open-water months.

The grinding capacity declines shown in a few districts may simply represent temporary mill shutdowns during upgrade projects or the permanent retirement of obsolete grinding equipment. In some years, declines may also reflect the transfer of some grinding capacity to nonclinker applications where the reporting company chose not to consider it as available for cement.

Yearend 2000 stockpiles of portland cement were 11% higher than at yearend 1999; although this change affects the apparent consumption statistics in table 1, it has little significance for the cement industry itself. Shifts in stockpiles can result from buildups or drawdowns related to maintenance and upgrade shutdowns of mills, changes in sales volumes, interruptions to delivery schedules, and the conversion of one type of cement to another higher tonnage type (such as portland converted to blended cement).

Although the sales of various types of portland cement are listed, split out, on table 16, data are not collected on the actual production of the different varieties of portland cement. However, it is likely that the production, for most types, is at least somewhat proportional to the sales in table 16, both in relative percentage and absolute tonnage terms, after adjustment for sales of imported cement (see tables 18-22). The import adjustment can only be approximate, because import tariff numbers only allow differentiation of clinker from hydraulic cement, and within hydraulic cement, differentiation only among gray portland (this would include most of the table 16 listings), white portland, aluminous cement, and "other" hydraulic cement. In terms of the gray portland imports, it may be assumed that the majority qualifies as Types I or II (imports into southern California include a lot of Type V). An import adjustment for white cement is made difficult because of problems with the import data (see the "Values" subsection under the "Consumption" section below). Finally, imports feed stockpiles, not just sales. The import cautions notwithstanding, it can at least be stated that production of Types I and II (or hybrids thereof) accounted for about 90% of total portland cement output.

Portland cement producers in the United States ranged from those having a single, perhaps very small, plant to large, multiplant corporations having in excess of 10% of total U.S. capacity. The ranking of these companies in terms of production and capacity is complicated by how one defines the term "company;" some entities are subsidiaries of common parent corporations and some plants are jointly owned by two or more companies. If companies having common parents are lumped under the larger subsidiary's name, and if the joint ventures are apportioned, the top 10 companies at yearend 2000, in descending order of production, were Holnam, CEMEX (Southdown), Lafarge, Lehigh, Ash Grove, Blue Circle, Essroc, Lone Star, RC Cement, and TXI. Together, these accounted for 72% and 69% of total U.S. production and production capacity, respectively, and all except Ash Grove and TXI were foreign-owned as of yearend.

Masonry Cement.—Production of masonry cement (including plastic and portland lime cements) fell by 1% to 4.3 Mt in 2000 (table 4), following an almost 10% increase the previous year. Unlike portland cement, masonry cement production was virtually identical to its reported domestic consumption, and very little of that consumed was imported (table 9). The data in both tables 4 and 9, however, underrepresent true production and consumption levels of masonry cement, because it is common for masonry cement (particularly the portland lime variety) to be made at the job site itself, from purchased portland cement and lime. There are no data on this jobsite activity, but it is likely to be substantial. The reported production decline reflects lackluster demand during the year (see "Consumption" section below) and cold-weather-induced work delays towards yearend. In 2000, all but 5% of the masonry cement was reported by cement companies as having been made directly from clinker rather than starting from a finished portland cement. This ratio has not varied much in recent years.

Clinker.—Table 5 lists district-level information on clinker production, capacity, capacity utilization, and yearend stockpiles. Output of clinker increased by 2.8% to 78.1 Mt in 2000, yet another record. As with cement, clinker production in 2000 reflected a 0.3% increase owing to the 1-day longer leap year. The increase was widespread, with only a few districts (Illinois, Kentucky, Mississippi, and Tennessee; Arizona and New Mexico; and northern California) showing declines, and most of these were small. As in 1999, clinker was produced by a total of 111 integrated cement plants, operating 201 kilns. Two of these plants and kilns were in Puerto Rico. About 70% of the plants used dry-process kiln technology. Two facilities operated both wet and dry kilns, and one facility completed its kiln conversion during the year from wet to semidry technology (listed as dry in table 5).

California, Texas, Pennsylvania, Missouri, and Michigan, in descending order, remained the top five clinker-producing States in 2000. Combining companies as much as possible under common ownership, the top 5 companies had 49% of total U.S. clinker production and capacity, and the top 10 companies had about 72% of both. The top 10 companies, in descending order of production, were CEMEX (including Southdown), Holnam (remained first in capacity, however), Lafarge, Lone Star, Lehigh, Ash Grove, Essroc, Blue Circle, RC Cement, and TXI.

Apparent clinker capacity increased by 4.0% to 89.3 Mt/yr; as with production, the capacity statistic benefited from the additional workday in 2000. Capacity utilization fell slightly to 87.5% (from 88.5% in 1999), but there continued to be only very few districts that showed utilization rates below 85%. The low rate in Indiana was due to a kiln conversion (upgrade) shutdown for part of the year. With few exceptions, the capacity utilization rates depict an industry at full practicable production levels nationwide.

Annual clinker capacity and capacity utilization data are sensitive to reporting errors related to the classification of kiln downtimes. For each kiln, apparent annual capacity is calculated as the reported daily capacity times the "expected working year," which is the full year (366 days in 2000) minus the number of days that the kiln was shut down for routine maintenance. Emergency shutdowns, scheduled shutdowns for plant upgrades, and those for slow market conditions are not counted, except to the extent that they overlap the days planned for routine maintenance. Typically, one or two outages, totaling 1 to 4 weeks, are scheduled for annual routine maintenance, and this work mostly revolves around replacement or repair of the refractory brick linings in kiln and other pyroprocessing equipment. Company interpretations vary, however, as to what should be counted as routine maintenance, and those interpretational differences affect the length of the expected working year and hence the calculated annual capacity. This downtime uncertainty or sensitivity means that small changes in regional annual capacity or capacity utilization have little, if any, statistical significance. This differs from the grinding (cement) capacity data noted earlier, which are directly reported by the plants. The daily clinker capacities listed in table 5 should be viewed with caution as they are particularly sensitive to propagation of rounding errors.

Within the above constraints, average plant clinker capacity in 2000 was 0.82 Mt/yr, up by 3.7%, and average kiln capacity was 0.45 Mt/yr, up by 4.4%. Plants operating only dry (including one semidry plant) process kilns produced 75.5% of the total clinker (table 7), those operating wet kilns accounted for 22.5% of the clinker, and the two plants that operate both types of kilns contributed the remainder. The dry kiln contribution in 1999 was 73.7%.

Yearend 2000 clinker stockpiles totaled 5.3 Mt, up by 1.5 Mt, but the significance of this is uncertain. Clinker stocks are generally built up ahead of planned kiln shutdowns, most but not all of which are held in the winter months. Some clinker is also imported. Nevertheless, the yearend increase in 2000 is in line with reported monthly clinker production increases late in the year (and in all other months except May) combined with an 11% drop in portland cement sales in November and a 17% drop in December. The stockpile increase, combined with an increase in production, is consistent with the decline of 0.8 Mt in clinker imports for the year (table 22).

Raw Materials and Energy Consumed in Cement Manufacture.—Nonfuel raw materials used for cement manufacture may be divided into materials used to make the clinker and those added subsequently in the grinding phase (finish mill) to make the cement itself. The differentiation is primarily of environmental interest; materials used to make clinker are burned in the kiln and are associated with various chemical changes and emissions; those used in the finish mill are merely comminuted. Table 6 lists these materials as well as the amount of imported (foreign) clinker ground. About 1.7 t of nonfuel raw materials are needed to make 1 t of clinker, and the ratio also approximately holds to make portland cement (provided that the foreign clinker used to make cement is also back-converted to raw materials). Limestone or other calcareous materials account for about 87% of the total raw materials required. The mass ratios among various major raw materials were essentially the same for 2000 and 1999. The listing of materials under headers like "Calcareous" and "Siliceous" is to some degree artificial because many of the raw materials supply more than one oxide.

The clinker versus cement differentiation of nonfuel raw materials is subject to reporting errors, as this was not requested prior to the 1998 survey and some plants remain unaccustomed to it. Accordingly, some of the increases in 2000 may simply reflect improved reporting rather than a net change in true consumption. Additionally, some materials may be inconsistently classified from year to year or among plants. For example, one plant's limestone might be another's cement rock; likewise with clay and shale and among the several ferrous slags. Furthermore, some materials are generally not routinely fully measured by the plant, most notably CKD, where the component automatically recycled to the kiln is generally unmeasured. Accordingly, the CKD consumption listed in table 6 (clinker column) is substantially too low. Increasing environmental interest in CKD may lead the industry to begin measuring this material more completely in the future.

Among the siliceous raw materials, some of the pozzolans appear to be out of balance with the sales (as a proxy for production) of blended cements listed in table 16. This is true especially for GGBFS, consumption of which is much too high for the sales of the appropriate blended cement. The explanation for this is that most of this slag was not consumed by the cement industry to make blended cements but was used as a grinding aid in States that allow an addition of a minor amount (up to about 3%) of GGBFS within Type I portland. However, the amount of GGBFS listed in table 6 is perhaps only 10% of the true consumption of this material by, ultimately, the concrete (especially ready-mixed) producers, who buy GGBFS directly from slag processors and blend it as a partial portland cement substitute into their concrete mixes. Likewise, the amount of fly ash listed in the table 6 cement column is but a small fraction of the roughly 9 Mt/yr of this material purchased directly by the concrete industry for use as a cement extender (American Coal Ash Association, 1999). It should be reiterated that table 6 reflects consumption by the cement producers, not the concrete manufacturers. The large increase in steel slag consumption (for clinker) in table 6 appears to reflect the increasing popularity of the CemStar process developed by TXI, as discussed earlier.

Table 7 lists the consumption of fuels by type of kiln process. Many cement plants are able to switch among a variety of primary fuel types, and many routinely burn a mix of fuels. It is difficult to analyze changes in the ratios among fuels on a national basis, save that the high costs of petroleum-based fuels and natural gas in 2000 led to widespread shifts back to coal and increased use of solid and liquid wastes. The decline in use of waste tires is surprising but may reflect unreported problems with environmental permits held or sought by specific plants. It could also represent data omissions or misinclusion of tires in the "Solid" waste rather than "Tires" category.

As in past years, dry plants produced the majority of the clinker and consumed the majority of fuels (although less fuel per ton of clinker), with the exception of wet process consumption of liquid waste fuels. High production costs associated with the wet kiln process made the cost savings achievable through use of liquid wastes (which the plants are paid to take) very attractive, and the very long residence times in the kilns made for environmentally efficient burning of this material.

Table 8 lists the consumption of electricity by the cement industry, differentiated by process type. As expected, dry process plants had a higher average unit electricity consumption that wet kilns, reflecting the complex array of fans and blowers associated with modern dry kilns. The average unit consumption for dry plants increased slightly in 2000, possibly reflecting the inclusion of one semidry plant that was converted from wet technology during the year. The large increase in unit consumption by plants operating both wet and dry kilns is of little significance, as it represents only two plants. The increase listed for grinding plants, which follows a decrease in 1999, may reflect increased output of GGBFS from some of these plants. Slag-processing plants have higher unit electricity consumption levels than do cement mills because slag is harder to grind and is ground finer than clinker.

Consumption

Apparent consumption of cement is listed in table 1 and rose by 1.5% in 2000 to 110.5 Mt. Although apparent consumption is a standard statistic for comparing consumption of various commodities, the measure of consumption preferred by the cement industry for its market analyses (because the data are available monthly and are sourced directly from the cement companies) is that of cement sales or shipments to final customers. These monthly data are listed totaled for 1999 and 2000 in tables 9 and 10. Consumption (sales) in 2000 of portland and masonry cement rose by 1.0% to 109.7 Mt. The definition of "final customer" is left to the reporting cement producer, but is generally understood to include concrete manufacturers, building supply dealers, construction contractors, and the like. The monthly data are collected in terms of the destination of sales (location of final customer, i.e., consumption by State), and by State or country of origin (manufacture). Although the monthly reports differentiate between portland cement and (portland-based) blended cement, both are included in the term "portland cement" in this report (including table 9).

Tables 11 through 16 list various annual survey data on or derived from shipments of cement reported by cement producers and import terminals. Some of the data, especially those in tables 12 and 13, look superficially similar to the data in tables 9 and 10, but there are important differences between the two data sets, particularly for portland cement. Tables 9 and 10 show the larger totals, and these data are believed to be more complete (especially regarding imported cement) and thus a better measure of true consumption levels. Tables 9 and 10 also show the true location of the sales (customers) for the cement; however, the cement could have been sourced elsewhere. In contrast, the regional data in tables 12 through 16 simply reflect the location of the reporting facilities, not their customers nor necessarily where the cement was manufactured.

Examination of the data for Michigan and Ohio will illustrate the interpretational difference between the two data sets. Michigan consumed 3.5 Mt of portland cement in 2000 (table 9), but Michigan producers shipped almost 5.8 Mt (table 12) to final customers, not necessarily all in Michigan. Michigan was thus a net exporter of cement. Ohio consumed 3.9 Mt of portland cement, but its producers (and terminals) shipped only 1.2 Mt (table 12). Ohio was thus a net importer of cement. Nonproducing States like New Jersey import all of the cement they consume (table 9).

National Consumption.—In 2000, portland cement consumption grew by only 1.1% (compared with 5.0% in 1999) but still achieved a new record of 105.3 Mt (table 9). The imported cement component of this fell by 2.5% to 21.9 Mt; the decline was mainly because of domestic production increases, but imports still were about 21% of total consumption. However, the cement import volumes understate the importance of imports, because the country also brought in 3.8 Mt of clinker (table 22), equivalent to about 3.9 Mt of portland cement, so the true import dependence for portland cement in 2000 was closer to 25%. Masonry cement consumption declined by 0.5% to 4.3 Mt from the record level of 1999. The import component of this was only about 1%.

Because cement is a key construction material, growth in cement consumption reflects trends in construction spending. Overall construction spending levels increased by 2.1% in 2000 (relative to revised 1999 data) to $706.9 billion (constant 1996 dollars), according to U.S. Census Bureau data quoted by the Portland Cement Association (2001). Within this total, residential construction grew by 2.1% to $323.7 billion, of which single-family dwellings accounted for $204.8 billion, up by 1.1%. Despite continued very low mortgage rates, the residential construction growth rate in 2000 was modest compared with the 6% level seen in 1999 and reflected a generally slowing economy; much of the growth was in residential improvements rather than new units. Private nonresidential construction grew by 3.6% to $179.7 billion, powered by a 12.0% increase in office construction to $47.6 billion. This performance likely reflects the long lead times on orders placed in 1999 or earlier. Industrial construction fell by 6.2% to $27.4 billion and followed a 17.2% drop in 1999. Public sector construction spending was essentially stagnant (down by 0.2%) in 2000 at $151.8 billion. Public building construction increased by 2.8% to $70.4 billion. The important road construction component of public spending fell by 3.6% to $45.2 billion, a disappointment given the anticipated increase in spending related to TEA-21 funding, and the 8.8% (revised) spending increase in 1999. The explanation, in part, was that a higher than anticipated percentage of TEA-21 work during 2000 was for repairs rather than for more concrete-intensive new construction. Further, the slowing general economy was apparently hurting State revenues and hence State contributions to projects that involved joint State and Federal funding sources.

In contrast with recent years, the growth rate in overall construction spending in 2000 was higher than that, in tonnage terms, of portland plus masonry cement consumption. In the latter half of the 1990s, an increase in "penetration rate" (tons of cement consumed per million dollars of construction spending) was seen more or less each successive year. The improved penetration rate was generally credited to promotional efforts by the cement industry, in some years aided by moderate (relative to other construction materials) cement price increases. For example, in 1996, $1 million in construction spending "bought" 147.9 t of cement, and in 1999, $1 million (in 1996 dollars) "bought" 156.7 t of cement. Despite the virtually stagnant cement prices in 2000 (see "Values" subsection that follows), the penetration rate per $1 million (1996 dollars) declined to 155.2 t. The reasons for the decline are unclear, but probably include a combination of factors. Ignoring speculation on construction spending data accuracy (caused by to reporting delays, for example) and the likelihood of revisions to the 2000 inflation rates, major factors could be lag times in construction schedules relative to payment reporting, construction design (i.e., use of concrete versus competing construction materials), construction categories (e.g., single family versus multiple family dwellings versus roads versus factories, etc.), and type of work (e.g., concrete-intensive new construction versus less concrete-intensive repairs). Regarding the type of work, it might be speculated that, in a slowing economy, new construction might be deferred in favor of repairs to existing structures. Another factor, although difficult to quantify, is the fact that even the USGS monthly cement surveys do not capture 100% of the cement imports, but these missing imports are being consumed nonetheless. If this missing material amounted to just 1 Mt more in 2000 than in 1999, the penetration rate for 2000 would be unchanged from that in 1999. Yet another factor, also difficult to quantify, is that the true total consumption of hydraulic cement in the United States would include that of cementitious or pozzolan extenders bought directly by the concrete producers. These extenders have been mentioned in the raw materials discussion in the "Production" section and also will be discussed in the "Types of Portland Cement Consumed" subsection that follows; the tonnages involved (especially pre-1998) are not known with certainty, but would likely be in the range of 7 Mt/yr to 12 Mt/yr for the period 1996-2000. Finally, total construction spending involves many material and other costs (e.g., labor) besides those for cement or concrete.

Table 9 lists consumption of portland cement by State, and the general origins of the (total) cement consumed. About half of the States showed consumption declines, although many of these were small and likely would have registered a net increase for the year but for cold-weather-induced declines almost nationwide in November and December. Consumption increases were maintained in most of the strong-performing States of recent previous years, although strong increases (of 0.1 Mt or more) were seen only in California, Colorado, Florida, Nevada, and Virginia. Texas, usually a strong performer, managed to eke out a modest increase courtesy of the northern half of the State. Overall, in contrast with recent years, consumption in the southeastern Atlantic and Gulf Coast States was generally weak throughout the year, notably southern Texas (except during the summer). Several of the Rocky Mountain States, notably Utah, showed a slowdown in consumption, although Nevada remained very strong. Consumption grouped by census district is listed in table 10. In terms of portland cement, the 10 largest consuming States, in declining order, were California, Texas, Florida, Ohio, Illinois, Michigan, Georgia, Pennsylvania, Arizona, and New York. These combined had 53.5% of the U.S. total consumption.

Consumption of masonry cement also declined in about half of the States, but most of the declines were small. As noted in the "Production" section, data for masonry cement sales to final customers (table 9) underrepresent true consumption because it is common for masonry cement to be mixed from components at the job site rather than being brought in as a finished product. Also, the data exclude the output of a small number of small masonry cement blending plants, which are treated instead as final customers for portland cement. The very small (reported) consumption decline is likely because of to late year cold weather construction delays compared with the warmer 1999 winter.

Table 11 lists portland cement shipments to final customers in terms of transportation method. As in previous years, bulk deliveries by truck directly from plants or via terminals continued to dominate deliveries to customers. In contrast, railroad and waterborne transport were the most important methods of shipping cement from plants to terminals.

Values.—Tables 12 through 14 list mill net values provided by the plants and import terminals for their total shipments to domestic final customers of gray portland cement, white cement, and masonry cement. Because value data are highly proprietary and some companies express misgivings about providing value data of any type, values are not requested for shipments by individual types of portland cement. However, the tonnages shipped, by type, are reported (table 16). For the value of total shipments, no distinction is made between bulk and container (bag) shipments; however, container shipments would be expected to have higher unit values. Regional values for white cement have been lumped with those for gray portland cement, with the exception of the national total for white in table 14. Fewer than 10% of respondents to the 2000 survey declined to provide mill net value data—a modest improvement from the 1999 survey. Where value data were not provided, values supplied by plants in the same market area were averaged and applied as an estimate.

Mill net values for integrated plants can be defined as the (sales) value at, or free on board (f.o.b.), the manufacturing plant, including any packaging charges but excluding any discounts and shipping charges to the final customers. For independent terminals, particularly import terminals, the equivalent statistic sought would be the terminal net value. In the case of imports, this would essentially represent the cost, insurance, and freight (c.i.f.) value of the imports plus unloading and storage costs plus the terminal's markup.

Because the values listed in table 12 incorporate more than one type of portland cement, in both bulk and bag shipments, and some overall estimates, readers are cautioned that the values listed should be considered to be estimates, even though they are presented unrounded. Indeed, the mill net values are better viewed as price indices for cement, suitable for crude comparisons among regions and during time. Most especially, the unit value data cannot be viewed as actual shopping prices for cement. The data for portland cement are assumed to be dominated by bulk sales of the Types I and II varieties.

The average mill net value of portland cement in 2000 was $77.34 per ton, up by only 0.2%— a change of no statistical significance. Combined with a 2.4% increase in shipment tonnage (table 12), the total value of shipments rose by 2.6% to $7.8 billion. The same average unit value applied to the larger portland sales tonnage in table 9 yields a total value of $8.1 billion, up by 1.4%. The lower percentage increase in the value of the table 9 sales reflects the inclusion therein of a higher tonnage of (inexpensive) imported material than in table 12. Although the tonnage of imported cement grew by 0.7% in 2000, the unit value of the imports fell by 2.2% to $49.57 per ton (tables 18-22). Another constraint on portland cement prices continued to be that ready-mixed concrete companies (customers), for cost and performance reasons, were using a substantial fraction of cementitious or pozzolanic extenders in their mixes, which they would blend themselves, and were thus buying less straight or blended portland cement than they would have otherwise. By comparison with the average customs value (comparable to mill net plus, possibly, shipping to the export terminal) of imported gray portland cement, which was $35.50 per ton (table 20), and which is a rough indicator of sales prices in foreign countries, U.S. sales prices were very high by world standards. This made the United States a very attractive export target for many foreign producers.

Table 13 lists masonry cement sales and values in terms of the location of the reporting facilities. The average unit value of sales rose by 4.1% to $107.42 per ton and total sales rose by 2.6% to $459 million ($465 million for the volume in table 9). It should be noted, however, that the mill net values for masonry cement contain more component estimates than those for portland cement, and for a number of respondents, the masonry cement mill net values appear to have been reported on a bulk-equivalent basis instead of being inclusive of bagging charges.

Table 14 is a summary of cement unit values for the country overall. The data for white cement should be viewed with caution because there are only a few producers and importers of this product, and a significant share of white cement sales to final customers is as (marked up) resales by gray cement companies. Additionally, white cement includes a larger component of relatively costly package shipments, of imported material, and of estimates overall. Thus, the 4% unit mill net value decrease in 2000 to $159.45 per ton, if real, may not be statistically significant. A discussion of prices for imported white cement is given in the "Foreign Trade" section that follows.

The only data for domestic delivered prices for cement are those for Type I portland (per short ton) and masonry cement (per 70-pound bag) published monthly by the journal Engineering News-Record. The data represent a survey of customers, which most likely are ready-mixed concrete producers for portland cement and building supply depots for masonry cement, in 20 U.S. cities. The 20-city average delivered price in 2000 for Type 1 portland cement converts to $88.79 per metric ton, up by 1.7%, and ranged by only $1.29 per ton during the year. In contrast to some recent years, prices declined in the fourth quarter from their summer highs, reflecting cold-weather-related construction activity declines in the winter. The $12.18 difference between the Engineering News-Record average price and the average mill net value for gray portland cement in table 14 is an indicator of the approximate average delivery charge for bulk cement. This was significantly higher than the $10.86 per ton delivery differential in 1999 and likely reflects, at least in part, the higher fuel costs in 2000. District variations in mill net values in table 12 do not parallel very well the variations among Engineering News-Record prices for comparably located cities, possibly reflecting local transportation and related variables and the fact that the mill net regionality (table 12) reflects the location of the survey respondent, not the customer. The Engineering News-Record 20-city average for masonry cement in 2000 was $6.23 per bag, which literally converts to $196.21 per ton and which was a 26% increase from the price in 1999. The average price and the price shift both greatly exceed the $107.42 per ton (up by 4%) mill net value shown in tables 13 and 14. The large differences for masonry cement would seem excessive, even accounting for a large component of packaging, handling, and (higher) delivery charges, and may reflect price reporting inaccuracies in either or both surveys.

Cement Customer Types.—Data on (portland) cement usage is collected on the basis of the types of customers to whom the cement is sold (table 15) rather than the direct application itself. The distinction is that a given customer, although classified in one category, may in fact have used the cement in more than one way. The data in table 15, as with values, are approximations. The main reason for this is that the surveys request more details (user categories) than many respondents are able to provide. Although much improved in recent years' surveys, there remain a number of companies or plants that either do not track their customers by user type at all or do so only broadly. A persistent problem is that of overlap of categories, the most common example of which is in cases where the customer is a ready-mixed concrete producer that is also engaged in road paving. The dilemma for the respondent is whether to assign the sales to the "Ready-mixed concrete" or to the "Contractors—road paving" subcategory on the form or whether to attempt a split. Further, for several user categories, the subset "Other" commonly gets used as a catch-all instead and is thus overused. Where estimates are made, either by the companies themselves or by the USGS, there is a bias towards the major usage categories; the minor categories are, therefore, likely underrepresented. As with the shipment data in table 12, the regional divisions in table 15 are the locations of the respondents, not the customers.

Notwithstanding these limitations, a number of comments on cement user types in 2000 can be made. As in past years, the dominance of ready-mixed concrete producers in the cement market is very evident. Ready-mixed concrete companies purchased almost 75 Mt of portland cement in 2000, or almost 74% of total sales, although there is undoubtedly significant overlap with the almost 5 Mt assigned to road paving contractors (table 15, footnote 5) and with the 1 Mt assigned to the "Government and miscellaneous" category. Compared with the respective levels in 1999, the ready-mixed tonnage in 2000 was up by 3.4%, the road paving category was down by 18%, and the two combined increased by 1.8%. Because the ready-mixed plus road paving combination would be expected to closely track the 2.4% increase in total (all categories) portland cement sales, some of the ready-mixed tonnage would be better assigned to the road paving category. That the road paving tonnage is likely too low is further supported by the 3.6% decline in road and highway construction spending noted earlier. A transfer of just 0.9 Mt, either all from the ready-mixed category or split 50-50 with the "other or unspecified" contractor subcategory, to the road paving category would shrink the road paving tonnage decline for the year to 3.6%. But this would not be statistically justified given that the overall error range in the table 15 data likely exceeds this adjustment amount significantly. Further, the tonnages do not reflect some of the imported cement used by ready-mixed concrete companies and road pavers.

Portland cement sales to concrete product manufacturers increased by 10.4% to 13.5 Mt, with sales to brick and block manufacturers up by 9.1% to 6.1 Mt; precast concrete companies, up by 22% to 3.1 Mt; and pipe manufacturers up by 8.2% to 1.7 Mt (table 15, footnote 4). These growth rates exceed those for building construction noted earlier, but this may not be suspicious given the large component of value added in building construction. Overall consumption by contractors fell by almost 13% to about 7.1 Mt, with large percentage declines seen in all the specific categories, not just road paving (table 15, footnote 5). These declines, again, seem to be out of step with the construction spending levels noted earlier but in part may reflect consumption of imported cement not captured by the annual survey. Sales to building materials dealers fell by 16.3% to 3.5 Mt, which would appear to be out of phase with the increased spending levels for residential construction; the decline probably, at least partially, reflects incomplete reporting.

The general category "Oil well, mining, waste" lumps minor categories that are prone to underrepresentation. Portland cement sales to customers engaged in oil well drilling were up by 41% to 1.2 Mt (table 15, footnote 6), although the rate of change is out of line with the almost 80% increase, to 1.0 Mt, in sales of oil well cement (table 16). The discrepancy is hard to evaluate because the user tonnage is likely underreported, and ordinary types of portland cement (e.g., Types I, II), which tend to get assigned to major use categories, can be used for shallow oil wells in lieu of specialized oil well cements. A large increase in such sales was expected, however, given higher crude petroleum prices and drilling levels during the year. There was an almost 48% increase in the average weekly Baker Hughes (oil and gas drilling) rig count for 2000 (Oil & Gas Journal, 2001). Reported sales to mining companies fell by 28%, but the data are likely incomplete and subject to large relative errors because of the small tonnages involved. A large decrease in 2000, however, was expected given generally depressed metal commodity prices during the year and anecdotal accounts of mine closures and layoffs. Cement is used by mining companies as an agglomeration agent for heap leaches and in concrete for machinery foundations and for backfill of underground excavations.

Types of Portland Cement Consumed.—Sales to final customers of varieties falling within the broad definition of portland cement are listed in table 16. In 2000, Types I and II, combined, accounted for 88% of total portland sales, a typical proportion though slightly lower than in 1999. As noted in the introduction, the annual survey tonnages (e.g., table 16) are smaller by several million tons than those derived from the monthly surveys. It is believed that most of the "missing" tons are imports, and it is known that the great majority of cement imports are of Type I and II portland. Accordingly, the entries for Types I and II and the grand totals in table 16 could be augmented by about 5 Mt and 4 Mt in 1999 and 2000, respectively. Minor augmentations would also be justified for the white cement and Type V categories. Reported sales of Type V portland cement jumped by 46% in 2000, but much of this increase can be accounted for by a reclassification of some Type I and II material made and sold in California based on its actual chemical performance (Type V cements exhibit high sulfate resistance).

Blended cement sales in 2000 grew by 8.6% to 1.3 Mt, representing 1.3% of total portland cement sales, about the same as in 1999. The 2000 sales (table 16) of blended cements are slightly higher than those derived from the monthly surveys (1.2 Mt and 1.2% of total portland plus blended sales), but the difference appears to be of little statistical significance. Overall, the proportion of total blended to total portland cement sales have remained virtually unchanged during the past several years, despite anecdotal evidence that concrete producers (particularly of ready-mixed product) have increased their use of cementitious extenders during this period. Evidently, although blended cement paste is becoming more popular with the concrete producers and their customers for cost and performance reasons, the concrete companies find it cheaper to do their own purchasing of extenders and their own blending rather than purchasing blended cements from the cement companies.

Notwithstanding similar total blended cement sales tonnages during the years, the ratios among specific types of blended cement have been variable. In 2000, sales of blends containing natural pozzolans fell by almost 16% (relative to levels in 1999) to 0.2 Mt; those of blends containing GGBFS rose almost by 29% to about 0.4 Mt; sales of blends with fly ash rose by 27% to 0.4 Mt; and sales of miscellaneous blended cements (e.g. containing CKD or silica fume) dropped by 9% to 0.3 Mt. In contrast, sales in 1999 (relative to 1998) of natural pozzolan blended cements declined by 19%; blends with GGBFS were up by 81%; those with fly ash were down by 27%; and those with miscellaneous pozzolans rose by 47%. For the 2000 blended cement sales, the tonnages listed are in line with the raw materials consumption (for cement rather than clinker) shown in table 6, except for blends with GGBFS and "Other pozzolans." The comparisons assume a typical pozzolan content in blended cement of 15% to 30% and that none of the pozzolan consumption in table 6 was for masonry cements. For GGBFS, the consumption for cement listed in table 6 is two to three times the amount needed to make the blended cement sold (table 16). The excess represents material used in the finish mills as a grinding aid; this is permitted within Type-I portland designations in some States provided that the slag content in the cement does not exceed about 3%. Although actual consumption data were lacking, based on the reported capacities of various slag-grinding facilities, it may be estimated that the amount of GGBFS consumed to make cement (table 6) is likely only about 10% of that which ultimately makes its way into concrete. Likewise, the amount of ash consumed for cement is only a small fraction of the 9 Mt reported as consumed for cement (other than for clinker) and concrete manufacture in 1999 (American Coal Ash Association, 1999) and probably in 2000 (actual 2000 data are unavailable); the inference is that most of this consumption is directly by the concrete manufacturers.

White portland cement sales increased by about 5%, but some of the cement may represent material that was actually sold within a white or colored masonry product. Oil well cement sales rose by almost 80%, reflecting substantially increased drilling activities during the year.

Foreign Trade

Tables 17 through 22 list trade data from the U.S. Census Bureau. Exports of hydraulic cement and clinker (table 17) increased in 2000 but, excepting sales to Canada, were essentially insignificant, and overall, the exports continued to be of almost no consequence to the U.S. cement economy. Almost all of the exported material was cement.

The U.S. cement economy continued to be significantly import dependent, although total imports of hydraulic cement and clinker (tables 18-19) declined by 2.3% to 28.7 Mt (including Puerto Rico). This was the first annual decline since 1992 and reflected a combination of a slowing growth in demand and an increase in domestic production capacity. The import tonnage decrease was in stark contrast to increases of 22% in 1999, 37% in 1998, and 24% in 1997. The 2000 tonnage represents approximately 25% of the total world trade in cement and clinker, based on global estimates (International Cement Review, 2001). The average unit c.i.f. value of imports fell by 1.4% to $48.72 per ton; the decline was a combination of a 4.0% decrease in base (customs) value to $37.44 per ton and an 8.4% increase in combined shipping (mostly fuel-related) and insurance costs to $11.28 per ton.

The hydraulic cement component of imports (derived by subtracting clinker imports in table 22 from the table 18 data) totaled 24.9 Mt, virtually unchanged from that in 1999. Gray portland cement imports were 95.7% of this total and were up by only 0.7% (table 20). The c.i.f. value of gray portland cement imports fell by 2.3% to $46.65 per ton, within which the customs value fell 5.1% to $35.50 per ton, and the freight and insurance charges rose by 7.7% to $11.15 per ton. In 1999, the customs value had fallen by 4.7% and the shipping charges had risen by almost 10%. The total c.i.f. value of gray portland imports fell by 1.7% to $1.11 billion. Customs values in 2000 ranged from $21.13 per ton for cement from the Philippines to $51.81 per ton for Canadian cement. Shipping charges ranged from $3.43 per ton from Canada (railroad) to $24.07 per ton from the Philippines, but there was considerable overlap of shipping charge rates among various source countries and regions and the cement landing points (table 19); because of this overlap and the large number of variables within shipping charges, no firm shipping charge trends could be discerned. As noted in the "Values" subsection, the customs values listed are much lower than the U.S. mill net and/or terminal net values of portland cement sold to final customers (tables 12 and 14), making the United States an attractive market for surplus foreign production, and making it relatively easy for U.S. importers to absorb rising transportation costs, even for material sourced from vast distances.

Although Thailand replaced Canada as the largest single source of hydraulic cement and clinker imports combined, in 2000, Canada remained the largest source of gray portland cement (table 20). Gray portland imports from Canada fell by 3.5% in 2000 to 3.9 Mt. Thailand was second, with 3.6 Mt, up by 16.3%. China, which had been second in 1999, was third with 3.3 Mt, down by 19.3%.

White cement imports are listed in table 21, and rose by almost 12% during the year to 0.92 Mt. The unit value (c.i.f.) rose by 1.2% to $110.70 per ton. However, this average value and several of the specific country annual average values appear to be too low (see, for example, the entries for Norway and various Asian countries), reflecting very low unit values on certain individual monthly shipments (not shown). Likewise, the import tonnage appears to be too high. Unless reflecting dumped material, the most likely explanation for the low unit values is that the data include some gray portland cement, supposed to be reported under the Harmonized Tariff Schedule of the United States (HTS) code 2523.29.00 or that the importers mistakenly invoiced under the white cement HTS code (2523.21.00). Coding errors are difficult to verify, but past experience indicates that they do occur, though infrequently. Apart from the low overall value, evidence for misinclusion of gray cement is also found in some price differences between imported gray and white portland cement. For example, the 2000 imports of white cement from Indonesia calculate to a (suspiciously low) unit value (c.i.f.) of $54.61 per ton, which was only $10.43 per ton more than the unit value for imported Indonesian gray portland cement. This white cement premium is far smaller than normal, even considering expected general variability because of the imports perhaps comprising a mix of bulk and bag shipments. For U.S. cement imports overall, the premium for white cement was $64.05 per ton, and that for overall sales (table 14), $82.84 per ton. Finally, the white cement import tonnage appears to be out of line with the market for this material. Although the white cement market is very difficult to analyze—it being a fairly specialized product that is sensitive to a relatively small number of individual construction projects—the import tonnage increase exceeds the construction spending trends noted earlier. A final indication of problems with the white cement import data is that the total import volume exceeds the total white portland cement sales volume in table 16, which is inclusive of sales of domestically produced material. The excess appears to be much larger than could be reasonably accommodated by apportioning some imports to masonry cement sales (not included in table 16) or to yearend stockpiles. However, despite misgivings about some of the entries in table 21, the data therein for at least the major country sources calculate to realistic unit values and thus appear to be accurate. In 2000, Mexico was the largest source of white cement imports, followed by Canada, Denmark, and Spain.

Imports of clinker are listed in table 22. Total imports in 2000 fell by 17.7% to 3.8 Mt, and the unit c.i.f. value of the imports rose by 1.8% to $43.13 per ton. However, the data for both years are bolstered by the inclusion of a small quantity of very expensive aluminous cement clinker from France, the cement from which has very different applications than those for portland cement. If the French material is removed, the total remaining imports drop to 3.7 Mt (down by 17.1%), at a unit customs value of $29.41 per ton (down by 3.7%), and a unit c.i.f. value of $40.13 per ton (up by 2.2%).

Thailand continued to be the largest country source of the clinker imports, followed by Canada, which had been the largest source in 1999. The remaining major suppliers of clinker to the United States, in decreasing order, were Turkey, Colombia, China, and the Republic of Korea; neither Korea nor Turkey had supplied clinker to the United States in 1999. Excluding aluminous cement clinker, customs values for imported clinker ranged from $18.70 per ton for Chinese material to $51.42 per ton for imports from Canada. Thailand clinker had an average customs value of $19.82 per ton. Because of shipping costs, the price range was less extreme on a c.i.f. basis: Chinese clinker was $27.22 per ton, Canadian clinker was $53.67 per ton, and Thailand clinker was $35.10 per ton.

Imports of cement and clinker, by customs district of entry, are listed in table 19. New Orleans continued to be by far the busiest entry point for both cement and clinker; Detroit had been the largest clinker import venue in 1999. Much of the material coming into New Orleans was destined to be transferred onto barges for transport up the Mississippi River system. In terms of serving local markets, the largest cement-importing States were California, Florida, and Texas.

World Review

Individual country cement production data are listed in table 23. The data for some countries may include their exports of clinker. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may not be all inclusive. Because data for many countries are estimated, the annual world totals (which have been rounded) must be viewed as estimates. As estimated, world hydraulic cement production increased by about 2.5% in 2000 to 1.64 Gt.

With production reported at 583.2 Mt, China was by far the largest cement producer in the world in 2000. Although precise data are lacking, India was in second place, and the United States was in third. The remainder of the top 15 cement-producing countries in 2000, in decreasing order, were Japan, the Republic of Korea, Brazil, Germany, Italy, Turkey, Russia, Thailand, Mexico, Spain, Indonesia, and Egypt. These top 15 countries accounted for about 75% of total world production and much of the growth in world production in the past decade. China alone, since 1995, has increased its output by 107 Mt/yr.

On a regional basis, Asia again accounted for about 59% of the world total production. This region, particularly Southeast Asia, was slowly recovering from the economic crisis that began in late 1997, and local cement production and consumption levels among the major cement economies increased in 2000; consumption, however, had yet to recover to precrisis levels. This meant that there were still substantial regional cement surpluses available for export at low base prices. Because of higher fuel (hence transportation) costs and generally weaker economies in the export target countries (particularly the United States), the cost advantage of importing cement from Southeast Asia was somewhat less than in 1999.

Europe retained its position as the second largest producing region; Western Europe accounted for 11.6% of world production, and Eastern Europe, 2.6%. North America, including Mexico, was the third largest producing region, with 8.1% of the total, and Latin America and the Caribbean had 5.4% of world output (this would be 7.3% if Mexico were included here). The Middle East, including Turkey, produced 6.3% of the world's cement, and Africa contributed 4.4%. Countries of the former Soviet Union produced only 2.9% of the world's cement in 2000 but had a great deal of surplus production capacity available.

There continued to be a large number of cement plant construction and/or modernization projects throughout the world, in many regions spurred by privatization programs and by the need for plants to conform to increasingly universal and stricter environmental standards. Much of the international investment was by a few major international cement companies, most based in Europe. For the most part, these were the same companies that controlled the U.S. cement industry. Geographic diversification of holdings was seen as an advantage, as it allowed a spreading of investment risk among many countries, a market share in regions of large economic growth potential, and access to a diversity of supply sources as needed. Many of the new plants under construction were very large, and many were geared, at least partly, to exports.

Outlook

Cement industry analysts at yearend were anticipating fairly stagnant or declining market conditions in 2001, followed by a small decline in demand for the next year or two, followed by a resumption in steady demand growth, albeit at modest rates of 1% to 3% per year, for the next few years thereafter. The pessimistic short-term outlook was based in part on the cold-weather-induced drastic falloff in cement consumption in November and December 1999 and a general slowdown in the U.S. economy, which looked not to be short-lived. Having been disappointed in 1999 and 2000 by highway construction levels that fell well short of predictions under the TEA-21 funding scenarios, the industry was adopting a wait-and-see attitude towards highway spending levels in 2001 though remaining optimistic that the TEA-21 funding would eventually generate large cement sales.

New plant and/or capacity expansion projects planned or underway in the United States total about 25 Mt/yr of new capacity coming on-line by 2005. Whether or not all of these projects come to fruition, significant capacity additions are certain. These additions likely will substantially reduce the need for imported cement and clinker, although plenty of this material was expected to remain available at attractive base prices. With the termination of antidumping remedies against Venezuela, it was expected that imports from that country could increase at the expense of material from other regional exporters.

Although there was little expectation that the Kyoto Protocol would be ratified, the industry expected that pressures to reduce emissions of CO_2 and that other pollutants would increase, and several companies were taking steps to adopt proactive policies on their plants' environmental performances.

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TABLE 1
SALIENT CEMENT STATISTICS 1/

(Thousand metric tons unless otherwise specified)

		1996	1997	1998	1999	2000
United States: 2/						
Production 3/		79,266	82,582	83,931	85,952	87,846
Production of clinker		70,361	72,686	74,523	76,003	78,138
Shipments from mills and terminals 4/		83,963	90,359	96,857	103,271	105,557
Value 5/	thousands	$5,952,203	$6,637,464	$7,404,394	$8,083,247	$8,292,625
Average value per ton 6/		$70.89	$73.46	$76.45	$78.27	$78.56
Stocks at mills and terminals, yearend 3/		5,488	5,784	5,393	6,367	7,566
Exports 7/		803	791	743	694	738
Imports for consumption:						
Cement 8/		11,565	14,523	19,878	24,578	24,561
Clinker		2,402	2,867	3,905	4,164	3,673
Total		13,967	17,390	23,783	28,742	28,234
Consumption, apparent 9/		90,355	96,018	103,457	108,862	110,470
World production e/ 10/		1,493,000 r/	1,547,000	1,547,000 r/	1,603,000 r/	1,643,000

e/ Estimated. r/ Revised.
1/ Portland and masonry cements only, unless otherwise indicated.
2/ Excludes Puerto Rico.
3/ Includes cement produced from imported clinker.
4/ Shipments are to final customers. Includes imported cement. Data are based on annual survey of individual plants and terminals and may differ from tables 9 and 10, which are based on consolidated monthly shipments data from companies.
5/ Value at mill or import terminal of portland (all types) and masonry cement shipments to final domestic customers. Although presented unrounded, the data contain estimates for survey nonrespondents.
6/ Total value at mill or import terminal of cement shipments to final customers divided by total tonnage of same. Although presented unrounded, the data contain estimates for survey nonrespondents.
7/ Hydraulic cement (all types) plus clinker.
8/ Hydraulic cement, all types.
9/ Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in stocks.
10/ Total hydraulic cement. May incorporate clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Chicago, metropolitan	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT

(Thousand metric tons unless otherwise specified)

District	1999 Plants active 2/	1999 Production 3/	1999 Capacity 1/ Finish grinding	1999 Capacity 1/ Percentage utilized	1999 Stocks at yearend 4/	2000 Plants active 2/	2000 Production 3/	2000 Capacity 1/ Finish grinding	2000 Capacity 1/ Percentage utilized	2000 Stocks at yearend 4/
Maine and New York	4	3,285	3,756	87.5	237	5	3,140	3,846	81.6	313
Pennsylvania, eastern 5/	7	4,710	5,205	90.5	263	7	4,685	5,374	87.2	251
Pennsylvania, western	4	1,980	2,222	89.1	107	4	1,950	2,540	79.8	183
Illinois	4	2,939	3,507	83.8	193	4	2,861	3,787	75.5	290
Indiana	4	2,511	3,052	82.2	190	4	2,634	3,456	76.2	303
Michigan	5	5,813	7,663	75.8	418	5	5,785	7,881	73.4	411
Ohio	2	1,132	1,515	74.7	65	2	1,034	1,497	69.1	73
Iowa, Nebraska, South Dakota	5	4,092	5,452	75.1	342	5	4,255	5,479	77.7	424
Kansas	4	1,974	2,085	94.7	133	4	1,983	2,085	95.1	206
Missouri	5	4,910	5,330	92.1	589	5	4,884	5,186	94.2	634
Florida	7	3,497	6,355	55.0	411	7	3,753	6,817	55.1	411
Georgia, Virginia, West Virginia	4	2,712	3,396	79.8	190	4	3,042	4,656	65.3	209
Maryland	3	1,728	1,837	94.1	97	3	1,756	1,992	88.2	107
South Carolina	3	2,610	3,335	78.3	80	3	2,912	3,361	86.6	172
Alabama	5	4,301	5,005	85.9	267	5	4,337	5,020	86.4	331
Kentucky, Mississippi, Tennessee	4	2,361	2,631	89.8	172	4	2,209	3,545	62.3	191
Arkansas and Oklahoma	4	2,650	3,162	83.8	183	4	2,663	3,162	84.2	281
Texas, northern 5/	6	4,203	4,878	86.2	242	6	4,752	6,012	79.0	370
Texas, southern	5	4,479	4,840	92.6	212	5	4,515	4,842	93.2	247
Arizona and New Mexico	3	2,238	2,336	95.8	83	3	2,175	2,336	93.1	111
Colorado and Wyoming	4	2,128	2,428	87.7	147	4	2,253	2,453	91.9	133
Idaho, Montana, Nevada, Utah	7	2,781	3,306	84.1	222	7	2,818	3,415	82.5	260
Alaska and Hawaii	1	254	499	50.9	49	1	286	288	99.5	27
California, northern	3	2,770	2,862	96.8	159	3	2,811	2,880	97.6	124
California, southern 5/	8	7,519	8,315	90.4	395	8	8,066	9,015	89.5	334
Oregon and Washington	4	1,999	2,598	77.0	238	4	1,953	2,498	78.2	170
Total or average 6/	115	81,577	97,568	83.6	5,902 7/	116	83,514	103,426	80.7	6,564 7/
Puerto Rico	2	1,825	2,065	88.4	34	2	1,664	2,065	80.6	33

1/ Reported annual grinding capacity based on fineness necessary to grind individual plants' normal product mixes, making allowance for downtime required for routine maintenance.
2/ Includes one plant that reported portland cement (clinker) grinding capacity but no production of portland cement.
3/ Includes cement produced from imported clinker.
4/ Includes imported cement. Includes mills and terminals.
5/ Includes data for white cement.
6/ Data may not add to totals shown because of independent rounding.
7/ Total stocks include inventory, not included on a district basis, held by independent importers.

TABLE 4
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT

(Thousand metric tons unless otherwise specified)

District	1999 Plants active	1999 Production 1/	1999 Stocks at yearend 2/	2000 Plants active	2000 Production 1/	2000 Stocks at yearend 2/
Maine and New York	4	122	18	4	130	11
Pennsylvania, eastern	6	219	35	6	225	41
Pennsylvania, western	4	111	13	4	99	16
Indiana	4	W	51	4	444	62
Michigan	5	283	31	5	296	37
Ohio	2	85	17	2	92	27
Iowa, Nebraska, South Dakota	3	W	6	3	W	10
Kansas	2	W	W	2	W	W
Missouri	1	W	W	1	W	W
Florida	4	494	40	5	543	35
Georgia, Virginia, West Virginia	5	370	46	5	331	36

See footnotes at end of table.

TABLE 4--Continued
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT

(Thousand metric tons unless otherwise specified)

District	1999 Plants active	1999 Production 1/	1999 Stocks at yearend 2/	2000 Plants active	2000 Production 1/	2000 Stocks at yearend 2/
Maryland	3	110	19	3	78	19
South Carolina	3	421	32	3	411	25
Alabama	4	429	56	4	401	57
Kentucky, Mississippi, Tennessee	3	W	W	3	83	6
Arkansas and Oklahoma	4	138	13	4	142	25
Texas, northern	4	153	10	4	156	9
Texas, southern	3	108	7	3	112	7
Arizona and New Mexico	3	W	6	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	--	--	(3/)	1	W	W
Alaska and Hawaii	1	3	(3/)	1	3	--
California	6	417 4/	14 4/	6	484	18
Total 5/	76	4,375 6/	466 7/	78	4,332 6/	492

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
1/ Includes cement produced from imported clinker.
2/ Includes imported cement.
3/ Less than 1/2 unit.
4/ Includes data for southern California only. Northern California data are withheld.
5/ Data may not add to totals shown because of independent rounding. Includes withheld districts.
6/ Production directly from clinker accounted for almost 94% of the total in 1999 and 95% in 2000. Production from portland cement accounted for the remainder.
7/ Total stocks include inventory, not shown on a district basis, held by independent importers.

TABLE 5
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2000, BY DISTRICT

(Thousand metric tons unless otherwise specified)

District	Active plants 1/ Process used Wet	Active plants 1/ Process used Dry	Active plants 1/ Process used Both	Active plants 1/ Total	Number of kilns	Daily capacity	Average days of routine mainte-nance	Apparent annual capacity 2/	Produc-tion	Percentage of capacity utilized	Yearend stocks 3/
Maine and New York	3	1	--	4	5	10.4	39.2	3,411	3,090	90.6	133
Pennsylvania, eastern	2	5	--	7	14	15.2	24.4	5,101	4,590	90.0	189
Pennsylvania, western	3	1	--	4	8	6.1	23.0	2,110	1,964	93.1	235
Illinois	--	4	--	4	8	8.4	19.6	2,829	2,484	87.8	276
Indiana	1	3 4/	--	4	8	10.2	26.0	3,430	2,544	74.2	186
Michigan	1	2	--	3	8	13.5	23.0	4,604	4,347	94.4	346
Ohio	1	1	--	2	3	3.5	24.7	1,196	1,038	86.7	66
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.6	25.7	4,632	3,983	86.0	282
Kansas	2	2	--	4	11	5.6	19.5	1,958	1,789	91.4	207
Missouri	2	3	--	5	7	14.0	24.9	4,662	4,558	97.8	315
Florida	1	4	--	5	7	12.6	23.0	4,315	3,472	80.5	226
Georgia, Virginia, West Virginia	1	3	--	4	7	10.6	29.3	3,608	2,937	81.4	209
Maryland	1	2	--	3	7	5.5	29.0	1,871	1,654	88.4	52
South Carolina	2	1	--	3	7	8.7	16.9	3,015	2,507	83.2	162
Alabama	--	5	--	5	6	14.1	17.8	4,808	4,161	86.5	264
Kentucky, Mississippi, Tennessee	2	2	--	4	5	8.8	17.6	3,038	2,132	70.2	336
Arkansas and Oklahoma	2	2	--	4	10	7.7	19.0	2,665	2,526	94.8	89
Texas, northern	3	3	--	6	15	16.4	20.4	5,752	4,607	80.1	165
Texas, southern	--	4	1	5	6	13.4	22.0	4,606	4,266	92.6	230
Arizona and New Mexico	--	3	--	3	9	6.5	17.4	2,240	2,184	97.5	151
Colorado and Wyoming	1	3	--	4	7	7.0	12.0	2,463	2,182	88.6	180
Idaho, Montana, Nevada, Utah	3	4	--	7	9	8.7	20.7	3,014	2,786	92.4	192
Alaska and Hawaii	--	--	--	--	--	--	--	--	--	--	35

See footnotes at end of table.

TABLE 5--Continued
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2000, BY DISTRICT

(Thousand metric tons unless otherwise specified)

District	Active plants 1/ Process used Wet	Dry	Both	Total	Number of kilns	Daily capacity	Average days of routine mainte- nance	Apparent annual capacity 2/	Produc- tion	Percentage of capacity utilized	Yearend stocks 3/
California, northern	--	3	--	3	3	8.7	33.0	2,872	2,721	94.7	145
California, southern	--	8	--	8	17	26.2	26.1	8,979	7,897	88.0	560
Oregon and Washington	1	2	--	3	3	6.3	35.3	2,085	1,721	82.5	88
Total or average 5/	32	75	2	109	199	261.5	23.0	89,264	78,138	87.5	5,321
Puerto Rico	--	2	--	2	2	5.9	34.0	1,964	1,518	77.3	252

-- Zero.
1/ Includes white cement plants.
2/ Calculated on a per-kiln basis using 366 days (leap year) minus reported days for routine maintenance and multiplied by the reported unrounded daily capacity.
3/ Includes imported clinker.
4/ Includes one semidry plant.
5/ Data may not add to totals shown because of independent rounding.

TABLE 6
RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES 1/ 2/

(Thousand metric tons)

Raw materials	1999 Clinker	1999 Cement 3/	2000 Clinker	2000 Cement 3/
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	91,021	1,138	93,947	1,263
Cement rock (includes marl)	23,981 r/	149 r/	21,820	133
Cement kiln dust 4/	305	112	351	155
Lime 5/	10	46	19	49
Other	--	--	21	225
Aluminous:				
Clay	4,770	23	4,205	8
Shale	3,679	--	3,743	3
Other (includes staurolite, bauxite, aluminum dross, alumina, and other)	387	--	400	--
Ferrous, iron ore, pyrites, millscale, other	1,259	--	1,310	--
Siliceous:				
Sand and calcium silicate	2,959	4	3,142	--
Sandstone, quartzite, other	745	--	925	--
Fly ash	1,521	85	1,679	88
Other ash, including bottom ash	760	--	930	--
Granulated blast furnace slag	--	349	--	303
Other blast furnace slag	97	--	43	--
Steel slag	591	--	805	--
Other slags	45	--	12	10
Natural rock pozzolans 6/	--	16	--	40
Other pozzolans 7/	38	4	38	8
Other:				
Gypsum and anhydrite	--	4,643	--	4,655
Clinker, imported 8/	--	4,607	--	4,573
Other, n.e.c.	--	51	--	46
Total 9/	132,169 r/	11,227 r/	133,391	11,558

r/ Revised. -- Zero.
1/ Includes Puerto Rico.
2/ Nonfuel materials only.
3/ Includes portland, blended, and masonry cements.
4/ Data are probably underreported.
5/ Data are probably underreported on the basis of reported volumes of masonry cements.
6/ Includes pozzolana and burned clays and shales.
7/ Includes diatomite, other microcrystalline silica, silica fume, and other pozzolans, whether or not used as such.
8/ Outside purchases by domestic plants; excludes purchases of domestic clinker.
9/ Data may not add to totals shown because of independent rounding.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS 1/ 2/

	Clinker produced			Fuel consumed					Waste fuel		
Kiln process	Plants active	Quantity (thousand metric tons)	Percentage of total	Coal 3/ (thousand metric tons)	Coke (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
1999:											
Wet	34	18,912	24.5	2,394	123	410	25,313	137,105	90	241	819,209
Dry	75	57,014	73.7	6,610	220	1,183	108,509 r/	433,682	586	575	86,319
Both	2	1,411	1.8	202	--	29	--	82,349	9	--	--
Total 4/	111	77,337	100.0	9,206	343	1,622	133,822 r/	653,136	685	816	905,527
2000:											
Wet	32	17,911	22.5	2,409	96	390	32,513	51,482	106	149	801,288
Dry	77	60,172	75.5	7,479	346	920	91,153	206,729	259	867	127,799
Both	2	1,574	2.0	208	--	41	--	80,049	8	--	--
Total 4/	111	79,656	100.0	10,095	442	1,351	123,666	338,261	374	1,016	929,087

r/ Revised. -- Zero.

1/ Includes portland and masonry cement. Excludes grinding plants.

2/ Includes Puerto Rico.

3/ All reported to be bituminous.

4/ Data may not add to totals shown because of independent rounding.

TABLE 8

ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS 1/

	Electric energy used							
	Generated at plant		Purchased		Total			
Plant process	Number of plants	Quantity (million kilowatt-hours)	Number of plants	Quantity (million kilowatt-hours)	Quantity (million kilowatt-hours)	Percentage	Finished cement 2/ produced (thousand metric tons)	Average consumption (kilowatt-hours per ton of cement produced)
1999:								
Integrated plants:								
Wet	--	--	34	2,859	2,859	23.5	21,789	131
Dry	4	486	75	8,601	9,087	74.6	61,804	147
Both	--	--	2	238	238	2.0	1,652	144
Total or average 3/	4	486	111	11,699	12,185	100.0	85,245	143
Grinding plants 4/	--	--	5	154	154	--	2,368	65
Exclusions 5/	--	--	3	--	--	--	165	--
2000:								
Integrated plants:								
Wet	--	--	32	2,685	2,685	21.4	20,544	131
Dry	4	497	77	9,095	9,592	76.6	64,930	148
Both	--	--	2	249	249	2.0	1,593	157
Total or average 3/	4	497	111	12,029	12,526	100.0	87,067	144
Grinding plants 4/	--	--	6	164	164	--	2,294	71
Exclusions 5/	--	--	2	--	--	--	149	--

-- Zero.

1/ Includes Puerto Rico.

2/ Includes portland and masonry cements.

3/ Data may not add to totals shown because of independent rounding.

4/ Excludes plants that reported production only of masonry cement.

5/ Tonnage of cement produced by plants that reported production of masonry cement only. One plant reported portland cement grinding capacity and so is included in table 3.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1999	Portland cement 2000	Masonry cement 1999	Masonry cement 2000
Destination:				
Alabama	1,514	1,565	155	145
Alaska 3/	120	127	--	--
Arizona	3,199	3,236	112	109
Arkansas	994	952	59	54
California, northern	4,309	4,706	60	63
California, southern	7,432	7,959	367	368
Colorado	2,476	2,597	30	43
Connecticut 3/	785	838	15	15
Delaware 3/	230	165	11	11
District of Columbia 3/	133	178	(4/)	2
Florida	7,094	7,694	553	591
Georgia	3,386	3,434	301	302
Hawaii	251	288	4	4
Idaho	536	558	1	1
Illinois, excluding Chicago	1,612	1,524	28	24
Illinois, Chicago, metropolitan 3/	2,297	2,312	57	62
Indiana	2,311	2,208	103	96
Iowa	1,766	1,710	10	8
Kansas	1,545	1,490	16	15
Kentucky	1,425	1,322	106	98
Louisiana 3/	1,874	1,790	59	55
Maine	219	221	6	5
Maryland	1,237	1,333	83	88
Massachusetts 3/	1,585	1,580	24	23
Michigan	3,486	3,489	160	160
Minnesota 3/	1,987	2,010	32	37
Mississippi	1,016	936	63	56
Missouri	2,590	2,562	42	42
Montana	334	318	1	1
Nebraska	1,114	1,079	10	9
Nevada	1,844	1,963	30	31
New Hampshire 3/	280	268	8	6
New Jersey 3/	1,836	1,915	75	73
New Mexico	777	831	5	6
New York, eastern	602	637	25	30
New York, western 3/	915	871	37	36
New York, metropolitan 3/	1,552	1,677	55	57
North Carolina 3/	2,733	2,764	336	319
North Dakota 3/	336	308	4	3
Ohio	4,171	3,907	199	190
Oklahoma	1,376	1,421	48	45
Oregon	1,053	1,003	1	1
Pennsylvania, eastern	2,134	2,212	60	66
Pennsylvania, western	1,261	1,162	73	66
Rhode Island 3/	178	154	4	3
South Carolina	1,357	1,318	141	139
South Dakota	401	432	3	3
Tennessee	2,264	2,097	236	223
Texas, northern	5,463	5,540	194	198
Texas, southern	6,064	6,005	121	126
Utah	1,509	1,432	(4/)	1
Vermont 3/	138	145	3	3
Virginia	2,074	2,216	154	156
Washington	2,020	2,016	3	3
West Virginia	406	417	30	26
Wisconsin 3/	2,363	2,185	36	33
Wyoming	228	248	1	1
U.S. total 5/	104,195	105,322	4,353	4,333
Foreign countries 6/	315	393	(4/)	--
Puerto Rico	1,810	1,663	(4/)	--
Grand total 5/	106,320	107,378	4,353	4,333

See footnotes at end of table.

TABLE 9--Continued
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 1999	Portland cement 2000	Masonry cement 1999	Masonry cement 2000
Origin:				
United States	82,032	83,787	4,296	4,281
Puerto Rico	1,810	1,663	--	--
Foreign countries 7/	22,478	21,927	56	52
Total shipments 5/	106,320	107,378	4,353	4,333

-- Zero.
1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.
2/ Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 11-13, 15, and 16, which are from annual surveys of individual plants and importers.
3/ Has no cement plants.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.
6/ Includes shipments to U.S. possessions and territories.
7/ Imported cement distributed in the United States by domestic producers and other importers.

TABLE 10
CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT) 1/ 2/

Region and census district	Portland cement: Quantity (thousand metric tons) 1999	Portland cement: Quantity (thousand metric tons) 2000	Portland cement: Percentage of U.S. total 1999	Portland cement: Percentage of U.S. total 2000	Masonry cement: Quantity (thousand metric tons) 1999	Masonry cement: Quantity (thousand metric tons) 2000	Masonry cement: Percentage of U.S. total 1999	Masonry cement: Percentage of U.S. total 2000
Northeast:								
New England 3/	3,185	3,206	3	3	60	55	1	1
Middle Atlantic 4/	8,300	8,474	8	8	325	328	7	8
Total 5/	11,485	11,680	11	11	385	383	9	9
South:								
South Atlantic 6/	18,650	19,519	18	19	1,609	1,634	37	38
East South Central 7/	6,219	5,920	6	6	560	522	13	12
West South Central 8/	15,771	15,708	15	15	481	478	11	11
Total 5/	40,640	41,147	39	39	2,650	2,634	61	61
Midwest:								
East North Central 9/	16,240	15,625	16	15	583	565	13	13
West North Central 10/	9,739	9,591	9	9	117	117	3	3
Total 5/	25,979	25,216	25	24	700	682	16	16
West:								
Mountain 11/	10,903	11,183	10	11	180	193	4	4
Pacific 12/	15,185	16,099	15	15	435	439	10	10
Total 5/	26,088	27,282	25	26	615	632	14	15
U.S. total 5/	104,195	105,322	100	100	4,353	4,333	100	100

1/ Includes imported cement shipped by importers and cement ground from imported clinker. Excludes Puerto Rico.
2/ Data are based on table 9.
3/ New England includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
4/ Middle Atlantic includes New Jersey, New York, and Pennsylvania.
5/ Data may not add to totals shown because of independent rounding.
6/ South Atlantic includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.
7/ East South Central includes Alabama, Kentucky, Mississippi, and Tennessee.
8/ West South Central includes Arkansas, Louisiana, Oklahoma, and Texas.
9/ East North Central includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.
10/ West North Central includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.
11/ Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.
12/ Pacific includes Alaska, California, Hawaii, Oregon, and Washington.

TABLE 11
SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER 1/

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total
	In bulk	In containers 2/	In bulk	In containers 2/	In bulk	In containers 2/	shipments to consumer
1999:							
Railroad	11,137	47	2,851	562	800	45	4,259
Truck	4,132	122	55,101	2,071	38,582	565	96,319
Barge and boat	9,993	--	149	--	(3/)	--	149
Other	--	--	--	--	20	--	20
Total 4/	25,262	169	58,101	2,634	39,402	611	100,746 5/
2000:							
Railroad	11,865	42	1,529	2	479	1	2,010
Truck	4,211	308	56,482	2,464	41,066	737	100,749
Barge and boat	8,082	--	183	--	6	--	188
Other	--	--	--	--	--	--	--
Total 4/	24,158	350	58,193	2,466	41,550	737	102,947 5/

-- Zero.
1/ Includes Puerto Rico. Includes imported cement and cement made from imported clinker.
2/ Includes bags and jumbo bags.
3/ Less than 1/2 unit.
4/ Data may not add to totals shown because of independent rounding.
5/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

TABLE 12
PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT 1/ 2/

	1999			2000		
	Quantity	Value 3/		Quantity	Value 3/	
District 4/ 5/	(thousand metric tons) 6/	Total (thousands)	Average per metric ton	(thousand metric tons) 6/	Total (thousands)	Average per metric ton
Maine and New York	3,653	$267,464	$73.21	3,422	$267,991	$78.32
Pennsylvania, eastern	4,709	323,732	68.74	4,832	335,078	69.34
Pennsylvania, western	1,788	141,769	79.30	1,412	112,338	79.55
Illinois	2,862	208,919	73.00	2,868	218,777	76.27
Indiana	2,986	211,572	70.86	2,932	199,744	68.13
Michigan	5,922	447,474	75.56	5,766	448,703	77.81
Ohio	1,275	102,203	80.18	1,174	94,503	80.53
Iowa, Nebraska, South Dakota	4,764	369,329	77.52	4,779	376,357	78.76
Kansas	1,754	131,952	75.23	1,693	132,298	78.13
Missouri	6,377	459,575	72.07	5,988	455,724	76.11
Florida	6,790	505,609	74.47	7,325	549,569	75.02
Georgia, Virginia, West Virginia	3,042	236,815	77.85	3,055	238,729	78.13
Maryland	1,645	118,248	71.87	1,675	118,776	70.93
South Carolina	2,804	219,892	78.41	2,661	192,178	72.21
Alabama	4,303	348,740	81.05	4,539	357,813	78.83
Kentucky, Mississippi, Tennessee	2,676	210,448	78.63	2,544	197,836	77.77
Arkansas and Oklahoma	2,924	216,170	73.92	2,659	209,528	78.80
Texas, northern	4,904	384,512	78.40	5,282	410,079	77.64
Texas, southern	5,718	421,881	73.78	5,608	392,860	70.05
Arizona and New Mexico	3,668	339,823	92.66	3,610	350,231	97.03
Colorado and Wyoming	2,385	194,784	81.66	2,581	232,221	89.97
Idaho, Montana, Nevada, Utah	2,965	253,987	85.66	2,965	245,179	82.70
Alaska and Hawaii	335	32,558	106.29 r/	381	39,880	104.67
California, northern	3,052	261,235	85.60	3,749	303,316	80.90
California, southern	8,485	654,767	77.16	9,004	669,445	74.35
Oregon and Washington	3,040	240,578	79.13	2,225	177,615	79.83
Independent importers, n.e.c. 7/	4,105	331,593	80.78	6,552	506,655	77.33
Total or average 8/	98,933	7,635,631	77.21 r/	101,282	7,833,425	77.34
Puerto Rico	1,814	W	W	1,665	W	W

See footnotes at end of table.

TABLE 12--Continued
PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT 1/ 2/

r/ Revised. W Withheld to avoid disclosing company proprietary data.
1/ Includes imported cement and cement produced from imported clinker.
2/ Includes white cement.
3/ Values represent ex-plant (f.o.b. plant) data collected for total shipments to final customers, not for shipments by specific type of portland cement. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators, accurate to no better than the nearest \$0.50 or even \$1.00.
4/ The district location is that of the reporting facility. Shipments may include material sold into other districts.
5/ Includes shipments by independent importers where district assignation is possible.
6/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.
7/ Shipments by importers for which district assignations were not possible.
8/ Data may not add to totals shown because of independent rounding.

TABLE 13
MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT 1/ 2/ 3/

	1999			2000		
	Quantity	Value 4/		Quantity	Value 4/	
	(thousand	Total	Average	(thousand	Total	Average
District 5/ 6/	metric tons) 7/	(thousands)	per metric ton	metric tons) 7/	(thousands)	per metric ton
Maine and New York	130	\$12,516	\$96.65	104	\$10,258	\$98.95
Pennsylvania, eastern	233	25,429	108.98	243	27,455	112.99
Pennsylvania, western	109	11,635	106.94	98	10,470	107.23
Illinois, Indiana, Ohio	525	52,667	100.34	491	52,949	107.76
Michigan	293	29,049	99.05	293	28,686	97.75
Iowa, Nebraska, South Dakota	44	4,071	92.38	40	3,750	93.69
Kansas and Missouri	145	9,918	68.42	141	11,957	85.07
Florida	477	49,187	103.09	519	61,952	119.43
Georgia, Virginia, West Virginia	311	40,948	131.51	306	40,029	130.72
Maryland	85	7,770	90.91	73	6,641	91.54
South Carolina	387	45,401	117.46	385	42,709	110.80
Alabama	458	50,836	111.01	442	50,166	113.61
Kentucky, Mississippi, Tennessee	94	9,212	97.89	87	8,516	97.96
Arkansas and Oklahoma	140	12,670	90.29	131	11,473	87.88
Texas	242	27,335	112.84	250	26,786	107.31
Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming	152	15,071	99.21	146	15,075	103.44
Alaska and Hawaii	3	331	96.98	4	772	214.95
California, Oregon, Washington	469	38,757	82.62	484	43,171	89.19
Independent importers, n.e.c. 8/	39	4,812	122.09	40	6,385	158.79
Total or average 9/	4,338	447,616	103.19	4,275	459,200	107.42

1/ Shipments are to final domestic customers and include shipments of imported cement and cement made from imported clinker.
2/ Includes white cement.
3/ Excludes Puerto Rico (did not record sales of masonry cement).
4/ Values are mill net and represent ex-plant (f.o.b. plant or import terminal) data collected for total shipments to final customers, not for shipments by cement type. Although presented unrounded, the data incorporate estimates for some plants. Accordingly, the data should be viewed as cement value indicators, accurate to no better than the nearest \$0.50 or even \$1.00 per ton.
5/ The district location is that of the reporting facility. Shipments may include material sold into other districts.
6/ Includes shipments by independent importers where district assignation is possible.
7/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.
8/ Shipments by importers for which district assignations were not possible.
9/ Total includes imports shipped by independent importers.

TABLE 14
AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES 1/ 2/

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
1999	76.41	166.04	77.18	103.19	76.45 r/
2000	76.61	159.45	77.34	107.42	78.56

r/ Revised.
1/ Excludes Puerto Rico. Mill net value is the actual value of sales to customers, f.o.b. plant or import terminal, less all discounts and allowances, less any freight charges from U.S. producing plant to distribution terminal and to final customers.
2/ Although unrounded, the data incorporate estimates for some plants and are accurate to no better than two significant figures.

TABLE 15
PORTLAND CEMENT SHIPMENTS IN 2000, BY DISTRICT AND TYPE OF CUSTOMER 1/

(Thousand metric tons)

District 2/ 3/	Ready-mixed concrete	Concrete product manufacturers 4/	Contractors 5/	Building material dealers	Oil well, mining, waste 6/	Government and miscellaneous 7/	District total 8/ 9/
Maine and New York	2,686	378	73	195	--	89	3,422
Pennsylvania, eastern	3,099	1,103	197	323	--	110	4,832
Pennsylvania, western	971	163	157	29	3	90	1,412
Illinois	2,112	399	77	28	252	--	2,868
Indiana	2,306	443	61	105	13	5	2,932
Michigan	4,231	667	484	364	21	--	5,766
Ohio	943	124	56	48	2	--	1,174
Iowa, Nebraska, South Dakota	3,611	688	356	60	57	7	4,779
Kansas	1,313	121	205	30	20	4	1,693
Missouri	4,427	757	690	84	--	30	5,988
Florida	5,135	1,561	108	373	2	145	7,325
Georgia, Virginia, West Virginia	2,230	372	94	339	11	9	3,055
Maryland	1,217	267	132	40	--	18	1,675
South Carolina	2,106	409	43	82	1	21	2,661
Alabama	3,473	689	209	156	3	9	4,539
Kentucky, Mississippi, Tennessee	2,122	270	119	28	5	--	2,544
Arkansas and Oklahoma	1,778	208	607	22	35	9	2,659
Texas, northern	3,305	456	1,069	75	354	22	5,282
Texas, southern	3,732	601	700	153	385	36	5,608
Arizona and New Mexico	2,679	355	266	162	39	108	3,610
Colorado and Wyoming	1,970	233	253	91	34	--	2,581
Idaho, Montana, Nevada, Utah	2,173	258	233	33	81	188	2,965
Alaska and Hawaii	318	37	4	22	--	--	381
California, northern	3,019	374	172	172	--	12	3,749
California, southern	6,669	1,434	399	380	73	49	9,004
Oregon and Washington	1,724	227	137	72	--	64	2,225
Independent importers, n.e.c. 10/	5,301	870	225	84	14	55	6,552
Total 9/	74,655	13,465	7,127	3,548	1,406	1,082	101,282
Puerto Rico	791	204	117	552	--	1	1,665

-- Zero.
1/ Includes shipments of imported cement and cement ground from imported clinker. Data other than district totals are presented unrounded but incorporate estimates for some plants and are likely accurate to only two significant figures.
2/ District location is that of the reporting facility. Shipments may include material sold into other districts.
3/ Includes shipments by independent importers, where district assignations were possible.
4/ Shipments to concrete product manufacturers include brick-block—6,092; precast—3,127; pipe—1,710; and other or unspecified—2,740.
5/ Shipments to contractors include airport—444; road paving—4,816; soil cement—950; and other or unspecified—1,034.
6/ Shipments to oil well, mining, and waste include oil well drilling—1,168; mining—78; and waste stabilization—160.
7/ Includes shipments for which customer types were not specified.
8/ Shipments calculated based on an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated monthly data.
9/ Data may not add to totals shown because of independent rounding.
10/ Shipments by independent importers for which district assignations were not possible.

TABLE 16
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE
UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE 1/

(Thousand metric tons)

Type	1999	2000
General use and moderate heat (Types I and II) (Gray)	90,891	90,644
High early strength (Type III)	3,297	3,815
Sulfate resisting (Type V)	3,046	4,453
Block	632	636
Oil well	578	1,039
White	848	894
Blended:		
Portland, natural pozzolans	230	194
Portland, granulated blast furnace slag	299	385
Portland, fly ash	319	405
Other blended cement 2/	345	313
Total 3/	1,193	1,296
Expansive and regulated fast setting	85	60
Miscellaneous 4/	175	111
Grand total 3/ 5/	100,746	102,947

1/ Includes imported cement. Includes Puerto Rico.
2/ Includes blends with cement kiln dust and silica fume.
3/ Data may not add to totals shown because of independent rounding.
4/ Includes waterproof and low heat (Type IV) varieties.
5/ Shipments are derived from an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

TABLE 17
U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1999		2000	
Country of destination	Quantity	Value 2/	Quantity	Value 2/
Aruba	5	255	2	218
Bahamas, The	9	1,294	15	1,883
Belize	--	--	6	1,054
Brazil	3	207	5	452
Canada	533	37,795	581	41,161
China	2	72	2	105
Colombia	4	337	2	289
Costa Rica	1	97	6	801
Czech Republic	1	21	7	308
Dominican Republic	6	1,410	1	158
Germany	10	473	(3/)	8
Hong Kong	2	123	9	434
Indonesia	9	415	--	--
Lebanon	(3/)	3	5	262
Mexico	44	7,017	51	10,347
Panama	4	265	3	263
Philippines	(3/)	25	3	711
Russia	1	37	3	128
Saudi Arabia	3	127	2	175
Taiwan	7	325	2	113
Trinidad and Tobago	8	363	2	103
United Kingdom	(3/)	209	4	568
Venezuela	3	313	3	745
Other	41 r/	4,007 r/	24	3,918
Total 4/	694	55,190	738	64,204

See footnotes at end of table.

TABLE 17--Continued

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

r/ Revised. -- Zero.

1/ Includes portland and masonry cements.

2/ Free alongside ship (f.a.s.) value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

3/ Less than 1/2 unit.

4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 18

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1999			2000		
		Value			Value	
Country of origin	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	388	8,520	15,079	180	4,305	7,384
Bahamas, The	--	--	--	206	7,506	9,485
Belgium	182	6,163	8,449	8	1,040	1,372
Bulgaria	264	10,161	13,129	635	26,301	33,691
Canada	5,511	280,812	303,271	4,948	268,875	285,040
China	3,836	123,507	163,169	3,451	107,852	143,945
Colombia	1,250	51,348	63,762	1,524	59,173	75,694
Croatia	23	5,115	5,727	64	7,097	8,453
Cyprus	81	3,044	3,712	--	--	--
Denmark	643	33,914	45,853	554	27,934	38,105
France	129	18,912	20,255	79	15,223	16,513
Greece	2,086	80,366	101,404	1,479	51,897	69,159
Indonesia	59	2,596	3,455	197	5,300	9,079
Italy	665	25,588	33,710	249	9,645	12,986
Korea, Republic of	1,529	43,200	67,045	1,823	49,742	75,578
Lebanon	--	--	--	108	4,167	4,935
Mexico	1,286	55,216	67,416	1,409	60,700	74,006
Morocco	177	6,800	8,956	22	974	1,331
Norway	332	12,125	15,227	263	10,257	12,626
Philippines	26	604	1,061	160	3,360	7,187
Spain	1,900	80,403	103,170	1,177	45,673	60,433
Sweden	791	26,777	34,463	903	28,879	37,694
Switzerland	54	1,915	2,878	--	--	--
Taiwan	39	672	1,068	82	2,417	3,745
Thailand	5,140	144,546	217,925	5,693	142,787	231,235
Turkey	767	30,575	37,760	1,453	47,868	69,273
United Kingdom	60	3,688	4,793	5	1,575	1,946
Venezuela	2,073	84,273	102,818	1,878	75,173	95,353
Other	62 r/	3,685 r/	4,269 r/	136	8,223	11,292
Total 4/	29,351	1,144,525	1,449,823	28,684	1,073,943	1,397,541

r/ Revised. -- Zero.

1/ Includes portland, masonry, and other hydraulic cements. Includes imports into Puerto Rico.

2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1999			2000		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Anchorage, AK:						
Canada	2	81	84	(3/)	12	14
China	88	3,113	4,497	94	2,875	4,197
Total 4/	90	3,194	4,582	95	2,887	4,211
Baltimore, MD:						
Colombia	64	2,905	4,108	141	5,645	8,043
Denmark	--	--	--	(3/)	32	40
Germany	(3/)	14	14	(3/)	291	336
Greece	--	--	--	199	7,273	10,334
Netherlands	(3/)	98	107	(3/)	96	105
Spain	--	--	--	15	474	834
Turkey	27	990	991	27	1,267	2,073
Venezuela	234	10,206	10,575	112	4,524	4,997
Total 4/	325	14,213	15,795	494	19,602	26,763
Boston, MA:						
Belgium	--	--	--	(3/)	69	72
Colombia	--	--	--	7	246	371
Netherlands	(3/)	138	146	(3/)	53	62
Norway	--	--	--	36	2,681	2,741
Spain	--	--	--	30	1,051	1,597
United Kingdom	--	--	--	(3/)	11	11
Venezuela	85	3,705	5,293	312	11,438	16,250
Total 4/	86	3,843	5,439	386	15,550	21,104
Buffalo, NY:						
Canada	626	32,195	33,928	546	29,548	31,133
Denmark	2	271	273	(3/)	10	10
United Kingdom	1	209	301	2	384	398
Total 4/	630	32,675	34,502	548	29,943	31,541
Charleston, SC:						
Australia	97	1,893	3,470	73	1,275	2,494
Canada	--	--	--	10	300	500
China	173	5,289	7,093	--	--	--
Colombia	6	234	322	101	3,932	5,337
Germany	--	--	--	(3/)	15	18
Greece	--	--	--	65	2,266	2,709
Indonesia	32	1,261	1,891	--	--	--
Korea, Republic of	--	--	--	36	1,075	1,558
Netherlands	--	--	--	(3/)	64	71
Spain	366	13,142	17,816	16	634	848
Sweden	14	300	360	--	--	--
Thailand	121	2,457	4,624	408	9,786	19,796
Turkey	--	--	--	204	6,178	11,806
United Kingdom	(3/)	151	198	1	370	463
Venezuela	21	876	1,085	--	--	--
Total 4/	830	25,602	36,860	915	25,895	45,601
Chicago, IL:						
Canada	--	--	--	34	1,902	1,992
Denmark	(3/)	2	4	--	--	--
India	--	--	--	(3/)	4	5
Japan	(3/)	25	27	(3/)	43	48
Total 4/	(3/)	28	31	35	1,949	2,046
Cleveland, OH:						
Canada	903	47,501	48,975	643	35,779	36,511
Spain	--	--	--	(3/)	2	3
United Kingdom	(3/)	60	83	1	221	285
Total 4/	903	47,560	49,058	644	36,002	36,799
Columbia-Snake, OR-WA, China	455	15,837	21,042	452	14,172	19,318
Detroit, MI:						
Canada	1,734	87,694	96,112	1,472	85,463	89,245
Denmark	(3/)	51	54	--	--	--
Germany	--	--	--	23	1,049	1,059

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1999			2000		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Detroit, MI--Continued:						
Korea, Republic of	--	--	--	102	4,509	4,549
Morocco	96	3,761	5,614	22	974	1,331
Thailand	160	7,241	7,311	--	--	--
United Kingdom	(3/)	170	214	--	--	--
Total 4/	1,991	98,916	109,305	1,619	91,994	96,183
Duluth, MN, Canada	362	17,956	20,764	263	14,028	16,007
El Paso, TX, Mexico	426	17,490	21,952	489	19,295	24,414
Great Falls, MT:						
Belgium	--	--	--	(3/)	10	11
Canada	166	7,313	9,014	16	888	1,095
Total 4/	166	7,313	9,014	16	898	1,106
Honolulu, HI:						
Australia	56	1,064	1,981	--	--	--
China	147	3,579	4,589	122	2,201	3,216
Thailand	66	1,062	1,721	144	2,460	3,898
Total 4/	270	5,704	8,292	266	4,661	7,115
Houston-Galveston, TX:						
Belgium	--	--	--	(3/)	12	13
China	27	698	1,175	(3/)	37	45
Colombia	111	4,652	6,804	136	5,738	8,483
Croatia	--	--	--	18	612	965
Denmark	26	964	1,261	28	769	1,135
France	(3/)	93	102	(3/)	269	295
Germany	--	--	--	(3/)	75	86
Greece	290	10,593	14,182	104	3,347	4,658
India	--	--	--	(3/)	3	4
Indonesia	--	--	--	15	488	527
Japan	(3/)	45	56	(3/)	16	22
Korea, Republic of	1,513	42,531	66,135	1,609	41,700	66,232
Mexico	15	456	694	--	--	--
Peru	--	--	--	26	796	1,191
Philippines	26	604	1,061	--	--	--
Spain	287	11,136	13,567	--	--	--
Thailand	504	11,149	18,723	531	12,595	18,913
Turkey	56	2,214	3,190	513	14,827	21,440
United Arab Emirates	--	--	--	43	3,467	5,372
United Kingdom	31	816	1,357	(3/)	79	150
Venezuela	42	1,793	2,263	18	755	873
Total 4/	2,928	87,746	130,571	3,043	85,584	130,405
Laredo, TX, Mexico	137	15,413	16,117	159	17,861	18,621
Los Angeles, CA:						
Australia	(3/)	7	8	(3/)	4	5
China	1,690	54,905	70,357	1,475	47,719	61,992
Germany	(3/)	3	4	--	--	--
India	--	--	--	(3/)	4	5
Japan	29	1,097	1,328	33	1,001	1,324
Mexico	(3/)	8	9	--	--	--
Taiwan	--	--	--	(3/)	3	4
Thailand	--	--	--	85	2,386	3,541
United Arab Emirates	(3/)	12	15	--	--	--
United Kingdom	(3/)	18	20	(3/)	13	16
Total 4/	1,719	56,049	71,741	1,593	51,131	66,886
Miami, FL:						
Belgium	4	488	517	3	534	566
China	165	4,184	6,377	--	--	--
Colombia	11	553	703	3	318	403
Denmark	59	2,042	2,651	104	3,114	4,484
France	--	--	--	(3/)	5	6
Indonesia	--	--	--	20	662	896
Korea, Republic of	--	--	--	43	1,392	1,829

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1999			2000		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Miami, FL--Continued:						
Mexico	5	450	529	5	446	568
Spain	889	40,803	52,077	776	31,763	40,768
Sweden	518	16,712	21,447	849	27,148	35,378
Thailand	55	1,359	2,092	18	600	840
United Kingdom	(3/)	80	102	(3/)	137	177
Venezuela	190	7,829	10,024	138	4,995	6,627
Total 4/	1,896	74,501	96,519	1,960	71,113	92,544
Milwaukee, WI:						
Canada	50	2,801	3,401	80	4,598	4,958
Croatia	--	--	--	18	468	468
Total 4/	50	2,801	3,401	99	5,066	5,426
Minneapolis, MN, Germany	(3/)	6	8	(3/)	--	--
Mobile, AL:						
Australia	70	1,172	2,410	--	--	--
Colombia	25	1,054	1,054	--	--	--
Greece	--	--	--	32	1,020	1,339
Indonesia	28	1,336	1,564	--	--	--
Taiwan	24	342	423	--	--	--
Thailand	293	6,171	10,747	459	9,443	18,322
Turkey	--	--	--	66	1,522	2,346
Total 4/	440	10,074	16,197	557	11,985	22,006
New Orleans, LA:						
Belgium	172	5,210	7,133	--	--	--
Bulgaria	130	5,093	6,652	344	12,530	17,489
China	25	577	615	2	155	204
Colombia	--	--	--	(3/)	9	11
Croatia	22	4,921	5,516	27	5,976	6,977
Cyprus	27	1,154	1,490	--	--	--
France	12	2,239	2,600	13	2,435	2,798
Greece	797	30,989	38,338	327	11,278	14,692
Italy	649	24,904	32,969	244	8,993	12,159
Lebanon	--	--	--	45	1,713	2,325
Sweden	259	9,765	12,657	26	830	1,115
Thailand	2,859	80,942	124,384	2,524	64,692	100,247
Turkey	146	7,833	9,232	290	11,773	14,909
Venezuela	231	9,515	11,885	429	18,949	22,812
Total 4/	5,330	183,144	253,469	4,271	139,333	195,738
New York City, NY:						
Bahamas, The	--	--	--	206	7,506	9,485
Colombia	(3/)	6	10	(3/)	11	17
Croatia	(3/)	151	168	(3/)	40	42
Denmark	170	10,459	12,051	68	4,359	5,150
Germany	--	--	--	(3/)	16	17
Greece	394	14,828	18,958	350	12,402	16,791
India	--	--	--	(3/)	5	6
Lebanon	--	--	--	(3/)	3	4
Liechtenstein	(3/)	16	17	--	--	--
Netherlands	(3/)	166	180	(3/)	88	100
Norway	332	12,125	15,227	227	7,576	9,885
Sweden	--	--	--	28	901	1,201
Turkey	265	9,567	11,180	300	10,533	14,185
United Kingdom	(3/)	72	84	(3/)	98	109
Venezuela	28	1,076	1,188	34	1,248	1,778
Total 4/	1,188	48,465	59,064	1,214	44,787	58,770
Nogales, AZ:						
Mexico	656	19,725	25,879	718	21,418	28,124
Netherlands	--	--	--	(3/)	17	21
Total 4/	656	19,725	25,879	718	21,434	28,145

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1999			2000		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Norfolk, VA:						
Bulgaria	109	4,092	5,401	291	13,771	16,202
China	--	--	--	(3/)	2	2
Denmark	223	8,857	11,841	(3/)	67	88
France	90	15,768	16,502	65	12,471	13,361
Germany	--	--	--	(3/)	9	11
Greece	464	19,246	23,647	402	14,311	18,636
Indonesia	--	--	--	38	1,098	1,695
Netherlands	(3/)	34	36	(3/)	185	196
United Kingdom	2	516	629	1	208	261
Venezuela	8	248	337	--	--	--
Total 4/	896	48,761	58,394	798	42,122	50,453
Ogdensburg, NY:						
Canada	178	6,637	7,033	192	7,355	7,720
Croatia	(3/)	42	44	--	--	--
Total 4/	178	6,679	7,077	192	7,355	7,720
Pembina, ND, Canada	341	16,917	19,044	344	16,830	18,770
Philadelphia, PA:						
Germany	1	605	720	(3/)	310	348
Italy	--	--	--	4	560	700
Thailand	339	7,448	8,974	499	9,840	14,342
United Kingdom	(3/)	22	24	(3/)	7	8
Total 4/	340	8,075	9,718	503	10,717	15,399
Port Arthur, TX, Thailand	30	539	539	--	--	--
Portland, ME:						
Canada	66	5,988	6,171	68	6,445	6,812
Saudi Arabia	25	934	934	--	--	--
Turkey	--	--	--	46	1,090	1,761
Total 4/	92	6,922	7,105	114	7,535	8,574
Providence, RI:						
Colombia	24	956	1,373	15	513	727
Philippines	--	--	--	143	2,984	6,501
Spain	247	11,142	14,562	268	9,465	13,724
Venezuela	73	2,936	3,929	137	4,945	7,146
Total 4/	345	15,034	19,863	562	17,907	28,098
San Diego, CA:						
China	551	18,443	24,014	709	21,724	28,464
Mexico	45	1,446	1,888	30	1,001	1,310
Thailand	--	--	--	1	98	127
Total 4/	596	19,890	25,902	739	22,823	29,902
San Francisco, CA:						
Canada	--	--	--	12	579	672
China	354	11,315	16,343	421	13,018	18,628
Switzerland	16	654	1,203	--	--	--
Taiwan	--	--	--	82	2,415	3,742
Thailand	407	18,562	26,203	321	14,385	20,427
United Kingdom	--	--	--	(3/)	3	6
Total 4/	777	30,531	43,750	835	30,398	43,475
San Juan, PR:						
Belgium	6	464	799	5	415	710
Bulgaria	25	977	1,077	--	--	--
China	--	--	--	134	4,685	6,111
Colombia	13	851	878	31	1,142	1,240
Cyprus	54	1,890	2,222	--	--	--
Denmark	33	1,974	3,503	202	8,105	11,512
France	26	812	1,051	--	--	--
Italy	16	677	730	(3/)	8	9
Japan	(3/)	97	144	--	--	--
Lebanon	--	--	--	63	2,451	2,606
Mexico	3	229	347	7	679	968
Morocco	80	3,039	3,342	--	--	--

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	1999			2000		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
San Juan, PR--Continued:						
Spain	34	1,170	1,233	7	204	214
Thailand	40	640	1,390	--	--	--
Turkey	111	3,843	5,090	--	--	--
Venezuela	168	5,395	6,040	--	--	--
Total 4/	609	22,058	27,847	450	17,688	23,369
Savannah, GA:						
Australia	33	574	1,166	--	--	--
China	5	180	231	--	--	--
Colombia	49	2,301	2,926	24	1,295	1,351
Denmark	18	1,594	2,332	5	366	507
Indonesia	--	--	--	82	1,484	3,642
Italy	(3/)	6	11	(3/)	76	108
Taiwan	15	330	645	--	--	--
Thailand	129	3,422	5,240	132	2,988	5,244
Turkey	--	--	--	6	679	754
United Kingdom	25	1,574	1,779	(3/)	45	61
Venezuela	87	3,689	4,063	69	2,746	2,805
Total 4/	362	13,670	18,393	318	9,679	14,471
Seattle, WA:						
Australia	132	3,810	6,044	106	3,027	4,885
Canada	833	40,654	42,182	1,077	51,724	55,005
China	126	4,449	5,618	44	1,264	1,767
Japan	1	238	344	(3/)	33	48
Total 4/	1,090	49,152	54,188	1,227	56,048	61,705
St. Albans, VT:						
Canada	250	15,076	16,564	178	13,084	14,018
France	--	--	--	(3/)	44	53
Total 4/	250	15,076	16,564	178	13,128	14,071
Tampa, FL:						
Canada	--	--	--	12	340	588
China	28	938	1,217	--	--	--
Colombia	946	37,835	45,584	1,054	39,767	48,961
Denmark	112	7,700	11,882	146	11,112	15,178
Greece	141	4,710	6,278	--	--	--
India	--	--	--	(3/)	8	10
Indonesia	--	--	--	20	650	880
Korea, Republic of	--	--	--	33	1,066	1,410
Philippines	--	--	--	16	376	687
Spain	79	3,010	3,914	64	2,081	2,444
Switzerland	38	1,261	1,675	--	--	--
Thailand	136	3,555	5,978	551	12,400	23,866
Turkey	161	6,128	8,077	--	--	--
United Arab Emirates	--	--	--	5	409	617
Venezuela	752	30,765	37,918	558	21,423	27,154
Total 4/	2,395	95,902	122,523	2,458	89,632	121,795
U.S. Virgin Islands:						
Barbados	--	--	--	2	74	94
Panama	5	156	187	3	92	117
Venezuela	53	1,964	2,357	71	4,149	4,911
Total 4/	57	2,120	2,543	75	4,315	5,122
Washington, DC, Italy	--	--	--	(3/)	5	6
Wilmington, NC:						
Colombia	--	--	--	13	557	750
Indonesia	--	--	--	21	918	1,438
Italy	--	--	--	(3/)	4	4
Korea, Republic of	16	669	910	--	--	--
Thailand	--	--	--	22	1,114	1,670
Venezuela	103	4,275	5,861	--	--	--
Total 4/	118	4,944	6,771	55	2,593	3,864
Grand total 4/	29,351	1,144,525	1,449,823	28,684	1,073,943	1,397,541

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

-- Zero.

1/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

2/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

3/ Less than 1/2 unit.

4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 20

U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	1999			2000		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	228	5,703	9,514	179	4,301	7,379
Bahamas, The	--	--	--	199	6,713	8,553
Belgium	74	2,605	3,463	--	--	--
Bulgaria	238	9,185	12,053	635	26,301	33,691
Canada	4,057	202,552	217,108	3,916	202,885	216,312
China	3,678	119,504	157,973	3,301	104,103	138,811
Colombia	1,096	45,329	56,701	1,314	51,444	66,633
Croatia	--	--	--	18	612	965
Cyprus	27	1,154	1,490	--	--	--
Denmark	438	16,861	21,960	385	12,721	17,756
Greece	1,843	71,910	90,203	1,392	48,417	64,535
Indonesia	56	1,852	2,584	161	3,894	7,113
Italy	665	25,529	33,625	248	9,557	12,863
Korea, Republic of	1,529	43,200	67,045	1,721	45,232	71,029
Mexico	1,080	31,948	42,586	1,174	34,282	45,756
Norway	332	12,125	15,227	226	7,576	9,885
Philippines	26	604	1,061	159	3,360	7,187
Spain	1,795	70,193	91,577	1,054	35,535	48,253
Sweden	789	26,387	33,949	903	28,879	37,694
Taiwan	15	330	645	81	2,417	3,745
Thailand	3,089	91,438	139,770	3,594	100,413	156,533
Turkey	767	30,575	37,760	1,225	40,632	59,230
United Kingdom	48	1,563	2,135	(3/)	33	37
Venezuela	1,725	72,309	88,758	1,851	73,376	93,495
Other	75 r/	2,861 r/	3,674 r/	106	3,672	4,723
Total 4/	23,672	885,716	1,130,861	23,842	846,355	1,112,178

r/ Revised. -- Zero.

1/ Includes imports into Puerto Rico.

2/ The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	1999 Quantity	1999 Value Customs 2/	1999 Value C.i.f. 3/	2000 Quantity	2000 Value Customs 2/	2000 Value C.i.f. 3/
Belgium	10	952	1,316	8	949	1,276
Canada	210 r/	22,725 r/	23,447 r/	181	21,118	21,892
China	5	202	327	26	1,359	1,674
Colombia	2	265	337	9	880	1,042
Denmark	205	17,054	23,893	170	15,211	20,343
Indonesia	3	744	871	36	1,406	1,966
Mexico	183	21,267	22,555	205	23,807	25,352
Norway	--	--	--	36	2,681	2,741
Spain	105	10,206	11,586	123	10,136	12,176
Thailand	80	9,663	14,523	23	1,212	1,798
Turkey	--	--	--	24	1,976	2,340
United Arab Emirates	--	--	--	48	3,876	5,988
United Kingdom	8	793	960	(4/)	17	18
Venezuela	15	635	836	22	1,560	1,612
Other	(4/)	263	287 r/	14	1,686	1,960
Total 5/	825 r/	84,769 r/	100,939 r/	923	87,872	102,178

r/ Revised. -- Zero.
1/ Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	1999 Quantity	1999 Value Customs 2/	1999 Value C.i.f. 3/	2000 Quantity	2000 Value Customs 2/	2000 Value C.i.f. 3/
Australia	159	2,810	5,557	--	--	--
Canada	1,221	53,203	60,268	847	43,552	45,459
China	153	3,776	4,843	122	2,282	3,321
Colombia	151	5,754	6,723	201	6,849	8,019
Croatia	--	--	--	18	468	468
Cyprus	54	1,890	2,222	--	--	--
France	127	17,853	19,112	76	13,177	14,312
Greece	141	4,710	6,278	--	--	--
Korea, Republic of	--	--	--	102	4,509	4,549
Lebanon	--	--	--	90	3,593	4,097
Morocco	177	6,800	8,956	22	974	1,331
Switzerland	39	1,261	1,675	--	--	--
Thailand	1,971	43,445	63,632	2,077	41,163	72,904
Turkey	--	--	--	204	5,261	7,703
Venezuela	328	11,014	12,883	--	--	--
Other	49 r/	1,319 r/	1,500 r/	(4/)	3	3
Total 5/	4,570 r/	153,834	193,650	3,760	121,830	162,167

See footnotes at end of table.

TABLE 22--Continued
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY 1/

r/ Revised. -- Zero.
1/ For all types of hydraulic cement. Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 23
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1996	1997	1998	1999	2000 e/
Afghanistan e/	116	116	116	116	120
Albania e/	203 r/	100 r/	84 r/	106 r/	110
Algeria e/	6,500 r/	7,096 2/	7,500 r/	7,500	8,300
Angola e/	270	301 2/	350	350	350
Argentina	5,117	6,858	7,091	7,187	7,150
Armenia	282	297	300	287 r/	219 2/
Australia e/	6,250 r/	6,450 r/	6,850 r/	7,450 r/	7,500
Austria	3,874	3,852	3,850 e/	3,950 e/	3,900
Azerbaijan	223	315	201	200	200
Bahrain	192	172	230	156 r/	89 2/
Bangladesh e/ 3/	650	865	900	950	980
Barbados	107	173	259	253 r/	268 2/
Belarus	1,467	1,876	2,035	2,100 r/	1,800 2/
Belgium	7,857	8,052	7,000 r/ e/	7,500 r/ e/	8,000
Benin e/	360	450	520	520	520
Bhutan e/	160	160	150	150	150
Bolivia	934	1,035	1,169 r/	1,214 r/	1,300
Bosnia and Herzegovina e/	150	200	300	300	300
Brazil	34,597	38,096	39,942	40,270	39,208 p/
Brunei	250 r/ e/	250 r/ e/	216	208 r/	232 2/
Bulgaria	2,137	1,656	1,700 e/	1,700 e/	1,700
Burkina Faso e/	30	40	40	50	50
Burma	505	516	365	338	393 2/
Cambodia e/	200	200	300	300	300
Cameroon	305	350	400	500 e/	500
Canada	11,587	12,015	12,124	12,634 r/	12,612 p/
Chile	3,634	3,735	3,888	3,036 r/	3,491
China	491,190	511,730	536,000	573,000	583,190 2/
Colombia	8,907	8,446	9,190	7,500 r/ e/	7,500
Congo (Brazzaville)	50 e/	20 r/	--	--	20
Congo (Kinshasa)	241	125	134 r/	158 r/	96
Costa Rica	830	940	1,200 r/	1,260 r/	1,150
Côte d'Ivoire e/	1,000	1,100	650	650	650
Croatia	1,842	2,134	2,295	2,712	2,852 2/
Cuba	1,453	1,713	1,800 e/	1,920 r/	1,700
Cyprus e/	1,000	910	1,200 2/	1,200	1,200
Czech Republic	5,015	4,877	4,604	4,241 r/	4,093 2/
Denmark	2,629	2,683	2,528	2,600 r/ e/	2,650
Dominican Republic	1,642	1,835	1,885	2,000 e/	2,000
Ecuador	3,028	2,900 e/	2,600 r/	2,300 r/	2,800
Egypt	18,700	19,700	21,000 e/	23,313 r/	24,143 2/
El Salvador	948	1,020	1,076 r/	1,031 r/	1,064 2/
Eritrea e/	47 2/	60 r/	50 r/	50 r/	45
Estonia	388	423	321	358	329 2/
Ethiopia e/	690	752	784	638 r/	880 2/

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1996	1997	1998	1999	2000 e/
Fiji	84	96	90	95 e/	95
Finland	975	905	903 e/	1,310 r/	1,350
France	19,514	19,780	19,500 e/	19,527	20,000
French Guiana	52	51	50 e/	50 e/	50
Gabon	185	200 e/	196	200 e/	200
Georgia	85	91	200	300	300 2/
Germany	31,533	35,945	36,610	38,099	38,000
Ghana	1,500 e/	1,700 e/	1,630	1,870	1,950 2/
Greece e/	14,700	14,982 2/	15,000	14,000 r/	14,500
Guadeloupe e/	230	230	230	230	230
Guatemala	1,090	1,280	1,770 r/	1,900 r/	2,000
Guinea e/	260	260	260	250	250
Honduras	952	980 e/	1,020 r/	1,200 r/	1,280
Hong Kong	2,027	1,925	1,539	1,387	1,284 2/
Hungary	2,747	2,811	2,999	2,979 r/	3,000
Iceland	88	101	118 r/	131 r/	144 2/
India e/	75,000	80,000	85,000	90,000	95,000
Indonesia	24,646	27,505	22,341	23,925	27,789 2/
Iran	18,350	19,250	19,500 e/	20,000 e/	20,000
Iraq e/	1,600	1,700	2,000	2,000	2,000
Ireland	1,933	2,100	2,000 e/	2,000 e/	2,000
Israel	5,600 r/	5,400 e/	6,476 r/	6,354 r/	6,600
Italy	33,327	33,721	35,512	36,000 e/	36,000
Jamaica	557	588	558	504	500
Japan	94,492	91,938	81,328	80,120	81,300
Jordan	3,512 r/	3,251 r/	2,650 r/	2,687 r/	2,640 2/
Kazakhstan	1,120	661 e/	600 e/	838 r/	1,175 2/
Kenya	1,816	1,506	1,200 e/	1,204 r/	1,071 2/
Korea, North e/	17,000	17,000	17,000	16,000	15,000
Korea, Republic of	58,434	60,317	46,091	48,157	51,255 2/
Kuwait e/	2,000	2,000	2,000	2,000	2,000
Kyrgyzstan	544	658	709	386	500 2/
Laos e/	78 r/	84 r/	80 r/	80 r/	80
Latvia	325	246	W	W	W
Lebanon	3,500 r/ e/	2,703	3,310 r/	3,200 r/	3,200
Liberia e/	15	7	10	15	15
Libya	3,550	2,524	3,000 e/	3,000 e/	3,000
Lithuania	700 r/ e/	714 r/	788	666	570 2/
Luxembourg	667	683	700 e/	700 e/	700
Macedonia	491	500 e/	461	520	585 2/
Madagascar	44 r/	36 r/	44 r/	46 r/	48
Malawi	91	176	134 r/	187 r/	198
Malaysia	12,349	12,668	10,397	10,104 r/	11,445 2/
Mali e/	12	10	10	10	10
Martinique e/	220	220	220	220	220
Mauritania e/	100	80	50	50	50
Mexico	25,366	27,548	27,744	29,413	31,677 2/
Moldova	40	122	74	50	222 2/
Mongolia	106	112	109	104	92 2/
Morocco	6,585	7,236	7,200 e/	7,200 e/	7,200
Mozambique	180 e/	220 e/	260 r/	270 r/	310
Namibia e/	50	100	150	150	150
Nepal 3/	309	225	280 e/	290 e/	300
Netherlands	3,140	3,230	3,200 e/	3,200 e/	3,200
New Caledonia	100 e/	100 e/	--	--	100
New Zealand	974	976	950 r/ e/	960 r/ e/	950
Nicaragua	360	377	480 r/	570 r/	650
Niger e/	29 2/	30	30	30	30
Nigeria	2,545	2,520	2,700 e/	2,500 e/	2,500
Norway	1,664	1,724	1,676	1,700 e/	1,720
Oman	1,260	1,264	1,300 e/	1,300 e/	1,716 2/
Pakistan	8,900 e/	9,001	8,901	9,300 e/	9,500
Panama	647	700	750	900 r/	1,000

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/

(Thousand metric tons)

Country	1996	1997	1998	1999	2000 e/
Paraguay	613	675 e/	620 r/	640 r/	650
Peru	3,848	4,301	4,340	3,799	3,800
Philippines	12,429	14,681	12,888	12,556	12,500
Poland	13,959	15,003	14,970	15,550 r/	14,807 2/
Portugal	8,455	9,395	9,500 e/	9,500 e/	9,200
Qatar	690	692	700 e/	1,025 r/	1,050
Réunion	299	277	380 r/	380 r/	400
Romania	6,956	7,298	7,300	6,252	8,264 2/
Russia	27,800	26,700	26,000	28,400	32,400 2/
Rwanda	42 r/	60 r/	59 r/	66 r/	70
Saudi Arabia	16,437	15,400	14,000 r/ e/	14,000 e/	15,000
Senegal	811	854	1,000	1,000 e/	1,000
Serbia and Montenegro	2,205	2,011	2,253	1,575	2,117 2/
Sierra Leone e/	160	50	100	100	100
Singapore e/	3,300	3,300	3,300	3,250	3,250
Slovakia	2,802	3,017	3,000 e/	3,000 e/	3,000
Slovenia	1,026	1,113	1,149	1,224 r/	1,300
South Africa e/	9,000	9,500	9,500	8,900	8,900
Spain (including Canary Islands)	25,157	27,632	27,943	30,800	30,000
Sri Lanka	928 e/	965 e/	874 r/	976 r/	1,008 2/
Sudan	380 e/	291	206 r/	267 r/	300
Suriname e/	60	65	65	65	65
Sweden	2,447	2,253	2,105	2,100 e/	2,150
Switzerland	3,638	3,568	3,600 e/	3,600 e/	3,600
Syria	4,500 e/	4,840 r/	4,607 r/	4,781 r/	4,830
Taiwan	21,537	21,522	19,652	18,283	18,500
Tajikistan	50	36	18	30	50 2/
Tanzania	726 r/	621 r/	778 r/	833 r/	833
Thailand	38,749 r/	37,086 r/	30,000 r/ e/	34,000 r/ e/	32,000
Togo	413	421	565	560	560
Trinidad and Tobago	617	653	690	688	743 2/
Tunisia	4,567	4,424 r/	4,588 r/	4,864 r/	5,409 2/
Turkmenistan e/	451 2/	450	450	450	450
Turkey	35,214	36,035	38,200	34,258 r/	35,825 2/
Uganda	250 r/	270 r/	285 r/	310 r/	320
Ukraine	5,017	5,098	5,591	5,828	5,311 2/
United Arab Emirates e/	6,000	5,250	6,000	6,000	6,000
United Kingdom	12,214	12,638	12,409	12,697 r/	12,800
United States (including Puerto Rico) 4/	80,818	84,255	85,522	87,777	89,510 2/
Uruguay	685	781	750 r/	720 r/	700
Uzbekistan	3,300	3,300	3,400 e/	3,300 e/	3,400 2/
Venezuela	7,556	8,145 r/	8,202 r/	8,500 r/ e/	8,600
Vietnam	6,586	8,019	9,700 r/	10,381 r/	12,500
Yemen	1,028	1,235	1,201	1,454	1,400
Zambia	348	384	351	300 r/ e/	380
Zimbabwe e/	1,000	1,100	1,100	1,000	1,000
Total 5/	1,493,000 r/	1,547,000	1,547,000 r/	1,603,000 r/	1,643,000

e/ Estimated. p/ Preliminary. r/ Revised. W Withheld to avoid disclosing proprietary data. -- Zero.

1/ Table includes data available through August 20, 2001. Data may include clinker exports for some countries.

2/ Reported figure.

3/ Data for year ending June 30 of that stated.

4/ Portland and masonary cements only.

5/ Data are rounded to four significant digits.

CEMENT

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Nicholas Muniz, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

This report covers hydraulic cement varieties that can be loosely grouped as portland cement and masonry cement; unless otherwise specified, activity levels in this report exclude Puerto Rico. In 2001, U.S. production of portland and masonry cements, combined, increased by about 1% to a new record of about 88.9 million metric tons (Mt) (table 1). Output of clinker, the intermediate product of cement manufacture, increased by about 0.4% to a new record of 78.5 Mt. The small relative production increases for cement and clinker may reflect the fact that 2000 was a leap year, with an extra working day. The United States continued to rank third in the world in overall hydraulic cement output, behind China and India; world output was about 1.7 billion metric tons (Gt).

Domestic consumption of cement continued to grow at a modest rate and reached a new overall record despite continued general weakness in the U.S. economy. Apparent consumption of cement in 2001 increased by about 2% to about 112.7 Mt (table 1). These growth rates were similar to those in 2000, but significantly lower than those of the immediately preceding years. As with previous years, the large production shortfall in 2001 was met by imports of cement, although the overall import levels declined. The 3% overall decline in cement prices was offset by the higher sales volumes. The total value (at the plant) of annually reported cement sales to final domestic customers rose by about 3.7% to about $8.6 billion (table 1), and essentially the same total value applies to the 2001 consumption tonnage (defined as shipments to final customers and based on monthly data) reported in table 9; the total value of 2000 sales in table 9 was also $8.6 billion. The delivered value of concrete, excluding mortar, in the United States was estimated to be at least $40 billion in 2001, based on typical portland cement contents of concrete.

The range of cements included within the general portland cement designation as used in this report can be found in table 16. Data for sales of blended cements listed separately from other portland cements (combined) are available within the monthly cement reviews of the U.S. Geological Survey (USGS) Mineral Industry Surveys series, starting with January 1998. In this report, masonry cement includes true masonry cements, portland-lime cements, and plastic cements. Excluded from this report are data on the production and sales of aluminous cements and pure cementitious or pozzolanic additives, such as fly ash and ground granulated blast furnace slag (GGBFS, but increasingly being referred to as slag cement).

In 2001, U.S. production of portland cement rose by about 1.1% to about 84.5 Mt, yet another new record. The top five producing States, in descending order, were Texas, California, Pennsylvania, Michigan, and Missouri. Portland cement producers in the United States ranged widely in size and in the number of plants operated. If companies having common parents are combined under the larger subsidiary's name and if joint ventures are apportioned, then the top 10 companies at yearend 2001, in descending order of cement production, were Lafarge North America, Inc; Holcim (US) Inc.; CEMEX, S.A. de C.V.; Lehigh Cement Co.; Ash Grove Cement Co.; Essroc Cement Corp.; Lone Star Industries Inc.; RC Cement Co. (including Alamo Cement Co.); Texas Industries Inc. (TXI); and California Portland Cement Co. The top 5 of these had about 52% of total U.S. production and production capacity, and all 10 together accounted for about 75% of total U.S. production and production capacity. Of the companies listed, all except Ash Grove and TXI were foreign-owned as of yearend.

Widespread consolidation in the international cement industry continued in 2001, with three significant ownership changes affecting the U.S. industry during the year. Following its well publicized but unsuccessful takeover bid in 2000 for Blue Circle Industries, Lafarge made an improved offer for Blue Circle in early 2001 that was accepted. Lafarge became the world's largest cement producer and the largest in the United States as a result of this merger. The merger resulted in Lafarge's operating subsidiary in the United States and Canada (Lafarge Corp.) having 13 integrated cement plants in the United States as well as 2 (clinker) grinding plants in Florida (Port Manatee and Tampa) and a large grinding plant for GGBFS at Sparrows Point, MD. In September, Lafarge Corp. changed its name to Lafarge North America, Inc.

As part of the Blue Circle takeover, Lafarge agreed to sell St. Marys Cement Corp. (a Blue Circle subsidiary that operated a large grinding plant in Detroit, MI, as well as several U.S. terminals). St. Marys was bought by Votorantim Cimentos Ltda., the largest Brazilian cement producer; this was Votorantim's first foray into the North American cement market. Also during the year, Grupo Cementos de Chihuahua, S.A. de C.V. (GCC), a Mexican cement company, purchased Dacotah Cement Co. from the State of South Dakota. Prior to the sale, the Rapid City, SD, facility had been the only U.S. cement plant under State ownership. After the purchase, Dacotah Cement was renamed GCC Dacotah, Inc. The only other U.S. cement plant owned by GCC was Rio Grande Portland Cement Co. at Tijeras, NM. In December, the Swiss corporation Holderbank Financière Glaris Ltd., the world's largest cement producer prior to the Lafarge-Blue Circle merger, formally changed its name to Holcim Ltd. Its main U.S. subsidiary, Holnam Inc., became Holcim (US) Inc. In August, Australian-owned CSR America, Inc., changed its name to Rinker Materials Corp. The company owned two cement plants in Florida—the Rinker plant in Miami and the Florida Crushed Stone Co. plant in Brooksville.

In May, seven cement companies involved with grinding or using GGBFS formed the Slag Cement Association, based in Sugar Land, TX, to promote the use of this product as an additive in blended portland cements and as a partial replacement for portland cement in concrete mixes.

The bulk of this report is based on data compiled from USGS annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are independent of U.S. cement manufacturers. For 2001, responses were received from 125 of 144 facilities canvassed, a response rate of 87%. The 19 forms not received included 12 integrated plants, 1 grinding plant, and 6 independently reporting import terminals. The forms that were received accounted for approximately 90% of the U.S. total cement and clinker production shown and approximately 85% of total cement sales. In contrast, responses received for the 2000 data year totaled 143 of 144 facilities canvassed, included all the producers, and covered 100% of actual production and more than 99% of sales.

The need to estimate data for so many survey forms not received for the 2001 survey required the rounding of some State, district, and national totals on a number of tables; these rounded data have been footnoted. However, data were not rounded for districts where the data were obtained by telephone inquiry, were unaffected by missing forms, or were available from the monthly surveys (e.g., clinker production).

Legislation and Government Programs

Economic Issues.—Government economic policies and programs affecting the cement industry are those affecting cement trade, interest rates, and public sector construction spending. In terms of trade, the major issue in 2001 remained that of antidumping tariffs against Japan and Mexico; in a 2000 sunset review judgement, these tariffs were ruled as still necessary. On March 8, 2001, the U.S. Department of Commerce released its determination for the ninth review period, covering August 1998 to July 1999, for gray portland cement and clinker from Mexico; the dumping margin for the period was set at 39.34% (Southern Tier Cement Committee, 2001).

The major Government construction funding program in 2001 remained the Transportation Equity Act for the 21st Century (TEA-21), passed in 1998, which authorized $216.3 billion in funding for the 6-year period from 1998 to 2003 to upgrade the country’s transportation infrastructure. The level of funding in TEA-21 exceeded previous spending levels by an average of about 44% per State, and the bill contained substantial funding guarantees. Funding provided for about $173 billion for new roads and bridges and existing infrastructure upgrades and repairs, of which about 95% was guaranteed. Although Federal public sector expenditures on highways increased since the passage of TEA-21, the increases were below expectations, as have been the levels of cement consumption for this work. Various factors have been blamed for the actual TEA-21 funding and consumption levels, including delays in or unavailability of State funding for cofunded projects, greater than anticipated lag times between project initiation and actual cement consumption, greater than anticipated work not requiring significant concrete, and as pointed out by Engineering News-Record (2001), environmental issues that have caused delays to or cancellation of some projects and, in many cases, raised project costs.

Environmental Issues.—Cement production involves both mining and manufacturing activities. Environmental issues related to mining of cement raw materials are mostly local and are common to most surface mines; they include potential problems with dust, increased sediment loads to local streams, noise, and ground vibrations from blasting.

Emissions of cement kiln dust (CKD), nitrogen and sulfur oxides, and carbon dioxide (CO_2) accompanying the manufacture of clinker are the main environmental issues concerning the cement industry. These issues have been discussed in more detail in previous editions of this report. The most important emissions are of CO_2, amounting to nearly 1 metric ton (t) of gas per ton of clinker, about one-half of which is derived from the calcination of calcium carbonate raw materials, and the rest from the combustion of fuels. Overall, CO_2 generation by the U.S. industry in 2001 was about 75 Mt.

Many individual cement companies and the industry in general view CO_2 issues in a multinational or global context while remaining cognizant of potential country-level statutory limitations or remedies regarding emissions. The major concern by the industry is that strategies designed to reduce CO_2 emissions by the largest cumulative sources (powerplants and motor vehicles) may disproportionately impact the cement industry. The levels of national CO_2 emissions reductions currently under consideration are those specified by the Kyoto Protocol, signed at the United Nations Framework Convention on Climate Change held in Kyoto, Japan, in 1997. Although the U.S. Government did not ratify the Kyoto Protocol and, in early 2001, formally withdrew from its provisions, the Government continues to acknowledge the desirability of reducing U.S. emissions of CO_2, and consequently, the U.S. cement industry has continued to study ways to reduce such emissions. In January, a long-term strategy for reducing the environmental impact of concrete production was released (American Concrete Institute, 2001). In addition, member companies of the Portland Cement Association agreed to a voluntary goal to reduce their average CO_2 emissions, as calculated per ton of cementitious product, by 10% below 1990 levels by the year 2020.

Cement kilns are considered to be a relatively environmentally benign way of burning a variety of hazardous and nonhazardous wastes owing to the very high temperatures at which clinker is made and the long residence times of materials in the kiln. However, the ability of plants to burn waste materials, either as fuels or raw materials, can be constrained by the degree to which such materials increase fugitive emissions of regulated trace elements or compounds. These limits can impact normal (non-waste-burning) operations as well. In 2001, the U.S. Environmental Protection Agency released new toxic release inventory (TRI) threshold guidelines for mercury, lead, and some persistent bioaccumulative toxics that were much lower than previous thresholds. For example, the new threshold for lead was set at 100 pounds per year, down from 10,000 pounds per year. The new threshold for mercury was just 10 pounds per year, down from 25,000 pounds per year. Although the thresholds are levels above which a plant must report their emissions, they are not emissions limits. Given the large quantities of fuels and raw materials burned by cement plants, it was likely that many plants would reach or exceed the new TRI thresholds, even where the materials burned contained these substances only in trace quantities, and the industry was concerned that it would suffer adverse publicity as a result.

Production

In 2001, cement was produced in 37 States and in Puerto Rico (tables 3-4). In addition to the portland and masonry cement plants, there were several grinding facilities that produced GGBFS from unground slag brought in from domestic or foreign sources.

There were no new (greenfields) portland cement plant openings during 2001[1]. In the related field of cementitious products, however, grinding plants to make GGBFS or slag cement were opened at two locations. The St. Lawrence Cement Group opened a 0.5-million-metric-ton-per-year (Mt/yr) GGBFS grinding plant in Camden, NJ; the plant came onstream in June and was commissioned in September (Cement Americas, 2002d; Holcim Ltd., 2002, p. 24). All the granulated slag feed for the facility is imported. Holcim completed and commissioned a 0.45-Mt/yr slag-grinding plant in Midfield, AL, which services United States Steel Corporation's Fairfield, AL, steel plant, to which a 1,200-metric-ton-per-day (t/d) granulator had been added as part of the project (Cement Americas, 2002b). Lafarge was constructing a GGBFS grinding plant in South Chicago, Il; the facility will be fed with imported slag (Cement Americas, 2001).

A number of existing portland cement plants completed major capacity upgrade projects during the year. In June, Holcim permanently shut down the two remaining operational wet kilns at its Portland Plant in Florence, CO, in anticipation of the operation of the plant's newly completed 1.9-Mt/yr dry kiln line in August. Unfortunately, major structural problems in the preheater-precalciner tower were discovered within 2 weeks of the new kiln's startup, which forced the shutdown of the new kiln until the tower could be repaired. The repairs were expected to continue into mid-2002. Holcim had announced that the Portland Plant's new kiln line would allow the closure of the company's plant in LaPorte, CO (near Fort Collins), but this plant's closure was delayed indefinitely until the problems at the Portland plant were resolved (International Cement Review, 2001b). Because the Portland plant briefly had production from both wet and dry kilns during the year, the facility is incorporated in the combined (wet and dry) technology grouping for 2001, rather than within the wet technology grouping, in tables 5, 7, and 8. Three other wet plants operated dry kilns during the year for the first time and are likewise grouped under the combined grouping. In July, Ash Grove started up a new 1.5-Mt/yr dry kiln line at its Chanute, KS, plant. The new kiln line replaced two wet kilns (Cement Americas, 2002a; Ash Grove Cement Co., 2001). In April, RC Cement Co. started up its new 0.72-Mt/yr kiln line and shut down a pair of wet kilns at its Signal Mountain, TN, plant. The plant's new finish mill had been brought online in mid-2000 (Maranzana, 2000). A new 5,500-t/d dry kiln line was brought online by TXI at its Midlothian, TX, plant in January; the accompanying finish mill had been completed in late 2000 (International Cement Review, 2000). Although the new kiln would replace some of the existing wet kiln clinker output, TXI had no plans to permanently idle any of the four existing wet kilns.

[1]One small (clinker) grinding plant opened late in the year in Milwaukee, WI, but no data were as yet available for it, and it is not included in this report's tabulations.

Test kiln firing commenced in late October, with the first clinker produced in early November, at the new 5,500-t/d dry kiln line at Lehigh's plant in Union Bridge, MD (Krupp Polysius AG, 2002). The facility's four long dry kilns were expected to be shut down permanently in mid-2002.

At its Victorville, CA, plant, CEMEX retired a long dry kiln and started up a newly completed 5,500-t/d dry kiln. This completed a multiyear expansion program at the plant (CEMEX, S.A. de C.V., 2002). Lafarge was nearing completion of the expansion projects at the Sugar Hill, MO, and Calera, AL, plants. The new kiln lines were expected to be operational in 2002 (Lafarge North America, Inc., 2002, p. 31). Rinker Materials' plant in Miami, FL, had its first full year of operation on its new dry kiln line, which was completed in 2000. Roanoke Cement Co. opened a large, new cement bagging facility in December; this completed a 5-year general modernization and upgrade program at the plant (Cement Americas, 2002c).

Hawaiian Cement Co. completed construction of its twin 30,000-t cement silos as part of its plan to rely solely on imported cement (Wurlitzer, 2001). The company ceased importing clinker in March and permanently closed its grinding plant in September. In the only other permanent plant closure during the year, Kosmos Cement Co. [a joint venture between CEMEX (75%) and Lone Star Industries Inc. (25%)], shut down the kiln at its Pittsburgh, PA, plant in March and closed the grinding plant in September. The facility will be maintained as a distribution terminal.

Portland Cement.—Portland cement was manufactured in the United States in 2001 at a total of 115 plants. There were also two portland cement plants in Puerto Rico. Six of the portland-cement-producing facilities were only grinding plants that did not produce their own clinker. Excluded from the count in 2001 was one plant (counted in 2000) that reported portland cement production but, in fact, only reground imported portland cement into another variety (i.e., it did not grind clinker). Of the six grinding plants counted, one was operated only intermittently during the year, and several also ground slag in addition to clinker. The distribution, by district, of portland cement plants, cement production, grinding capacities, and yearend cement stockpiles, is listed in table 3.

There was a substantial mix of significant production increases and decreases among the districts (table 3). The closure of the Kosmos plant in Pittsburgh probably explains much of the decline seen in western Pennsylvania. The declines seen in Kansas, Missouri, and South Carolina appear to be the result of disruptions to normal operations caused by upgrade projects at plants in those States. The decline in the Colorado-Wyoming district appears to be largely a result of the problems at Holcim's Florence, CO, plant, and the decline in the Alaska-Hawaii district reflects the cessation of production (grinding) in Hawaii noted above. Declines in the Georgia-Virginia-West Virginia district and in California appear to be mostly owing to relatively weak markets during the year. The very strong increase in the Kentucky-Mississippi-Tennessee district appears to reflect the 2000 upgrade of the Kosmos Cement plant in Louisville, KY, and the Signal Mountain, TN, plant upgrade in 2001. The strong increase in northern Texas reflects the 2000 and 2001 upgrades of the Midlothian plants of Holcim and TXI, respectively. In most States showing production declines that can be related to production disruptions, large drawdowns in yearend cement stockpiles were seen. Yearend stockpiles for the country dropped by almost 1 Mt, or about 13.6%, to about 6.1 Mt.

The overall grinding capacity rose by about 3.2% to 106.8 Mt; however, grinding capacity utilization fell by about 2%. The capacity utilization percentages shown in table 3 are relative to portland cement production, but if they are calculated on a total cement (including masonry) basis, then the utilization percentage in 2001 improves to 83.3%, still down by about 2% from 2000 levels. Many cement plants have excess grinding capacity because it is relatively inexpensive to provide for such. Also, the capacities shown in table 3 for some districts include reported clinker grinding capacity that is currently utilized to grind slag (GGBFS). This is especially true in Florida, which shows a relatively low capacity utilization level. The low value for Alaska-Hawaii reflects the closure, noted earlier, of the district's sole grinding plant during the year. Some low utilization rates also reflect plant upgrades late in the year; the full new capacity is credited without commensurate full year production at the upgraded levels. In contrast to recent years, many districts showed capacity utilization rates in 2001 that were perhaps slightly below full practical operational levels.

Data are not collected on the production of specific varieties of portland cement, but it may be presumed that production levels approximate the breakdown, by type, of portland cement sales (shipments) listed in table 16. Ideally, this comparison should be adjusted for the import component of sales. Imports are dominated by Types I and II portland cement but include significant Type V (mainly into southern California) and white cement. Production of Types I and II (or hybrids thereof) accounted for about 90% of total portland cement output.

Masonry Cement.—Production of masonry cement rose by about 2.7% to about 4.5 Mt in 2001 (table 4), following a 1.4% decline the previous year. Unlike portland cement, little if any masonry cement is imported; accordingly, production is virtually identical to the consumption levels (as defined by shipments to final customers) in table 9. The data in both tables 4 and 9, however, underrepresent true production and consumption levels of masonry cement because it is common for masonry cement (particularly the portland lime variety) to be made at the jobsite from purchased portland cement and lime. There are no data on this jobsite activity. In 2001, all but about 5% of the masonry cement continued to be reported by cement companies as having been made directly from clinker rather than starting from a finished portland cement.

Clinker.—Output of clinker increased by about 0.4% to 78.5 Mt in 2001, a new record (table 1). Unlike the case of cement production, clinker production data were not rounded even for States for which plant forms were not received because monthly clinker production data were available for all the nonrespondent facilities (table 5). This does not apply to the capacity or stockpile data, some entries for which have been rounded. As with portland cement production, there was a broad mix of district-level clinker production increases and declines. Most of the production increases could be attributed to capacity upgrades that occurred either late in 2000 or early enough in 2001 that significantly enhanced production could be realized; cases in point are Arizona, Indiana, Kentucky and Tennessee, and northern Texas. Some upgrade work (e.g., southern California and Maryland), on the other hand, led to kiln output disruptions or shutdowns of old kilns in advance of new kiln startups. The large decline in the Colorado-Wyoming district output was because of the startup problems at one new kiln line in Colorado.

In 2001, clinker was produced by a total of 111 integrated cement plants operating 206 kilns. Two of these plants and kilns were in Puerto Rico. Of the total, 77 plants were dry process facilities. The number of wet process plants declined to 28, because 4 wet plants were reclassified into the "Integrated plants: Both" (wet and dry) category owing to the addition and operation of dry kilns during the year. Three of these plants likely will be reported as dry process plants in the 2002 edition of this report. The dry process plant category includes one semidry plant in Indiana.

California, Texas, Pennsylvania, Missouri, and Michigan, in descending order, remained the top five clinker-producing States in 2001 (table 5). Combining companies as much as possible under common ownership, the top 5 companies had 52% of total U.S. clinker production and 55% of capacity, and the top 10 companies had 75% of production and 77% of capacity. The top 10 companies, in descending order of clinker production, were Holcim, CEMEX (ranked first in capacity), Lafarge (including Blue Circle), Lehigh, Ash Grove, Essroc, TXI, Lone Star, RC Cement, and California Portland.

Annual clinker capacity and capacity utilization data are highly sensitive to reported kiln shutdown periods, specifically those for routine maintenance. This downtime sensitivity means that changes of a few percentage points in regional annual clinker production capacity or capacity utilization rates have little statistical significance. Apparent clinker capacity in 2001 increased by about 10% to 98.4 Mt/yr, despite the 1-day shorter working year (table 5). Overall capacity utilization fell to 80% from 87.5% in 2000, but this includes the inclusion of new capacity added late in the year (hence not offset by production) or capacity that was unavailable because of technical problems (one plant in Colorado). With few exceptions, the capacity utilization rates depict an industry running its kilns at full or close to full practicable production levels nationwide.

Based on the data in table 5, average plant clinker capacity in 2001 was about 0.90 Mt/yr, up by about 10%, and average kiln capacity was 0.48 Mt/yr, up by 7%. Plants operating only dry process kilns in 2001 produced 75.2% of the total clinker, which was unchanged from 2000 (table 7). Wet kiln plants accounted for 18.5%, down from 22.5% in 2000, and combination plants, 6.3%, compared with 2% in 2000; the changes here represent the four extra combination technology plants in 2001.

Yearend 2001 clinker stockpiles totaled 4.5 Mt, down by 0.8 Mt. The apparent drawdown of stockpiles may explain part of the large reduction in clinker imports during the year (tables 1, 22).

Raw Materials and Energy Consumed in Cement Manufacture.—The differentiation between raw materials consumed for clinker manufacture and those added in the finish mill to make cement is primarily of environmental interest. Materials used to make clinker are burned in the kiln and are associated with various chemical changes and emissions, whereas those used in the finish mill are just ground. The amount of nonfuel raw materials consumed to make cement and clinker are listed in table 6. About 1.7 t of nonfuel raw materials is needed to make 1 t of clinker. This ratio also approximately holds to make cement, provided that the imported foreign clinker is first converted to its raw materials equivalent. Limestone or other calcareous materials account for about 85% of the total raw materials, including converted imported clinker, required to make cement and about 87% of those required to make clinker.

Overall, the ratio among raw materials types did not change appreciably in 2001. Some of the few specific changes seen may still simply reflect improved reporting rather than a net change in true consumption. Also, some materials may be inconsistently classified from year to year or among plants; for example, one plant's limestone might be another's cement rock. The chemical grouping of materials under terms like "calcareous" and "siliceous" is to some degree arbitrary because many of the raw materials supply more than one oxide. The CKD data for both years remain significantly underrepresented because few plants routinely measure consumption of this material; the apparent increase in consumption for clinker in 2001 thus likely reflects improved reporting. The changes in 2001 among slag varieties appear to represent mischaracterization of these materials—a common reporting error.

Among the siliceous raw materials, some of the pozzolans continue to appear to be out of balance with the sales (a proxy for production) of blended cements listed in table 16. This is especially true for GGBFS, the consumption of which is too high for the sales of the appropriate blended cement. The reason for this apparent excess is that most of the material listed in table 6 was not consumed by the cement industry to make blended cements but was introduced in unground form as a finish mill grinding aid in those States allowing a minor amount (3% or less) of GGBFS to be included in Type I portland cement. The GGBFS consumed for cement is only about 10% of the total GGBFS ultimately consumed by the concrete industry, as concrete manufacturers, especially ready-mixed producers, purchase GGBFS directly from the slag processors and incorporate it as a partial portland cement substitute within their concrete mixes.

In contrast to GGBFS, the amount of fly ash listed in the table 6 cement column could be accommodated within the equivalent blended cement sales in table 16, although at a lower ratio than that seen for 2000. The fly ash consumed to make clinker is far less than the roughly 10 Mt/yr of this material purchased directly by the concrete industry for use as a cement extender (American Coal Ash Association, 2000).

The natural rock pozzolan consumption shown in table 6 is in reasonable balance with the equivalent blended cement sales in table 16. The ratio to sales may be better examined through inclusion of the clay and shale (for cement) tonnages, on the assumption that this material is in burned or activated form. The amount of "other" pozzolans consumed for cement appears to be significantly too low relative to the equivalent blended cement sales (table 16), but the ratio would improve if the clay and shale for cement entries are included here instead of with the natural rock pozzolans, or if some of the CKD is included.

Many cement plants are able to switch among a variety of primary fuel types, and many routinely burn a mix of fuels (table 7). Some of the specific fuel declines seen for the wet (kiln) plants in 2001 merely reflect the move of four wet plants into the combination (wet and dry) process category as a result of upgrades during the year (three will become dry process plants in 2002).

As usual, dry process plants had a higher average electricity consumption per ton of product than wet process plants (table 8). This reflects the complex array of fans and blowers associated with modern dry kilns. The average unit consumption for wet plants increased in 2001, evidently reflecting the transfer of four, relatively efficient, wet plants into the combined technology category for the data year. The average for the combined process plants declined slightly because of this reclassification, and the decrease also reflects a net decline at these plants in the latter part of the year in the number of wet kilns in favor of single, larger capacity dry kilns. Multikiln plants tend to have higher unit electricity consumption rates than overall equivalent capacity single-kiln plants. The average consumption by dry plants did not change in 2001 but likely will do so in 2002 as the category receives the upgraded plants from the combined technology category.

The increase in unit electricity consumption for grinding plants followed an increase in 2000, and likely represents increased output of GGBFS from some of these facilities; GGBFS is harder to grind, and is typically ground finer, than clinker.

Consumption

Apparent consumption of portland and masonry cement is listed in table 1 and rose by about 2% in 2001 to a total of 112.7 Mt. Although apparent consumption is a standard statistic of comparison among various commodities, the measure of consumption preferred by the cement industry for its market analyses is that of cement shipments to final customers (i.e., sales). These monthly data are listed for 2000 and 2001 in tables 9 and 10 and are based on monthly shipment surveys of the cement-producing companies and importers, for which the response rate was 100% for both years. The definition of "final customer" is left to the reporting cement producer but is generally understood to include concrete manufacturers, building supply dealers, construction contractors, and others.

A significant tonnage difference commonly exists between the annual U.S. sales totals derived from annual canvasses for portland cement listed in tables 1 and 11-16 and the monthly survey-based totals listed in tables 9 and 10. The differences likely are the result of imported cement handled by certain terminals acting independently of the manufacturing plants. This imported material is captured on the monthly surveys because of the consolidated nature of monthly reporting but can be missed on the more facility-specific annual forms. The annual reporting protocols have been modified and the size of the discrepancy has declined. For example, in 1999 (data not listed), the discrepancy was 5.3 Mt; the discrepancy was 4.0 Mt and about 0.2 Mt in 2000 and 2001, respectively. The small size of the gap in 2001 is due, in part, to the use of monthly data as estimates for nonrespondent facilities in the annual canvass. Nevertheless, some significant amount of real decline for 2001 is indicated, based on lower discrepancies for many of the forms that were received. In contrast to portland cement, masonry cement tends not to show significant discrepancies between the monthly and annual sales totals, likely because little of this material is imported.

Superficial similarities between table 9 and tables 12-13 belie key differences in their component data. It should be noted that, apart from the fact that the national totals in table 12 are missing some imported material, the district data in tables 12-13 show the locations of the reporting facilities, not the location of consumption. In contrast, table 9 shows the locations of the final customers and the quantities they consumed. For example, where a single-State district in table 12 shows a higher tonnage than the same State in table 9, it implies that the State was a net exporter of cement. Where table 9 shows the higher tonnage, the State in question was a net importer of cement.

In 2001, portland cement consumption grew by about 2.7% (compared with 1.1% in 2000 and 5.0% in 1999) to a new record of about 108 Mt (table 9). The imported cement component of consumption fell slightly (table 9), and the imported clinker component (tables 1, 22) fell substantially, both reflecting higher domestic cement and clinker production and, perhaps, drawdowns in stockpiles (tables 3, 5). Nonetheless, import dependence remained high—about 22% for cement and about 24% for cement and clinker combined. Masonry cement consumption grew by about 3.4% to about 4.5 Mt, about 1% of which was imported (table 9).

Because of its key role as a construction material, cement consumption levels broadly reflect those of construction spending. Relative to revised 2000 U.S. Census Bureau data quoted by the Portland Cement Association (2002), overall construction spending levels in 2001 declined by about 1% to $704.7 billion (constant 1996 dollars). Most of the spending decline was seen in residential ($322.3 billion, down by 0.5%) and nonresidential ($166.6 billion, down by 6.5%) building construction; both appeared to reflect the generally weak economy during the year and were despite continued low interest rates. Office construction, in particular, was down by about 9% to $43.1 billion. In contrast, public construction spending was up by about 4.5% to $162.0 billion, led by buildings ($80.3 billion, up by about 6%) and highway ($45.4, up by about 6%) construction. The increase for highway construction was less than that expected based on TEA-21 authorized funding levels.

Construction spending and cement consumption can be examined in terms of overall cement "penetration rates," namely the amount of total cement consumed per $1 million in construction spending. Although many variables affect this type of analysis, especially the distribution of spending among different types of construction, changes in penetration rates can reflect cost or performance advantages of concrete over competing construction materials, promotional efforts by the concrete industry, shifts in spending between new construction and repairs to existing infrastructure, lag times between construction spending and concrete consumption, and underreported cement consumption because of partial substitution in concrete mixes of portland cement by pozzolans. Using the apparent consumption data in table 1, the overall construction spending data show a generally increasing trend in penetration rates for 1997 to 2001; $1 million in construction spending bought, in chronological order, 151.8 t of cement in 1997; 155.5 t, in 1998; 156.8 t, in 1999; 155.3 t, in 2000; and 159.9 t, in 2001.

Table 9 lists consumption of portland cement by State and the general origins of the total cement consumed. The increase of overall portland cement consumption was fairly broadly distributed among States. Relatively few States showed large changes in consumption relative to 2000 levels. Relatively large increases were seen in Colorado, Illinois, Kansas, Missouri, Nebraska, New Jersey, western New York, Oklahoma, Pennsylvania, Texas, Virginia, and Wisconsin. Relatively large declines were only seen in Florida, Tennessee, and Utah (the latter reflecting the completion in 2000 of some major construction projects). In terms of portland cement, the 10 largest consuming States, in declining order, were Texas, California, Florida, Illinois, Ohio, Pennsylvania, Michigan, Georgia, New York, and Arizona. The top 5 States, combined, had about 38% of total U.S. consumption, and the top 10 States had about 54%.

Consumption levels for masonry cement changed little in 2001, with only six States showing large increases, and no States showing large decreases, in absolute tonnage terms. The strong increase shown for northern California is partially due to improved reporting. As with production, data for masonry cement sales to final customers in table 9 underrepresent true consumption because it is common for masonry cement to be mixed from components at the jobsite rather than being brought in as a finished product. Also, the data exclude the output of a few small masonry-cement-blending plants, which are treated instead as final customers for portland cement.

Cement Customer Types.—Data on portland cement usage are collected on the basis of the types of customers to whom the cement is sold rather than the direct application itself (table 15). The distinction is that a customer, although classified in one category, may in fact use cement in more than one way. The customer type data in table 15 are approximations and include a high proportion of estimates by the companies themselves. The customer breakouts are presented unrounded, however, to avoid very large relative errors in the smaller customer type categories; these categories tend to be underrepresented in estimated data. As in past years, the dominant customers for cement are the ready-mixed concrete producers.

Types of Portland Cement Consumed.—Sales to final customers of varieties falling within the broad definition of portland cement are listed in table 16. In 2001, Types I and II, combined, continued to account for 88% of total portland cement sales, a typical proportion though slightly lower than in 1999. Sales of Type III portland increased slightly but declined as a percentage of total sales. Sales of block cement declined by 13.5%, and sales of white cement declined by 2.7%. These declines are in accord with the decrease in building construction expenditures noted earlier. Sales of Type V cements rose by 9.4%, which is counter to the decline in total cement consumption in southern California, Nevada, and the fairly stagnant levels in Arizona. As with the large increase in Type V sales in 2000, some of the increase may be due to a reclassification to Type V of some sulfate-resistant Type II cement made and sold in California.

Blended cement sales in 2001 increased by 16.5% to 1.5 Mt, but this still represented only about 1.4% of total portland cement sales, about the same as in 2000. The 2001 tonnage closely matches that from the monthly surveys included within the table 9 total. Overall, the proportion of total blended to total portland cement sales have remained virtually unchanged during the past several years despite the fact that the concrete producers, particularly of ready-mixed product, have significantly increased their use of cementitious extenders during this period. This illustrates the concrete producers' preference, for cost reasons, to do the blending themselves. Notwithstanding the consistency of total blended cement sales tonnages over the years, the tonnages of different types of blended cement have been variable.

Prices

Monetary data collected by the USGS reflect total and unit mill net values provided by the plants and import terminals (terminal nets) for their total shipments to domestic final customers of gray portland cement, white cement, and masonry cement (tables 12-14). The value data make no distinction between bulk and container (bag or package) shipments; however, container shipments would be expected to have higher unit values. Regional values for white cement have been lumped with those for gray portland cement, with the exception of the national total for white cement in table 14. In 2001, value data had to be estimated for 21.5% of the facilities surveyed, including nonrespondents and respondents who declined to provide value data. In contrast, estimates in 2000 were required for fewer than 10% of the facilities. All of the values listed should be considered to be estimates, even though they may be presented unrounded. Mill net values are better viewed as price indices for cement, suitable for crude comparisons among regions and over time. The data for portland cement are assumed to be dominated by bulk sales of the Types I and II varieties.

The average mill net value of portland cement in 2000 was about $75 per ton, down by 3%. Only Alaska plus Hawaii (both unusual markets dominated by imports) and California showed mill net unit value increases. For the national total consumption levels listed in table 9 and 12, portland cement sales in 2001 were worth a total of $8.1 billion. For the total value in table 12, this was a modest increase relative to total in 2000. The relative value totals in table 9 were essentially unchanged for the 2 years shown.

The unit value of imported hydraulic cement (table 18 data minus table 22 data) fell by 1.2% to $48.99 per ton on a cost, insurance, freight (c.i.f.) basis; this is well below the terminal net price to the final customer. It is likely that the availability of imported cement, although in lower quantities, helped to prevent price increases in regions with access to this material. Another constraint on portland cement prices continued to be the direct use of pozzolans by ready-mixed concrete companies as partial replacements for portland cement.

Although general world cement mill net price data are lacking, they can be approximated by the customs value data listed in tables 18-22. The average unit customs value for hydraulic cement in 2001 was just $38.03 per ton, down by 0.4%, and for gray portland cement, it was $35.21 per ton, down by 0.8% (tables 18, 20, 22). The average U.S. mill net value noted above is very high by comparison, and this makes the United States a very attractive export target for many foreign producers.

The average unit value of masonry cement sales was essentially stagnant in 2001 at $107 per ton (table 13). The total value of sales rose by about 4% to about $479 million. It should be noted, however, that the mill net values for masonry cement contain more component estimates than those for portland cement, and for a number of respondents, the masonry cement mill net values appear to have been reported on a bulk-equivalent basis instead of being inclusive of bagging charges.

The value data for white cement should be viewed with caution because there are only a few producers and importers of this product, and a significant share of white cement sales to final customers are resales by gray cement companies. Additionally, white cement includes a larger component of relatively costly package shipments, of imported material, and of estimated values. Thus, the 3% unit mill net value decrease in 2001 to $155 per ton, if real, may not be statistically significant (table 14). A discussion of prices for imported white cement is given in the "Foreign Trade" section.

Foreign Trade

Tables 17-22 list trade data from the U.S. Census Bureau. Exports of hydraulic cement and clinker increased in 2001 but, excepting sales to Canada, continued to be insignificant, and overall, the exports continued to be of almost no consequence to the U.S. cement market (table 17). Almost all of the exported material was cement.

The U.S. cement market continued to be significantly import dependent, although total imports of hydraulic cement and clinker declined by 9.8% to 25.9 Mt; this includes Puerto Rico (tables 18-19). Following the 2.3% decrease in 2000, the decline in 2001 was only the second annual decline since 1992 and reflected a combination of a slowing growth in demand and an increase in domestic production capacity. The import tonnage decrease was in stark contrast to increases of 22% in 1999, 37% in 1998, and 24% in 1997. The 2000 import tonnage represented approximately 25% of the total world trade in cement and clinker based on global estimates (International Cement Review, 2001a). The 2001 figure may represent an even higher fraction of the total world trade. The average unit c.i.f. value of imports rose by 0.5% to $48.96 per ton.

The hydraulic cement component of imports totaled 23.9 Mt, about 1 Mt less than in 2000 (tables 18, 22). Gray portland cement imports were 95% of this total and were down by 4.7% (table 20). The c.i.f. value of gray portland cement imports fell by 1.2% to $46.07 per ton, and the customs value fell by 0.8% to $35.21 per ton. The total c.i.f. value of gray portland cement imports fell by 5.9% to $1.05 billion. Customs values in 2001 ranged from $21.11 per ton for cement from the Philippines to $53.06 per ton for Canadian cement. As mentioned in the "Prices" section, the customs values listed are much lower than the U.S. mill net and/or terminal net values of portland cement sold to final customers, making the United States an attractive market for surplus foreign production and making it relatively easy for U.S. importers to absorb rising transportation costs, even for material sourced from vast distances.

White cement imports increased by about 1.4% to 0.94 Mt (table 21). The overall value fell by about 4%, reflecting a unit c.i.f. value decline of 5.8% to $104.32 per ton. However, some of the component country values (e.g., Indonesia, $69.78 per ton; Norway, $70.31 per ton; and Venezuela, $38.49 per ton) appear to be too low to be white cement or entirely white cement. Likewise the import tonnages appear to be too high; it is very unlikely that the tonnage of imported white cement would exceed the sales of white cement listed in table 16, especially when the sales include material produced at three U.S. plants. The most likely explanation for the low unit values for the countries noted above, especially Venezuela, is that their data include some gray portland cement or even clinker. Importers sometimes enter the wrong invoice codes; the Harmonized Tariff Schedule of the United States code for gray portland cement is 2523.29.00, which is not much different from the codes for white cement (2523.21.00) or clinker (2523.10.00).

Imports of clinker are listed in table 22. Total imports in 2001 fell by 49% to just 1.9 Mt (possibly off by the 0.1 Mt of white cement imports listed in table 21 for Venezuela, if this material is clinker). The average c.i.f. value rose by 12.9% to $48.70 per ton. The fact that this is higher than the average unit value for gray portland cement is explained by the large influence of the clinker imports from France ($177.65 per ton); this material is aluminous cement clinker. If the French clinker is removed, the total remaining imports drop to 1.8 Mt (down by almost 50%) at a unit value of $43.88 per ton, up by 9.4%.

World Review

The world hydraulic cement production data listed in table 23 were derived from data collected by USGS country specialists from a variety of sources. The data for some countries may include their exports of clinker. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may not be all-inclusive. World hydraulic cement production increased by about 2.4% in 2001 to an estimated 1.7 Gt.

Outlook

U.S. cement consumption is likely to decline by a small percentage in 2002 before recovering somewhat in 2003 because of the weak U.S. economy and the reduced capability of States to cofund TEA-21 infrastructure projects. Medium-term consumption beyond 2002 is anticipated to grow fairly steadily at rates in the range of 1% to 3% per year. A lot of new capacity is slated to come onstream in the 2002 to 2005 period, and this is expected to displace some imports. Average U.S. prices for cement are not expected to increase significantly during this timeframe. The terrorist attacks of September 11, 2001, had remarkably little direct effect on cement consumption rates, even in metropolitan New York; the main worry of the industry about the long-term effects of the attacks relates to the degree to which new or renewed U.S. security policies affect future public sector construction expenditures.

Despite the U.S. formal withdrawal from the provisions of the Kyoto Protocol, there is little expectation that there will not be continued pressure on the U.S. industry to reduce its emissions of CO_2 and other pollutants, especially given the fact that the companies controlling the U.S. industry also operate in countries likely to ratify or adopt reduction targets similar to those of the Kyoto Protocol. A number of major world cement producers are formulating a set of cohesive and proactive policies to both improve the environmental performances of their plants and adopt "greener" marketing strategies. Cement companies are expected to become increasingly involved in the production and marketing of cementitious extenders or partial substitutes for cement, particularly GGBFS.

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TABLE 1
SALIENT CEMENT STATISTICS 1/ 2/

(Thousand metric tons unless otherwise specified)

	1997	1998	1999	2000	2001
United States:					
Production of cement 3/	82,582	83,931	85,952	87,846	88,900
Production of clinker	72,686	74,523	76,003	78,138	78,451
Shipments from mills and terminals 4/ 5/	90,359	96,857	103,271	105,557	112,510
Value 4/ 6/ thousands	$6,637,464	$7,404,394	$8,083,247	$8,292,625	$8,600,000
Average value per ton 4/ 7/	$73.46	$76.45	$78.27	$78.56	$76.50
Stocks at mills and terminals, yearend	5,784	5,393	6,367	7,566	6,600
Exports 4/ 8/	791	743	694	738	746
Imports for consumption:					
Cement 9/	14,523	19,878	24,578	24,561	23,591
Clinker	2,867	3,905	4,164	3,673	1,884
Total 10/	17,390	23,783	28,742	28,234	25,476
Consumption, apparent 11/	96,018	103,457	108,862	110,470	112,710
World, production e/ 12/	1,540,000 r/	1,530,000 r/	1,600,000 r/	1,660,000 r/	1,700,000

e/ Estimated. r/ Revised.
1/ Portland and masonry cements only unless otherwise indicated. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.
2/ Excludes Puerto Rico.
3/ Includes cement produced from imported clinker.
4/ Includes imported cement and cement produced from imported clinker. Includes sales by import terminals.
5/ Shipments are to final domestic customers. Data are based on annual survey of individual plants and terminals and may differ from tables 9 and 10, which are based on consolidated monthly shipments data from companies.
6/ Value at mill or import terminal of portland (all types) and masonry cement shipments to final domestic customers. Although presented unrounded, the data contain estimates for survey nonrespondents.
7/ Total value at mill or import terminal of cement shipments to final customers divided by total tonnage sold. Although presented unrounded, the data contain estimates for survey nonrespondents.
8/ Portland, masonry, and other hydraulic cements, plus clinker. Includes cement made in the United States from imported clinker.
9/ Hydraulic cement, all types.
10/ Data may not add to totals shown because of independent rounding.
11/ Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in stocks.
12/ Total hydraulic cement. May incorporate clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Chicago, metropolitan	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3

PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

	2000					2001				
			Capacity 2/					Capacity 2/		
District 3/	Active plants	Produc- tion 4/	Finish grinding	Percentage utilized	Stocks at yearend 5/	Active plants	Produc- tion 4/	Finish grinding	Percentage utilized	Stocks at yearend 5/
Maine and New York	5	3,140	3,846	81.6	313	5	3,250 6/	4,150 6/	78.2 6/	260 6/
Pennsylvania, eastern 7/	7	4,685	5,374	87.2	251	7	4,866	5,374	90.5	312
Pennsylvania, western	4	1,950	2,540	79.8	183	4	1,670 6/	2,540 6/	65.7 6/	120 6/
Illinois	4	2,861	3,787	75.5	290	4	2,869	3,769	76.1	176
Indiana	4	2,634	3,456	76.2	303	4	2,903	3,493	83.1	244
Michigan	5	5,785	7,881	73.4	411	5	5,920 6/	7,930 6/	74.7 6/	380 6/
Ohio	2	1,034	1,497	69.1	73	2	1,037	1,497	69.3	60
Iowa, Nebraska, South Dakota	5	4,255	5,479	77.7	424	5	4,365	5,393	80.9	272
Kansas	4	1,983	2,085	95.1	206	4	1,830 6/	2,320 6/	78.8 6/	110 6/
Missouri	5	4,884	5,186	94.2	634	5	4,715	5,312	88.8	493
Florida 8/	7	3,753	6,817	55.1	411	6	4,055	7,040 6/	57.6 6/	420 6/
Georgia, Virginia, West Virginia	4	3,042	4,656	65.3	209	4	2,918	4,619	63.2	188
Maryland	3	1,756	1,992	88.2	107	3	1,718	2,321	74.0	149
South Carolina	3	2,912	3,361	86.6	172	3	2,555	3,406	75.0	83
Alabama	5	4,337	5,020	86.4	331	5	4,480 6/	5,040 6/	88.9 6/	220 6/
Kentucky, Mississippi, Tennessee	4	2,209	3,545	62.3	191	4	2,990 6/	3,630 6/	82.4 6/	190 6/
Arkansas and Oklahoma	4	2,663	3,162	84.2	281	4	2,650 6/	3,160 6/	83.9 6/	190 6/
Texas, northern 7/	6	4,752	6,012	79.0	370	6	5,793	7,581	76.4	373
Texas, southern	5	4,515	4,842	93.2	247	5	4,560 6/	4,850 6/	93.9 6/	220 6/
Arizona and New Mexico	3	2,175	2,336	93.1	111	3	2,189	2,638	83.0	120 6/
Colorado and Wyoming	4	2,253	2,453	91.9	133	4	2,020 6/	2,450 6/	82.4 6/	120 6/
Idaho, Montana, Nevada, Utah	7	2,818	3,415	82.5	260	7	2,972	3,669	81.0	282
Alaska and Hawaii	1	286	288	99.5	27	1	112	288	39.1	64
California, northern	3	2,811	2,880	97.6	124	3	2,687	2,880	93.3	171
California, southern 7/	8	8,066	9,015	89.5	334	8	7,382	8,902	82.9	355
Oregon and Washington	4	1,953	2,498	78.2	170	4	1,947	2,500 6/	78.0 6/	190 6/
Independent importers, n.e.c. 9/	--	--	--	--	510	--	--	--	--	350
Total or average 10/	116	83,514	103,426	80.7	7,073 r/	115	84,450 11/	106,770 11/	79.1 11/	6,110 11/
Puerto Rico	2	1,664	2,065	80.6	33	2	1,546	2,156	71.7	73
Grand total 10/	118	85,178	105,491	80.7	7,106 r/	117	86,000	108,920	79.0	6,190

r/ Revised. -- Zero.

1/ Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

2/ Reported annual grinding capacity is based on fineness necessary to grind individual plants' normal product mixes, making allowance for downtime required for routine maintenance.

3/ District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

4/ Includes cement produced from imported clinker.

5/ Includes imported cement. Includes mills and terminals.

6/ Data are rounded because they contain estimates for nonrespondent facilities.

7/ Includes data for white cement.

8/ Plant count excludes one plant that reported cement (clinker) grinding capacity but no output of portland cement.

9/ Data include only those importers for which regional assignations were not possible.

10/ Data may not add to totals shown because of independent rounding.

11/ Data exclude one small grinding plant that commenced operations late in the year in Wisconsin.

TABLE 4
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

	2000			2001		
District 2/	Active plants	Production 3/	Stocks at yearend 4/	Active plants	Production 3/	Stocks at yearend 4/
Maine and New York	4	130	11	4	130 5/	10 5/
Pennsylvania, eastern	6	225	41	6	239	43
Pennsylvania, western	4	99	16	4	90 5/	10 5/
Indiana	4	W	62	4	W	53
Michigan	5	296	37	5	290 5/	40 5/
Ohio	2	92	27	2	74	13
Iowa, Nebraska, South Dakota	3	W	10	2	W	W
Kansas	2	W	W	2	25	15
Missouri	1	W	W	2	111	23
Florida	5	543	35	5	556	37
Georgia, Virginia, West Virginia	5	331	36	5	318	32
Maryland	3	78	19	3	77	14
South Carolina	3	411	25	3	487	39
Alabama	4	401	57	4	380	58
Kentucky, Mississippi, Tennessee	3	83	6	3	80 5/	10 5/
Arkansas and Oklahoma	4	142	25	4	130 5/	30 5/
Texas, northern	4	156	9	4	165	11
Texas, southern	3	112	7	3	126	9
Arizona and New Mexico	3	W	W	3	109	8
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	1	W	W
Alaska and Hawaii	1	3	--	1	3	--
California	6	484	18	7	564 6/	23 6/
Independent importers, n.e.c.	--	--	5	--	--	4
Total 7/	78	4,332 8/	492	79	4,450 5/ 8/	490 5/

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

1/ Includes masonry, portland-lime, and plastic cements. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

2/ District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

3/ Includes cement produced from imported clinker.

4/ Includes imported cement.

5/ Data are rounded because they contain estimates for nonrespondent facilities.

6/ Total for northern California includes production--85 and ending stocks--10. The total for southern California includes production--479 and ending stocks--13.

7/ Data may not add to totals shown because of independent rounding.

8/ Production directly from clinker accounted for 95% of the total in 2000 and 2001. Production from portland cement accounted for the remainder.

TABLE 5
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2001, BY DISTRICT 1/

(Thousand metric tons unless otherwise specified)

	Active plants 2/										
	Process used				No.		Average days of routine	Apparent		Percentage	
					of	Daily	mainte-	annual	Produc-	of capacity	Yearend
District	Wet	Dry	Both	Total	kilns 3/	capacity 4/	nance	capacity 5/	tion 6/	utilized	stocks 7/
Maine and New York	3	1	--	4	5	10.4 8/	28.2	3,520 8/	3,094	88.0 8/	110 8/
Pennsylvania, eastern	2	5	--	7	14	15.6	24.9	5,256	4,651	88.5	140
Pennsylvania, western	3	1	--	4	8	6.1 8/	25.0 8/	2,100 8/	1,450	69.0 8/	50 8/
Illinois	--	4	--	4	8	8.4	19.4	2,823	2,497	88.4	156
Indiana	1	3 9/	--	4	8	10.3	25.6	3,466	2,855	82.4	80
Michigan	1	2	--	3	8	13.5	24.8	4,544	4,305	94.8	300 8/
Ohio	1	1	--	2	3	3.5	13.7	1,213	1,058	87.2	99
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.7	25.2	4,638	3,939	84.9	142
Kansas	1	2	1	4	12	9.8 8/	22.0 8/	3,390 8/	1,789	53.0 8/	210 8/
Missouri	2	3	--	5	7	13.8	23.1	4,671	4,308	92.2	215
Florida	1	4	--	5	7	12.5 8/	26.0 8/	4,200 8/	3,589	85.5 8/	240 8/
Georgia, Virginia, West Virginia	1	3	--	4	7	10.6	24.7	3,617	2,869	79.3	243
Maryland	1	2	--	3	8	11.0	28.9	3,731	1,622	43.5	48
South Carolina	2	1	--	3	7	8.8	20.4	3,025	2,478	81.9	94
Alabama	--	5	--	5	6	14.1 8/	19.5 8/	4,830 8/	4,150	86.0 8/	240 8/
Kentucky, Mississippi, Tennessee	1	2	1	4	6	11.0 8/	15.0 8/	3,800 8/	2,920	77.0 8/	290 8/
Arkansas and Oklahoma	2	2	--	4	10	7.7 8/	24.0 8/	2,620 8/	2,522	96.0 8/	120 8/
Texas, northern	2	3	1	6	16	21.6	16.8	7,444	5,630	75.3	205
Texas, southern	--	4	1	5	6	13.4 8/	22.0 8/	4,610 8/	4,234	92.0 8/	260 8/
Arizona and New Mexico	--	3	--	3	9	7.4	19.0	2,516	2,201	87.5	200 8/
Colorado and Wyoming	--	3	1	4	7	11.0 8/	18.0 8/	3,880 8/	1,793	46.0 8/	80 8/
Idaho, Montana, Nevada, Utah	3	4	--	7	9	8.6	25.9	2,929	2,695	92.0	152
California, northern	--	3	--	3	3	8.7	25.0	2,964	2,628	88.7	140
California, southern	--	8	--	8	18	30.2	25.2	10,505	7,520	71.6	592
Oregon and Washington	1	2	--	3	3	4.3 8/	33.0 8/	2,100 8/	1,656	79.0 8/	90 8/
Total or average 10/	28	75	6	109	204	288.0 8/	22.0 8/	98,390 8/	78,451	80.0 8/	4,490 8/
Puerto Rico	--	2	--	2	2	5.9	30.0	1,975	1,528	77.4	334
Grand total 10/	28	77	6	111	206	294.0 8/	22.0 8/	100,360 8/	79,979	80.0 8/	4,830 8/

-- Zero.

1/ Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

2/ Includes white cement plants. Includes plants active for at least one day during the year.

3/ Kilns active at least 1 day during year. Excludes idle kilns (full year) that cannot be restarted (fully permitted) in less than 6 months.

4/ Sum of reported daily kiln capacities for each plant in district.

5/ Sum of apparent individual kiln capacities; for each kiln calculated as 365 days minus reported days shut down for routine maintenance and multiplied by the unrounded reported daily capacity.

6/ Several districts have one or more annual survey nonrespondent facilities for which estimates were made for most data categories. However, for all nonrespondent clinker producers, reported 12-month production data were available from monthly surveys and were incorporated.

7/ Includes imported clinker and clinker stockpiles at grinding plants.

8/ Data are rounded because they contain estimates for nonrespondent facilities.

9/ Includes one semidry kiln.

10/ Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES 1/ 2/

(Thousand metric tons)

	2000		2001 3/	
Raw materials	Clinker	Cement 4/	Clinker	Cement 4/
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	93,947	1,263	95,600	1,600
Cement rock (includes marl)	21,820	133	21,900	100
Cement kiln dust 5/	351	155	600	100
Lime 6/	19	49	300	40
Other	21	225	20	20
Aluminous:				
Clay	4,205	8	4,500	10
Shale	3,743	3	3,200	10
Other (includes staurolite, bauxite, aluminum dross, alumina, other)	400	--	500	--
Ferrous, iron ore, pyrites, millscale, other	1,310	--	1,500	--
Siliceous:				
Sand and calcium silicate	3,142	--	3,500	--
Sandstone, quartzite, other	925	--	500	--
Fly ash	1,679	88	1,600	70
Other ash, including bottom ash	930	--	800	--
Granulated blast furnace slag 7/	--	303	--	300
Other blast furnace slag	43	--	200	--
Steel slag	805	--	500	--
Other slags	12	10	50	5
Natural rock pozzolans 8/	--	40	--	50
Other pozzolans 9/	38	8	100	9
Other:				
Gypsum and anhydrite	--	4,655	--	4,800
Clinker, imported 10/	--	4,573	--	2,950
Other, n.e.c.	--	46	40	50
Total 11/	133,391	11,558	135,420	10,110

-- Zero.

1/ Includes Puerto Rico. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

2/ Nonfuel materials only.

3/ Data are rounded because they include estimates for a number of nonrespondent plants.

4/ Includes portland, blended, and masonry cements.

5/ Data are probably underreported.

6/ Data are probably underreported on the basis of reported volumes of masonry cements.

7/ Includes both ground and unground material.

8/ Includes pozzolana and burned clays and shales (where not reported directly as clay or shale).

9/ Includes diatomite, other microcrystalline silica, silica fume, and other pozzolans, whether or not used as such.

10/ Outside purchases by domestic plants; excludes purchases of domestic clinker.

11/ Data may not add to totals shown because of independent rounding.

TABLE 7
CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS 1/ 2/

	Clinker produced			Fuel consumed					Waste fuel		
Kiln process	Active plants	Quantity (thousand metric tons)	Percentage of total	Coal 3/ (thousand metric tons)	Coke (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
2000:											
Wet	32	17,911	22.5	2,409	96	390	32,513	51,482	106	149	801,288
Dry	77	60,172	75.5	7,479	346	920	91,153	206,729	259	867	127,799
Both	2	1,574	2.0	208	--	41	--	80,049	8	--	--
Total 4/	111	79,656	100.0	10,095	442	1,351	123,666	338,261	374	1,016	929,087
2001: 5/											
Wet	28	14,782	18.5	2,050	40	400	33,110	33,000	130	220	653,000
Dry	77	60,169	75.2	7,520	320	930	59,760	251,000	150	40	117,000
Both	6	5,029	6.3	670	60	40	450	113,000	20	60	59,000
Total 4/	111	79,979	100.0	10,240	420	1,370	93,320	397,000	300	320	829,000

-- Zero.
1/ Includes portland and masonry cement. Excludes grinding plants. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.
2/ Includes Puerto Rico.
3/ All reported to be bituminous.
4/ Data may not add to totals shown because of independent rounding.
5/ Fuel consumption data are rounded as they contain estimated data for nonrespondent plants. For nonrespondent plants, however, clinker production data were available from monthly surveys and were incorporated without rounding.

TABLE 8
ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS 1/

	Electric energy used							
	Generated at plant		Purchased		Total			
Plant process	Number of plants	Quantity (million kilowatt-hours)	Number of plants	Quantity (million kilowatt-hours)	Quantity (million kilowatt-hours)	Percentage	Finished cement 2/ produced (thousand metric tons)	Average consumption (kilowatt-hours per ton of cement produced)
2000:								
Integrated plants:								
Wet	--	--	32	2,685	2,685	21.4	20,544	131
Dry	4	497	77	9,095	9,592	76.6	64,930	148
Both	--	--	2	249	249	2.0	1,593	157
Total or average 3/	4	497	111	12,029	12,526	100.0	87,067	144
Grinding plants 4/	--	--	6	164	164	--	2,294	71
Exclusions 5/	--	--	2	--	--	--	149	--
2001: 6/								
Integrated plants:								
Wet	--	--	28	2,260	2,260	17.6	16,690	136
Dry	5	560	77	9,180	9,740	75.9	65,960	148
Both	--	--	6	830	830	6.5	5,400	154
Total or average 3/	5	560	111	12,300	12,800	100.0	88,050	146
Grinding plants 4/	--	--	6	160	160	--	2,280	75
Exclusions 5/	--	--	2	--	--	--	120	--

-- Zero.
1/ Includes Puerto Rico.
2/ Includes portland and masonry cements.
3/ Data may not add to totals shown because of independent rounding.
4/ Excludes plants that reported production only of masonry cement.
5/ Tonnage of cement produced by plants that reported production of masonry cement only. One plant reported portland cement grinding capacity and so is included in table 3.
6/ Electricity data are rounded because they include estimates for a number of nonrespondent plants.

TABLE 9
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 2000	Portland cement 2001	Masonry cement 2000	Masonry cement 2001
Destination:				
Alabama	1,565	1,569	145	141
Alaska 3/	127	133	--	--
Arizona	3,236	3,265	109	107
Arkansas	952	976	54	56
California, northern	4,706	4,668	63	111
California, southern	7,959	7,924	368	390
Colorado	2,597	2,660	43	45
Connecticut 3/	838	812	15	15
Delaware 3/	165	162	11	11
District of Columbia 3/	178	184	2	1
Florida	7,694	7,527	591	635
Georgia	3,434	3,412	302	310
Hawaii	288	280	4	4
Idaho	558	568	1	1
Illinois, excluding Chicago	1,524	1,698	24	23
Chicago, metropolitan 3/	2,312	2,464	62	66
Indiana	2,208	2,252	96	98
Iowa	1,710	1,698	8	6
Kansas	1,490	1,624	15	14
Kentucky	1,322	1,353	98	101
Louisiana 3/	1,790	1,770	55	50
Maine	221	225	5	6
Maryland	1,333	1,381	88	94
Massachusetts 3/	1,580	1,644	23	24
Michigan	3,489	3,557	160	160
Minnesota 3/	2,010	1,973	37	29
Mississippi	936	950	56	54
Missouri	2,562	2,672	42	43
Montana	318	353	1	1
Nebraska	1,079	1,201	9	9
Nevada	1,963	1,943	31	28
New Hampshire 3/	268	260	6	7
New Jersey 3/	1,915	2,069	73	78
New Mexico	831	888	6	7
New York, eastern	637	644	30	30
New York, western 3/	871	1,044	36	34
New York, metropolitan 3/	1,677	1,651	57	65
North Carolina 3/	2,764	2,734	319	327
North Dakota 3/	308	303	3	2
Ohio	3,907	4,029	190	194
Oklahoma	1,421	1,543	45	46
Oregon	1,003	981	1	1
Pennsylvania, eastern	2,212	2,312	66	62
Pennsylvania, western	1,162	1,283	66	69
Rhode Island 3/	154	182	3	4
South Carolina	1,318	1,386	139	140
South Dakota	432	460	3	2
Tennessee	2,097	1,963	223	215
Texas, northern	5,540	6,810	198	217
Texas, southern	6,005	5,942	126	126
Utah	1,432	1,297	1	1
Vermont 3/	145	122	3	4
Virginia	2,216	2,326	156	160
Washington	2,016	1,961	3	3
West Virginia	417	461	26	27
Wisconsin 3/	2,185	2,298	33	32
Wyoming	248	365	1	1
U.S. total 4/	105,322	108,212	4,333	4,482
Foreign countries 5/	393	442	--	--
Puerto Rico	1,954 r/	1,865	--	--
Grand total 4/	107,669 r/	110,520	4,333	4,482

See footnotes at end of table.

TABLE 9--Continued
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN 1/ 2/

(Thousand metric tons)

Destination and origin	Portland cement 2000	Portland cement 2001	Masonry cement 2000	Masonry cement 2001
Origin:				
United States	83,318 r/	86,602	4,281	4,435
Puerto Rico	1,663	1,523	--	--
Foreign countries 6/	22,688 r/	22,395	52	48
Total shipments 4/	107,669 r/	110,520	4,333	4,482

r/ Revised. -- Zero.
1/ Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.
2/ Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 11-13, 15, and 16, which are from annual surveys of individual plants and importers. Although presented unrounded, data are believed to be accurate to no more than three significant figures.
3/ Has no cement plants.
4/ Data may not add to totals shown because of independent rounding.
5/ Includes shipments to U.S. possessions and territories.
6/ Imported cement distributed in the United States by domestic producers and other importers. Data do not match the imports calculated from tables 19 and 22.

TABLE 10
CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT) 1/ 2/

Region and census district	Portland cement Quantity (thousand metric tons) 2000	Portland cement Quantity (thousand metric tons) 2001	Portland cement Percentage of U.S. total 2000	Portland cement Percentage of U.S. total 2001	Masonry cement Quantity (thousand metric tons) 2000	Masonry cement Quantity (thousand metric tons) 2001	Masonry cement Percentage of U.S. total 2000	Masonry cement Percentage of U.S. total 2001
Northeast:								
New England 3/	3,206	3,245	3	3	55	58	1	1
Middle Atlantic 4/	8,474	9,003	8	8	328	337	8	8
Total 5/	11,680	12,249	11	11	383	395	9	9
South:								
South Atlantic 6/	19,519	19,572	19	18	1,634	1,705	38	38
East south central 7/	5,920	5,834	6	5	522	511	12	11
West south central 8/	15,708	17,041	15	16	478	494	11	11
Total 5/	41,147	42,447	39	39	2,634	2,710	61	60
Midwest:								
East north central 9/	15,625	16,298	15	15	565	573	13	13
West north central 10/	9,591	9,931	9	9	117	105	3	2
Total 5/	25,216	26,230	24	24	682	678	16	15
West:								
Mountain 11/	11,183	11,339	11	10	193	191	4	4
Pacific 12/	16,099	15,948	15	15	439	508	10	11
Total 5/	27,282	27,287	26	25	632	699	15	16
U.S. total 5/	105,322	108,212	100	100	4,333	4,482	100	100

1/ Includes imported cement shipped by importers and cement ground from imported clinker. Excludes Puerto Rico. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.
2/ Data are based on table 9.
3/ New England includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.
4/ Middle Atlantic includes New Jersey, New York, and Pennsylvania.
5/ Data may not add to totals shown because of independent rounding.
6/ South Atlantic includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.
7/ East south central includes Alabama, Kentucky, Mississippi, and Tennessee.
8/ West south central includes Arkansas, Louisiana, Oklahoma, and Texas.
9/ East north central includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.
10/ West north central includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.
11/ Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.
12/ Pacific includes Alaska, California, Hawaii, Oregon, and Washington.

TABLE 11

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER 1/

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total
	In bulk	In containers 2/	In bulk	In containers 2/	In bulk	In containers 2/	shipments to consumer
2000:							
Railroad	11,865	42	1,529	2	479	1	2,010
Truck	4,211	308	56,482	2,464	41,066	737	100,749
Barge and boat	8,082	--	183	--	6	--	188
Other	--	--	--	--	--	--	--
Total 3/	24,158	350	58,193	2,466	41,550	737	102,947 4/
2001: 5/							
Railroad	11,610	140	1,940	--	420	(6/)	2,260
Truck	2,600	280	57,950	2,480	46,360	690	107,480
Barge and boat	9,880	--	130	--	50	--	180
Other	--	--	--	--	--	--	--
Total 3/	24,100	420	59,900	2,480	46,800	690	109,920

-- Zero.

1/ Includes Puerto Rico. Includes imported cement and cement made from imported clinker. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

2/ Includes bags and jumbo bags.

3/ Data may not add to totals shown because of independent rounding.

4/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

5/ Data for 2001 are rounded because they include estimates from a number of nonrespondent plants.

6/ Less than 1/2 unit.

TABLE 12

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT 1/

	2000			2001		
	Quantity	Value 2/		Quantity	Value 2/	
District 3/ 4/	(thousand metric tons)	Total (thousands)	Average per metric ton	(thousand metric tons)	Total (thousands)	Average per metric ton
Maine and New York	3,422	$267,991	$78.32	3,690 5/	$275,000 5/	$74.50 5/
Pennsylvania, eastern	4,832	335,078	69.34	5,602	387,855	69.24
Pennsylvania, western	1,412	112,338	79.55	1,630 5/	126,000 5/	77.50 5/
Illinois	2,868	218,777	76.27	3,095	230,612	74.50
Indiana	2,932	199,744	68.13	3,108	209,113	67.29
Michigan	5,766	448,703	77.81	7,270 5/	561,000 5/	77.00 5/
Ohio	1,174	94,503	80.53	1,116	86,508	77.49
Iowa, Nebraska, South Dakota	4,779	376,357	78.76	5,100	391,907	76.84
Kansas	1,693	132,298	78.13	1,850 5/	142,000 5/	76.50 5/
Missouri	5,988	455,724	76.11	5,918	433,764	73.30
Florida	7,325	549,569	75.02	7,120 5/	516,000 5/	72.50 5/
Georgia, Virginia, West Virginia	3,055	238,729	78.13	3,021	232,372	76.92
Maryland	1,675	118,776	70.93	1,986	143,220	72.12
South Carolina	2,661	192,178	72.21	3,113	200,476	64.40
Alabama	4,539	357,813	78.83	4,280 5/	336,000 5/	78.50 5/
Kentucky, Mississippi, Tennessee	2,544	197,836	77.77	2,720 5/	205,000 5/	75.50 5/
Arkansas and Oklahoma	2,659	209,528	78.80	2,700 5/	204,000 5/	75.50 5/
Texas, northern	5,282	410,079	77.64	6,735	510,215	75.75
Texas, southern	5,608	392,860	70.05	6,040 5/	407,000 5/	67.00 5/
Arizona and New Mexico	3,610	350,231	97.03	3,740 5/	346,000 5/	92.50 5/
Colorado and Wyoming	2,581	232,221	89.97	2,640 5/	207,000 5/	78.00 5/
Idaho, Montana, Nevada, Utah	2,965	245,179	82.70	2,984	237,462	79.57
Alaska and Hawaii	381	39,880	104.67	379	50,984	134.61
California, northern	3,749	303,316	80.90	3,546	289,400	81.62
California, southern	9,004	669,445	74.35	8,815	665,368	75.48
Oregon and Washington	2,225	177,615	79.83	2,010 5/	157,000 5/	78.00 5/
Independent importers, n.e.c. 6/	6,552	506,655	77.33	7,850 5/	568,000 5/	72.00 5/
Total or average 7/ 8/	101,282	7,833,425	77.34	108,050 5/	8,121,000 5/	75.00 5/

See footnotes at end of table.

TABLE 12--Continued

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT 1/

	2000			2001		
	Quantity	Value 2/		Quantity	Value 2/	
	(thousand	Total	Average	(thousand	Total	Average
District 3/ 4/	metric tons)	(thousands)	per metric ton	metric tons)	(thousands)	per metric ton
Puerto Rico	1,665	W	W	1,873	W	W
Grand total 7/ 8/	102,947	W	W	109,920 5/	W	W

W Withheld to avoid disclosing company proprietary data.

1/ Includes imported portland cement (gray and white) and cement produced from imported clinker. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

2/ Values represent ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded, but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per ton.

3/ The district location is that of the reporting facility. Shipments may include material sold into other districts.

4/ Includes shipments by independent importers where district assignation is possible.

5/ Data are rounded because they contain estimates for nonrespondent facilities.

6/ Importers for which district assignations were not possible.

7/ Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

8/ Data may not add to totals shown because of independent rounding.

TABLE 13

MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT 1/ 2/

	2000			2001		
	Quantity	Value 3/		Quantity	Value 3/	
	(thousand	Total	Average	(thousand	Total	Average
District 4/ 5/	metric tons)	(thousands)	per metric ton	metric tons)	(thousands)	per metric ton
Maine and New York	104	$10,258	$98.95	140 6/	$13,000 6/	$95.00 6/
Pennsylvania, eastern	243	27,455	112.99	225	26,866	119.49
Pennsylvania, western	98	10,470	107.23	100 6/	11,000 6/	110.00 6/
Illinois, Indiana, Ohio	491	52,949	107.76	511	57,005	111.47
Michigan	293	28,686	97.75	290 6/	29,000 6/	100.00 6/
Iowa, Nebraska, South Dakota	40	3,750	93.69	35	3,789	108.58
Kansas and Missouri	141	11,957	85.07	137	12,202	88.84
Florida	519	61,952	119.43	559	62,905	112.55
Georgia, Virginia, West Virginia	306	40,029	130.72	304	41,787	137.50
Maryland	73	6,641	91.54	81	7,410	91.33
South Carolina	385	42,709	110.80	442	47,753	108.01
Alabama	442	50,166	113.61	430 6/	44,000 6/	102.00 6/
Kentucky, Mississippi, Tennessee	87	8,516	97.96	80 6/	9,000 6/	110.00 6/
Arkansas and Oklahoma	131	11,473	87.88	130 6/	13,000 6/	103.00 6/
Texas, northern	133	14,023	105.43	137	16,359	119.06
Texas, southern	117	12,763	109.46	140 6/	14,000 6/	106.00 6/
Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, Wyoming	146	15,075	103.44	143	14,311	100.06
Alaska and Hawaii	4	772	214.95	4	841	223.76
California, Oregon, Washington	484	43,171	89.19	560	51,110	91.31
Independent importers, n.e.c. 7/	40	6,385	158.79	30 6/	4,000 6/	145.00 6/
Total or average 8/ 9/	4,275	459,200	107.42	4,460 6/	479,000 6/	107.00 6/

1/ Shipments are to final domestic customers and include shipments of imported cement and cement made from imported clinker. Excludes Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

2/ Includes gray, white, and colored varieties of masonry, portland-lime, and plastic cements.

3/ Values represent ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded, but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per ton.

4/ District location is that of the reporting facilities. Shipments may include material sold into other districts.

5/ Data are rounded because they contain estimates for nonrespondent facilities.

6/ Data are rounded because district contains at least one nonrespondent facility for which all data were estimated.

7/ Importers for which district assignations were not possible.

8/ Tonnages based on annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

9/ Data may not add to totals shown because of independent rounding.

TABLE 14
AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES 1/

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
2000 2/	76.61	159.45	77.34	107.42	78.56
2001 3/	74.50	155.00	75.00	107.00	76.50

1/ Excludes Puerto Rico. Mill net value is the actual value of sales to customers, free on board plant or import terminal, less all discounts and allowances, less any freight charges from U.S. producing plant to distribution terminal and to final customers.
2/ Although unrounded, the data incorporate estimates for some plants and are accurate to no better than two significant figures.
3/ Data are rounded because of an unusually large number of nonrespondents for which estimates for both sales tonnages and values were made.

TABLE 15
PORTLAND CEMENT SHIPMENTS IN 2001, BY DISTRICT AND TYPE OF CUSTOMER 1/

(Thousand metric tons)

District 2/ 3/	Ready-mixed concrete	Concrete product manufacturers 4/	Contractors 5/	Building material dealers	Oil well mining, waste 6/	Government and miscellaneous 7/	District total 8/
Maine and New York	2,835	561	26	182	--	87	3,690 9/
Pennsylvania, eastern	3,627	1,216	329	342	--	88	5,602
Pennsylvania, western	1,057	207	186	141	1	38	1,630
Illinois	2,353	371	102	3	212	55	3,095
Indiana	2,155	475	62	88	322	6	3,108
Michigan	5,407	748	766	322	18	4	7,270 9/
Ohio	890	132	52	42	--	--	1,116
Iowa, Nebraska, South Dakota	3,840	656	453	63	87	--	5,100
Kansas	1,456	127	217	31	20	2	1,850 9/
Missouri	4,638	565	607	84	--	24	5,918
Florida	5,183	1,476	93	278	--	91	7,120 9/
Georgia, Virginia, West Virginia	2,170	408	112	308	14	9	3,021
Maryland	1,503	372	57	25	--	29	1,986
South Carolina	2,345	543	97	110	--	18	3,113
Alabama	3,431	496	132	210	1	8	4,280 9/
Kentucky, Mississippi, Tennessee	2,293	244	132	18	7	21	2,720 9/
Arkansas and Oklahoma	2,012	212	403	31	36	2	2,700 9/
Texas, northern	4,554	445	1,017	209	498	11	6,735
Texas, southern	4,362	598	582	107	374	18	6,040 9/
Arizona and New Mexico	2,832	425	183	145	24	125	3,740 9/
Colorado and Wyoming	1,990	313	199	80	34	26	2,640 9/
Idaho, Montana, Nevada, Utah	2,324	222	133	86	162	57	2,984
Alaska and Hawaii	302	46	5	26	--	--	379
California, northern	2,892	330	166	147	1	9	3,546
California, southern	6,498	1,523	296	394	78	26	8,815
Oregon and Washington	1,614	202	89	79	--	28	2,010
Independent importers, n.e.c. 10/	6,220	1,138	270	155	17	50	7,850 9/
Total 8/	80,782	14,053	6,767	3,707	1,909	835	108,050 9/
Puerto Rico	1,015	247	95	514	--	2	1,873
Grand total 8/	81,797	14,300	6,862	4,220	1,909	837	109,920 9/

-- Zero.
1/ Includes shipments of imported cement and cement ground from imported clinker. Data other than district totals are presented unrounded but incorporate estimates for some plants and are likely accurate to only two significant figures. District totals are accurate to no more than three significant digits.
2/ District location is that of the reporting facility. Shipments may include material sold into other districts.
3/ Includes shipments by independent importers, where district assignations were possible.
4/ Grand total shipments to concrete product manufacturers include brick-block--6,627; precast-prestressed--3,295; pipe--1,542; and other or unspecified--2,836.
5/ Grand total shipments to contractors include airport--561; road paving--4,624; soil cement--828; and other or unspecified--799.
6/ Grand total shipments to oil well, mining, and waste include oil well drilling--1,386; mining--143; and waste stabilization--380.
7/ Includes shipments for which customer types were not specified.
8/ Data may not add to totals shown because of independent rounding.
9/ District totals are rounded as they include estimates for nonrespondent facilities.
10/ Shipments by independent importers for which district assignations were not possible.

TABLE 16
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE 1/

(Thousand metric tons)

Type	2000	2001
General use and moderate heat (Types I and II) (Gray)	90,644	96,970 2/
High early strength (Type III)	3,815	3,830
Sulfate resisting (Type V)	4,453	4,870
Block	636	550
Oil well	1,039	1,150
White 3/	894	870
Blended:		
Portland, natural pozzolans	194	192
Portland, granulated blast furnace slag	385	560 2/
Portland, fly ash	405	391
Other blended cement 4/	313	362
Total 5/	1,296	1,510 2/
Expansive and regulated fast setting	60	64
Miscellaneous 6/	111	110 2/
Grand total 5/ 7/	102,947	109,920

1/ Includes imported cement. Includes Puerto Rico. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.
2/ Data are rounded because they contain estimates for nonrespondent facilities.
3/ Mostly Type I, II, but may include Types III-V and block varieties.
4/ Includes blends with other pozzolans, such as cement kiln dust and silica fume.
5/ Data may not add to totals shown because of independent rounding.
6/ Includes low heat (Type IV), waterproof, and other portland cements.
7/ Shipments are derived from an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

TABLE 17
U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country of destination	2000 Quantity	2000 Value 2/	2001 Quantity	2001 Value 2/
Aruba	2	218	1	157
Bahamas, The	15	1,883	14	1,789
Belize	6	1,054	4	175
Brazil	5	452	2	237
Canada	581	41,161	614	41,553
China	2	105	8	367
Colombia	2	289	(3/)	17
Costa Rica	6	801	2	272
Czech Republic	7	308	1	34
Dominican Republic	1	158	2	342
Hong Kong	9	434	1	75
Jamaica	(3/)	58	6	296
Japan	1	176	2	192
Korea, Republic of	1	57	3	228
Lebanon	5	262	1	33
Mexico	51	10,347	43	6,335
Norway	1	39	3	158
Panama	3	263	1	138
Philippines	3	711	(3/)	23
Russia	3	128	4	194
Singapore	1	53	6	253
Taiwan	2	113	1	82
Trinidad and Tobago	2	103	(3/)	17
Turkey	--	--	3	126
United Kingdom	4	568	2	131
Venezuela	3	745	3	651
Other	20 r/	3,718 r/	19	2,116
Total 4/	738	64,204	746	55,991

See footnotes at end of table.

TABLE 17--Continued

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

r/ Revised. -- Zero.

1/ Includes portland and masonry cements.

2/ Free alongside ship (f.a.s.) value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

3/ Less than 1/2 unit.

4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 18

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	2000			2001		
		Value			Value	
Country of origin	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	180	4,305	7,384	146	3,294	6,018
Bahamas, The	206	7,506	9,485	32	989	1,335
Bulgaria	635	26,301	33,691	360	13,675	18,496
Canada	4,948	268,875	285,040	5,110	287,078	302,684
China	3,451	107,852	143,945	3,266	99,214	137,635
Colombia	1,524	59,173	75,694	1,705	64,675	85,278
Croatia	64	7,097	8,453	24	4,413	5,292
Denmark	554	27,934	38,105	527	21,700	32,624
France	79	15,223	16,513	71	13,041	13,635
Germany	24	1,765	1,875	(4/)	240	288
Greece	1,479	51,897	69,159	1,552	53,647	65,622
Indonesia	197	5,300	9,079	318	8,878	15,058
Italy	249	9,645	12,986	135	4,974	6,739
Korea, Republic of	1,823	49,742	75,578	1,326	32,646	53,572
Lebanon	108	4,167	4,935	--	--	--
Mexico	1,409	60,700	74,006	1,645	66,873	81,844
Morocco	22	974	1,331	--	--	--
Norway	263	10,257	12,626	413	17,992	18,973
Peru	26	796	1,191	247	7,524	10,624
Philippines	160	3,360	7,187	374	7,895	12,083
Spain	1,177	45,673	60,433	650	27,676	35,616
Sweden	903	28,879	37,694	989	31,311	40,698
Taiwan	82	2,417	3,745	551	16,256	25,375
Thailand	5,693	142,787	231,235	4,070	108,884	170,513
Turkey	1,453	47,868	69,273	767	27,285	36,988
United Arab Emirates	47	3,876	5,988	--	--	--
Venezuela	1,878	75,173	95,353	1,565	61,209	82,391
Other	49 r/	4,401 r/	5,557 r/	18	5,705	6,937
Total 5/	28,683	1,073,943	1,397,541	25,861	987,074	1,266,318

r/ Revised. -- Zero.

1/ Includes portland, masonry, and other hydraulic cements. Includes imports into Puerto Rico.

2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

4/ Less than 1/2 unit.

5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 19

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	2000			2001		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Anchorage, AK:						
Canada	(3/)	12	14	1	51	113
China	94	2,875	4,197	--	--	--
Thailand	--	--	--	108	2,572	5,023
Total 4/	95	2,887	4,211	109	2,623	5,135
Baltimore, MD:						
Colombia	141	5,645	8,043	--	--	--
Denmark	(3/)	32	40	--	--	--
Germany	(3/)	291	336	--	--	--
Greece	199	7,273	10,334	305	11,626	14,598
Netherlands	(3/)	96	105	(3/)	349	371
Spain	15	474	834	--	--	--
Turkey	27	1,267	2,073	--	--	--
Venezuela	112	4,524	4,997	--	--	--
Total 4/	494	19,602	26,763	305	11,975	14,969
Boston, MA:						
Belgium	(3/)	69	72	--	--	--
Colombia	7	246	371	--	--	--
Netherlands	(3/)	53	62	(3/)	181	215
Norway	36	2,681	2,741	24	1,264	1,267
Spain	30	1,051	1,597	--	--	--
United Kingdom	(3/)	11	11	--	--	--
Venezuela	312	11,438	16,250	249	9,472	11,968
Total 4/	386	15,550	21,104	273	10,917	13,450
Buffalo, NY:						
Canada	546	29,548	31,133	646	35,435	37,363
Denmark	(3/)	10	10	--	--	--
France	--	--	--	(3/)	7	7
Norway	--	--	--	(3/)	8	8
United Kingdom	2	384	398	5	1,035	1,059
Total 4/	548	29,943	31,541	651	36,486	38,438
Charleston, SC:						
Australia	73	1,275	2,494	31	553	1,075
Canada	10	300	500	--	--	--
Colombia	101	3,932	5,337	368	13,298	19,363
Germany	(3/)	15	18	--	--	--
Greece	65	2,266	2,709	471	15,391	15,394
Korea, Republic of	36	1,075	1,558	--	--	--
Netherlands	(3/)	64	71	--	--	--
Spain	16	634	848	--	--	--
Thailand	408	9,786	19,796	--	--	--
Turkey	204	6,178	11,806	--	--	--
United Kingdom	1	370	463	3	1,012	1,183
Venezuela	--	--	--	335	11,825	17,416
Total 4/	915	25,895	45,601	1,207	42,079	54,431
Chicago, IL:						
Canada	34	1,902	1,992	18	1,021	1,095
India	(3/)	4	5	--	--	--
Japan	(3/)	43	48	(3/)	64	73
Netherlands	--	--	--	(3/)	34	39
United Kingdom	--	--	--	(3/)	15	22
Total 4/	35	1,949	2,046	18	1,133	1,229
Cleveland, OH:						
Belgium	--	--	--	(3/)	9	12
Canada	643	35,779	36,511	855	45,063	46,374
Denmark	--	--	--	(3/)	22	29
Netherlands	--	--	--	(3/)	46	56
Spain	(3/)	2	3	(3/)	3	4
United Kingdom	1	221	285	1	277	357
Total 4/	644	36,002	36,799	855	45,420	46,832

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	2000			2001		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Columbia-Snake, ID-OR-WA						
Canada	--	--	--	80	4,032	4,280
China	452	14,172	19,318	544	17,767	24,698
Total 4/	452	14,172	19,318	625	21,799	28,978
Detroit, MI:						
Canada	1,472	85,463	89,245	1,269	78,175	79,599
Germany	23	1,049	1,059	--	--	--
Korea, Republic of	102	4,509	4,549	--	--	--
Morocco	22	974	1,331	--	--	--
Total 4/	1,619	91,994	96,183	1,270	78,175	79,599
Duluth, MN, Canada	263	14,028	16,007	284	16,115	18,486
El Paso, TX, Mexico	489	19,295	24,414	562	20,264	25,464
Great Falls, MT:						
Belgium	(3/)	10	11	--	--	--
Canada	16	888	1,095	5	385	400
United Kingdom	--	--	--	(3/)	8	10
Total 4/	16	898	1,106	6	393	410
Honolulu, HI:						
China	122	2,201	3,216	160	3,475	5,325
Thailand	144	2,460	3,898	109	2,692	3,783
Total 4/	266	4,661	7,115	269	6,167	9,108
Houston-Galveston, TX:						
Belgium	(3/)	12	13	--	--	--
China	(3/)	37	45	--	--	--
Colombia	136	5,738	8,483	120	4,895	7,343
Croatia	18	612	965	--	--	--
Denmark	28	769	1,135	181	5,508	7,772
France	(3/)	269	295	(3/)	234	278
Germany	(3/)	75	86	(3/)	138	167
Greece	104	3,347	4,658	--	--	--
India	(3/)	3	4	(3/)	2	2
Indonesia	15	488	527	--	--	--
Japan	(3/)	16	22	(3/)	8	9
Korea, Republic of	1,609	41,700	66,232	1,286	31,944	52,220
Mexico	--	--	--	(3/)	2	4
Netherlands	--	--	--	(3/)	19	22
Peru	26	796	1,191	188	5,751	8,149
Philippines	--	--	--	374	7,895	12,083
Thailand	531	12,595	18,913	186	4,862	6,848
Turkey	513	14,827	21,440	161	5,512	7,736
United Arab Emirates	43	3,467	5,372	--	--	--
United Kingdom	(3/)	79	150	(3/)	42	46
Venezuela	18	755	873	18	684	903
Total 4/	3,043	85,584	130,405	2,515	67,497	103,584
Laredo, TX, Mexico	159	17,861	18,621	163	18,376	19,358
Los Angeles, CA:						
Australia	(3/)	4	5	(3/)	9	9
China	1,475	47,719	61,992	1,871	57,121	77,400
India	(3/)	4	5	--	--	--
Japan	33	1,001	1,324	--	--	--
Taiwan	(3/)	3	4	--	--	--
Thailand	85	2,386	3,541	447	12,192	18,077
United Kingdom	(3/)	13	16	(3/)	34	40
Total 4/	1,593	51,131	66,886	2,318	69,356	95,525
Miami, FL:						
Belgium	3	534	566	3	623	660
Colombia	3	318	403	22	1,056	1,349
Denmark	104	3,114	4,484	--	--	--
France	(3/)	5	6	--	--	--
Germany	--	--	--	(3/)	21	27
Greece	--	--	--	162	5,940	7,694

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	2000			2001		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Miami, FL--Continued:						
Indonesia	20	662	896	--	--	--
Korea, Republic of	43	1,392	1,829	--	--	--
Mexico	5	446	568	(3/)	47	51
Netherlands	--	--	--	(3/)	34	42
Spain	776	31,763	40,768	583	25,202	32,235
Sweden	849	27,148	35,378	810	25,259	33,462
Thailand	18	600	840	19	579	830
Turkey	--	--	--	37	1,181	1,606
United Kingdom	(3/)	137	177	(3/)	76	97
Venezuela	138	4,995	6,627	52	2,116	2,882
Total 4/	1,960	71,113	92,544	1,687	62,135	80,935
Milwaukee, WI:						
Canada	80	4,598	4,958	111	6,280	6,711
Croatia	18	468	468	--	--	--
Total 4/	99	5,066	5,426	111	6,280	6,711
Minneapolis, MN, Germany	-- r/	--	--	(3/)	5	8
Mobile, AL:						
Australia	--	--	--	33	578	1,188
Greece	32	1,020	1,339	--	--	--
Korea	--	--	--	40	702	1,352
Peru	--	--	--	33	895	1,279
Thailand	459	9,443	18,322	288	6,258	11,801
Turkey	66	1,522	2,346	--	--	--
Total 4/	557	11,985	22,006	394	8,432	15,620
New Orleans, LA:						
Bulgaria	344	12,530	17,489	130	5,013	7,123
China	2	155	204	9	968	1,148
Colombia	(3/)	9	11	197	8,100	9,939
Croatia	27	5,976	6,977	22	3,991	4,871
Denmark	--	--	--	(3/)	9	10
France	13	2,435	2,798	(3/)	4	5
Germany	--	--	--	(3/)	37	39
Greece	327	11,278	14,692	--	--	--
Italy	244	8,993	12,159	134	4,878	6,632
Lebanon	45	1,713	2,325	--	--	--
Netherlands	--	--	--	(3/)	17	20
Sweden	26	830	1,115	--	--	--
Thailand	2,524	64,692	100,247	1,520	43,250	69,412
Turkey	290	11,773	14,909	152	6,401	8,038
Venezuela	429	18,949	22,812	127	6,559	7,306
Total 4/	4,271	139,333	195,738	2,291	79,228	114,541
New York City, NY:						
Bahamas, The	206	7,506	9,485	32	989	1,335
Colombia	(3/)	11	17	--	--	--
Croatia	(3/)	40	42	2	421	421
Denmark	68	4,359	5,150	(3/)	43	54
France	--	--	--	(3/)	2	2
Germany	(3/)	16	17	--	--	--
Greece	350	12,402	16,791	281	9,395	12,711
India	(3/)	5	6	(3/)	2	3
Italy	--	--	--	(3/)	7	11
Lebanon	(3/)	3	4	--	--	--
Netherlands	(3/)	88	100	1	333	378
Norway	227	7,576	9,885	389	16,719	17,698
Peru	--	--	--	26	879	1,196
Sweden	28	901	1,201	167	5,681	6,676
Turkey	300	10,533	14,185	300	10,269	14,244
United Kingdom	(3/)	98	109	1	373	482
Venezuela	34	1,248	1,778	22	821	1,184
Total 4/	1,214	44,787	58,770	1,220	45,935	56,396

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	2000			2001		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
Nogales, AZ:						
Mexico	718	21,418	28,124	911	27,198	35,806
Netherlands	(3/)	17	21	(3/)	30	39
Total 4/	718	21,434	28,145	911	27,228	35,845
Norfolk, VA:						
Bulgaria	291	13,771	16,202	230	8,661	11,373
China	(3/)	2	2	--	--	--
Denmark	(3/)	67	88	(3/)	14	20
France	65	12,471	13,361	71	12,781	13,327
Germany	(3/)	9	11	(3/)	25	32
Greece	402	14,311	18,636	260	8,951	11,925
Indonesia	38	1,098	1,695	197	5,427	8,545
Netherlands	(3/)	185	196	(3/)	39	45
United Kingdom	1	208	261	2	176	238
Total 4/	798	42,122	50,453	760	36,075	45,505
Ogdensburg, NY:						
Canada	192	7,355	7,720	210	10,851	11,162
France	--	--	--	(3/)	11	12
Ireland	--	--	--	(3/)	2	2
United Kingdom	--	--	--	(3/)	9	9
Total 4/	192	7,355	7,720	210	10,872	11,184
Pembina, ND, Canada	344	16,830	18,770	287	12,713	12,998
Philadelphia, PA:						
Belgium	--	--	--	(3/)	11	11
Germany	(3/)	310	348	--	--	--
Italy	4	560	700	--	--	--
Netherlands	--	--	--	(3/)	25	27
Thailand	499	9,840	14,342	358	8,146	8,838
United Kingdom	(3/)	7	8	(3/)	72	136
Total 4/	503	10,717	15,399	359	8,254	9,013
Portland, ME:						
Canada	68	6,445	6,812	90	8,187	8,970
Turkey	46	1,090	1,761	--	--	--
Total 4/	114	7,535	8,574	90	8,187	8,970
Providence, RI:						
Colombia	15	513	727	--	--	--
Philippines	143	2,984	6,501	--	--	--
Spain	268	9,465	13,724	30	1,051	1,597
Venezuela	137	4,945	7,146	489	18,461	25,371
Total 4/	562	17,907	28,098	519	19,512	26,968
San Diego, CA:						
China	709	21,724	28,464	144	4,532	6,054
Mexico	30	1,001	1,310	3	118	164
Thailand	1	98	127	401	12,698	18,014
Total 4/	739	22,823	29,902	548	17,348	24,232
San Francisco, CA:						
Canada	12	579	672	--	--	--
China	421	13,018	18,628	391	11,772	16,124
Taiwan	82	2,415	3,742	551	16,256	25,375
Thailand	321	14,385	20,427	78	3,050	4,172
United Kingdom	(3/)	3	6	(3/)	4	25
Total 4/	835	30,398	43,475	1,020	31,082	45,696
San Juan, PR:						
Belgium	5	415	710	5	327	602
China	134	4,685	6,111	112	2,445	5,029
Colombia	31	1,142	1,240	28	1,344	1,669
Denmark	202	8,105	11,512	235	7,313	12,538
Italy	(3/)	8	9	(3/)	28	31
Lebanon	63	2,451	2,606	--	--	--
Mexico	7	679	968	6	869	997

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

(Thousand metric tons and thousand dollars)

	2000			2001		
		Value			Value	
Customs district and country	Quantity	Customs 1/	C.i.f. 2/	Quantity	Customs 1/	C.i.f. 2/
San Juan, PR--Continued:						
Spain	7	204	214	(3/)	11	12
Total 4/	450	17,688	23,369	386	12,337	20,879
Savannah, GA:						
Colombia	24	1,295	1,351	--	--	--
Denmark	5	366	507	--	--	--
Germany	--	--	--	(3/)	13	16
Indonesia	82	1,484	3,642	76	1,448	3,373
Italy	(3/)	76	108	(3/)	61	66
Thailand	132	2,988	5,244	51	1,169	2,382
Turkey	6	679	754	4	281	281
United Kingdom	(3/)	45	61	(3/)	8	11
Venezuela	69	2,746	2,805	--	--	--
Total 4/	318	9,679	14,471	130	2,979	6,129
Seattle, WA:						
Australia	106	3,027	4,885	83	2,154	3,746
Canada	1,077	51,724	55,005	1,052	52,389	57,558
China	44	1,264	1,767	34	1,135	1,858
Japan	(3/)	33	48	1	344	500
Thailand	--	--	--	24	574	978
United Kingdom	--	--	--	(3/)	3	4
Total 4/	1,227	56,048	61,705	1,195	56,599	64,643
St. Albans, VT:						
Canada	178	13,084	14,018	201	16,383	17,577
France	(3/)	44	53	--	--	--
Total 4/	178	13,128	14,071	201	16,383	17,577
Tampa, FL:						
Canada	12	340	588	--	--	--
Colombia	1,054	39,767	48,961	968	35,915	45,529
Denmark	146	11,112	15,178	112	8,790	12,201
France	--	--	--	(3/)	2	3
Greece	--	--	--	73	2,343	3,299
India	(3/)	8	10	(3/)	7	9
Indonesia	20	650	880	--	--	--
Korea, Republic of	33	1,066	1,410	--	--	--
Philippines	16	376	687	--	--	--
Spain	64	2,081	2,444	38	1,409	1,767
Sweden	--	--	--	12	371	559
Thailand	551	12,400	23,866	483	10,842	20,356
Turkey	--	--	--	112	3,640	5,083
United Arab Emirates	5	409	617	--	--	--
Venezuela	558	21,423	27,154	213	8,165	11,240
Total 4/	2,458	89,632	121,795	2,009	71,484	100,047
U.S. Virgin Islands:						
Barbados	2	74	94	1	56	77
Colombia	--	--	--	2	67	87
Panama	3	92	117	--	--	--
Venezuela	71	4,149	4,911	61	3,106	4,122
Total 4/	75	4,315	5,122	64	3,229	4,285
Washington, DC, Italy	(3/)	5	6	(3/)	--	--
Wilmington, NC:						
Colombia	13	557	750	--	--	--
Indonesia	21	918	1,438	45	2,003	3,140
Italy	(3/)	4	4	--	--	--
Thailand	22	1,114	1,670	--	--	--
Total 4/	55	2,593	3,864	45	2,003	3,140
Grand total 4/	28,683	1,073,943	1,397,541	25,861	987,074	1,266,318

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY

r/ Revised. -- Zero.
1/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
2/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
3/ Less than 1/2 unit.
4/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 20

U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

	2000			2001		
		Value			Value	
Country	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	179	4,301	7,379	113	2,707	4,821
Bahamas, The	199	6,713	8,553	32	989	1,335
Bulgaria	635	26,301	33,691	360	13,675	18,496
Canada	3,916	202,885	216,312	4,148	220,077	234,274
China	3,301	104,103	138,811	3,160	96,173	133,303
Colombia	1,314	51,444	66,633	1,477	55,699	74,214
Croatia	18	612	965	--	--	--
Denmark	385	12,721	17,756	407	11,705	18,889
Germany	23	1,100	1,117	(4/)	78	92
Greece	1,392	48,417	64,535	1,414	48,354	58,529
Indonesia	161	3,894	7,113	273	6,875	11,918
Italy	248	9,557	12,863	135	4,885	6,643
Korea, Republic of	1,721	45,232	71,029	1,286	31,944	52,220
Lebanon	19	575	838	--	--	--
Mexico	1,174	34,282	45,756	1,404	39,864	53,052
Norway	226	7,576	9,885	367	14,906	15,801
Peru	26	796	1,191	214	6,630	9,346
Philippines	159	3,360	7,187	374	7,895	12,083
Spain	1,054	35,535	48,253	532	17,867	23,166
Sweden	903	28,879	37,694	989	31,311	40,698
Taiwan	81	2,417	3,745	551	16,256	25,375
Thailand	3,594	100,413	156,533	3,320	90,621	140,866
Turkey	1,225	40,632	59,230	738	25,093	34,316
Venezuela	1,851	73,376	93,495	1,417	55,971	76,722
Other	38 r/	1,234 r/	1,614 r/	1	120	154
Total 5/	23,842	846,355	1,112,178	22,711	799,695	1,046,313

r/ Revised. -- Zero.
1/ Includes imports into Puerto Rico.
2/ The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	2000			2001		
		Value			Value	
	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Bahamas, The	7	793	932	--	--	--
Belgium	8	949	1,276	7	950	1,263
Canada	181	21,118	21,892	213	25,674	26,323
China	26	1,359	1,674	--	--	--
Colombia	9	880	1,042	11	981	1,250
Denmark	170	15,211	20,343	120	9,995	13,736
Greece	6	614	728	14	1,173	1,497
Indonesia	36	1,406	1,966 4/	45	2,003	3,140 4/
Mexico	205	23,807	25,352	197	23,146	24,478
Norway	36	2,681	2,741 4/	45	3,077	3,164 4/
Spain	123	10,136	12,176	119	9,805	12,445
Thailand	23	1,212	1,798 4/	37	3,291	3,403
Turkey	24	1,976	2,340	28	2,192	2,671
United Arab Emirates	48	3,876	5,988	--	--	--
Venezuela	22	1,560	1,612 4/	100	3,807	3,849 4/
Other	(5/) r/	296 r/	319 r/	(5/)	391	421
Total 6/	923	87,872	102,178	936	86,486	97,641

r/ Revised. -- Zero.
1/ Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of gray portland or similar cement or clinker. This error occurs when the importer records the wrong tariff number with the U.S. Customs Service. Values exceeding $200 per ton likely indicate misidentified specialty cement, not white cement.
5/ Less than 1/2 unit.
6/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY 1/

(Thousand metric tons and thousand dollars)

Country	2000			2001		
		Value			Value	
	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	C.i.f. 3/
Australia	--	--	--	33	578	1,188
Canada	847	43,552	45,459	661	35,622	36,013
China	122	2,282	3,321	105	3,024	4,310
Colombia	201	6,849	8,019	217	7,996	9,814
Croatia	18	468	468	--	--	--
France	76	13,177	14,312	69	11,730	12,258
Germany	(4/)	3	3	--	--	--
Korea, Republic of	102	4,509	4,549	40	702	1,352
Lebanon	90	3,593	4,097	--	--	--
Morocco	22	974	1,331	--	--	--
Peru	--	--	--	33	895	1,279
Thailand	2,077	41,163	72,904	710	14,428	25,278
Turkey	204	5,261	7,703	--	--	--
Venezuela	--	--	--	48	1,431	1,821
Other	-- r/	-- r/	-- r/		--	--
Total 5/	3,760	121,830	162,167	1,916	76,405	93,313

See footnotes at end of table.

TABLE 22--Continued
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY 1/

r/ Revised. -- Zero.
1/ For all types of hydraulic cement. Includes imports into Puerto Rico.
2/ Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
3/ Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
4/ Less than 1/2 unit.
5/ Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 23
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1997	1998	1999	2000	2001 e/
Afghanistan e/	116	116	116	50 r/	50
Albania e/	100	84	106	110	110
Algeria e/	7,096 3/	7,500	7,500	8,300	8,300
Angola e/	301 3/	350	350	350	350
Argentina	6,858	7,091	7,187	7,150 e/	7,000
Armenia	297	300	287	219	300 3/
Australia e/	6,450	6,850	7,450	7,500	7,500
Austria	3,852	3,850 e/	3,817 r/	3,776 r/	3,802 p/ 3/
Azerbaijan	315	201	177 r/	200 e/	500 3/
Bahrain	172	230	156	89	89 3/
Bangladesh 4/	1,013 r/	1,240 r/	2,085 r/	3,580 r/	5,005 3/
Barbados	173	259	253	268	270
Belarus	1,876	2,035	2,100	1,847 r/	1,803 3/
Belgium	8,052	7,000 e/	7,277 r/	7,150 r/	7,500
Benin e/	200 r/	200 r/	200 r/	250 r/	250
Bhutan e/	160	150	150	150	160
Bolivia	1,035	1,169	1,201 r/	1,072 r/	1,100
Bosnia and Herzegovina e/	200	300	300	300	300
Brazil	38,096	39,942	40,270	39,208	39,500
Brunei	250 e/	216	208	232	250
Bulgaria	1,654 r/	1,742 r/	2,060 r/	2,209 r/	2,200
Burkina Faso e/	40	40	50	50	50
Burma	516	365	338	393	460
Cambodia e/	150 r/	150 r/	-- r/	-- r/	50
Cameroon	620 r/	740 r/	850 r/	890 r/	930
Canada	12,015	12,124	12,634	12,612	12,986 p/ 3/
Chile	3,735	3,888	3,036	3,491	3,500
China	511,730	536,000	573,000	597,000 r/	626,500 p/ 3/
Colombia	8,446	9,190	9,200 r/ e/	9,750 r/ e/	9,800
Congo (Brazzaville)	20	--	--	20 e/	20
Congo (Kinshasa)	125	134	158	96 e/	100
Costa Rica	940	1,085 r/	1,100 r/ e/	1,150 e/	1,100
Côte d'Ivoire e/	1,100	650	650	650	650
Croatia	2,134	2,295	2,712	2,852	3,247 p/ 3/
Cuba	1,707 r/	1,713 r/	1,785 r/	1,633 r/	1,700
Cyprus	910 e/	1,207 r/	1,157 r/	1,398 r/	1,369 3/
Czech Republic	4,877	4,604	4,241	4,093	3,550 p/
Denmark	2,683	2,528	1,926 r/	2,009 r/	2,010
Dominican Republic	1,835	1,885	2,000 e/	2,000 e/	2,000
Ecuador	2,900 e/	2,600	2,300	2,800 e/	2,800
Egypt	19,700	21,000 e/	23,313	24,143	24,500
El Salvador	1,020	1,065 r/	2,425 r/	2,504 r/	2,500
Eritrea e/	60	50	57 r/	45	47
Estonia	423	321	358	329	405 3/
Ethiopia	752 e/	750 r/	638	880	950
Fiji	96	90	95 e/	95 e/	95

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1997	1998	1999	2000	2001 e/
Finland	905	1,098 r/	1,310	1,422 r/	1,325 3/
France	19,780	19,500 e/	20,219 r/	20,137 r/	19,839 3/
French Guiana e/	51 3/	50	50	50	50
Gabon e/	200	196 3/	200	210 r/ 3/	210
Georgia	91	200	342 r/	348 r/	300 3/
Germany	35,945	36,610	35,912 r/	34,727 r/	28,034 3/
Ghana	1,700 e/	1,630	1,870	1,950	1,900
Greece	14,982	15,000 e/	13,908 r/	14,530 r/	15,500
Guadeloupe e/	230	230	230	230	230
Guatemala	1,280	1,500 r/	1,600 r/	1,600 r/	1,600
Guinea	260 e/	277 r/	297 r/	300 r/	300
Honduras	1,041 r/	896 r/	980 r/	1,100 r/	1,100
Hong Kong	1,925	1,539	1,387	1,284	1,300
Hungary	2,811	2,999	2,979	3,351 r/	3,500
Iceland	101	118	131	144	155
India e/	80,000	85,000	90,000	95,000	100,000
Indonesia	27,505	22,341	23,925	27,789	31,300 3/
Iran	19,250	21,300 r/ e/	22,080 r/	23,880 r/	26,650 3/
Iraq e/	1,700	2,000	2,000	2,000	2,000
Ireland	2,100	2,000 e/	2,466 r/	2,620 r/	2,600
Israel	5,400 e/	6,476	6,354	6,600 e/	6,900
Italy	33,721	35,512	37,299 r/	38,925 r/	39,804 p/ 3/
Jamaica	588	558	504	521 r/	500
Japan	91,938	81,328	80,120	81,070 r/	76,550 3/
Jordan	3,251	2,650	2,687	2,640	3,159 3/
Kazakhstan	661 e/	600 e/	838	1,175	1,957 3/
Kenya	1,506	1,426 r/	1,204	1,146 r/	1,085 p/ 3/
Korea, North e/	7,000 r/	7,000 r/	6,000 r/	6,000 r/	5,160
Korea, Republic of	60,317	46,091	48,157	51,255	52,012 3/
Kuwait e/	2,000	2,000	2,000	2,000	2,000
Kyrgyzstan	658	709	386	500	500 3/
Laos e/	84	80	80	92 r/	92
Latvia	246	366 r/	W	W	500
Lebanon	2,703	3,316 r/	2,714 r/	2,808 r/	2,700
Liberia e/	7	10	15	15	15
Libya e/	2,524 3/	3,000	3,000	3,000	3,000
Lithuania	714	788	666	570	520
Luxembourg	683	699 r/	742 r/	749 r/	750
Macedonia	500 e/	461	520	585	600
Madagascar	36	44	46	51 r/	54
Malawi	176	134	187	156 r/	181 3/
Malaysia	12,668	10,397	10,104	11,445	13,820 3/
Mali e/	30 r/	40 r/	30 r/	30 r/	40
Martinique e/	220	220	220	220	220
Mauritania e/	80	100 r/	100 r/	110 r/	110
Mexico	27,548	27,744	29,413	31,677	29,966 3/
Moldova	122	74	50	222	200 3/
Mongolia	112	109	104	92	68 3/
Morocco	7,236	7,414 r/	7,530 r/	8,100 r/	8,450
Mozambique	220 e/	260	270	310 e/	380
Namibia e/	50	100	150 r/	150 r/	8,450
Nepal e/ 4/	225 3/	280	290	300	285
Netherlands	3,230	3,200 e/	3,480 r/	3,450 r/	3,450
New Caledonia e/	100	--	--	-- r/	285
New Zealand e/	976 3/	950	960	950	950
Nicaragua	377	377 r/	350 r/	360 r/	360
Niger e/	30	30	30	40 r/	40
Nigeria e/	2,520 3/	2,700	2,500	2,500	3,000
Norway	1,724	1,676	1,827 r/	1,851 r/	1,870
Oman	1,264	1,300 e/	1,300 e/	1,716	1,750
Pakistan	9,001	8,901	9,600 r/ e/	9,900 r/ e/	9,900
Panama	700	750	760 r/	760 r/ e/	760
Paraguay	675 e/	620	640	700 r/ e/	750

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Thousand metric tons)

Country	1997	1998	1999	2000	2001 e/
Peru	4,301	4,340	3,799	3,700 r/ e/	3,589 3/
Philippines	14,681	12,888	12,556	11,959 r/	8,653 3/
Poland	15,003	14,970	15,555 r/	15,046 r/	11,918 3/
Portugal	9,395	9,500 e/	10,147 r/	10,343 r/	10,300
Qatar	692	700 e/	1,025	1,050 e/	1,050
Réunion	299	277	300	300 e/	10,300
Romania	7,298	7,300	6,252	6,058 r/	5,668 3/
Russia	26,700	26,000	28,400	32,400	35,100 3/
Rwanda e/	61 r/	59 r/	66 r/	71 r/	75
Saudi Arabia	15,400	14,000 e/	16,313 r/	18,107 r/	20,608 3/
Senegal e/	854 3/	1,000	1,000	1,000	1,000
Serbia and Montenegro	2,011	2,253	1,575	2,117	2,418 3/
Sierra Leone e/	160	50	100	100	1,000
Singapore e/	3,300	3,300	3,250	3,250	3,200
Slovakia	3,136 r/	4,705 r/	4,718 r/	3,045 r/	3,123 3/
Slovenia	1,113	1,149	1,224	1,300 e/	1,300
South Africa (sales)	9,797 r/	9,581 r/	9,008 r/	8,991 r/	9,165 3/
Spain (including Canary Islands)	27,632	27,943	35,782 r/	38,115 r/	40,512 3/
Sri Lanka	965 e/	874	976	1,008	1,010
Sudan	276 r/	198 r/	231 r/	146 r/	146
Suriname e/	60 r/	60 r/	60 r/	60 r/	60
Sweden	2,253	2,252 r/	2,298 r/	2,651 r/	2,700
Switzerland	3,568	3,600 e/	3,548 r/	3,771 r/	3,950 p/ 3/
Syria	4,840	4,607	4,781	4,830 e/	4,840
Taiwan	21,522	19,652	18,283	17,572 r/	18,128 3/
Tajikistan	36	18	30	50	70 3/
Tanzania	621	778	833	833 e/	875
Thailand	37,115 r/	22,722 r/	25,354 r/	25,499 r/	27,913 3/
Togo	421	500 r/	600 r/	700 r/	800
Trinidad and Tobago	653	690	688	743	708 3/
Tunisia	4,424	4,588	4,864	5,657 r/	5,721 3/
Turkmenistan e/	450	450	450	450	450
Turkey	36,035	38,200	34,258	35,825	30,120 p/ 3/
Uganda	290 r/	321 r/	347 r/	368 r/	416
Ukraine	5,098	5,591	5,828	5,311	5,800 3/
United Arab Emirates e/	5,250	6,000	6,100 r/	6,100 r/	6,100
United Kingdom	12,638	12,409	12,697	12,452 r/	11,854 3/
United States (including Puerto Rico) 5/	84,255	85,522	87,777	89,510	90,450 3/ 6/
Uruguay	781	750	720	700 e/	700
Uzbekistan	3,300	3,400 e/	4,471 r/	3,521 r/	4,000
Venezuela	8,145	8,202	8,500 e/	8,600 e/	8,700
Vietnam	8,019	9,738 r/	10,489 r/	13,347 r/	14,000
Yemen	1,235	1,201	1,454	1,400 e/	1,400
Zambia	384	351	300 e/	380 e/	380
Zimbabwe e/	1,100	1,100	1,000	1,000	1,000
Total	1,540,000 r/	1,530,000 r/	1,600,000 r/	1,660,000 r/	1,700,000

e/ Estimated. p/ Preliminary. r/ Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.
1/ World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are believed to be accurate to no more than three significant digits.
2/ Table includes data available through August 17, 2002. Data may include clinker exports for some countries.
3/ Reported figure.
4/ Data for year ending June 30 of that stated.
5/ Portland and masonry cements only.
6/ Data are rounded to four significant digits.

CEMENT

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Nick Muniz, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Hydraulic cements are the binding agents in concrete and mortar. The hydraulic cements covered in this report are largely restricted to those varieties that can be loosely grouped as portland cement and/or masonry cement. The portland cement varieties are listed in table 16 and include blended cements. Data for combined sales of blended cements listed separately from portland cement are available within the monthly cement reviews of the U.S. Geological Survey (USGS) Mineral Industry Surveys series, starting with January 1998. Masonry cements in both the annual and monthly reports include true masonry cements, portland-lime cements, and plastic cements. Certain other hydraulic cements, most notably aluminous cement, are included within the world hydraulic cement production data given in table 23. Data for pure (unblended) cementitious or pozzolanic additives, such as fly ash and ground granulated blast furnace slag (GGBFS), are excluded in this report from U.S. data and, where possible, from international data. Where these materials are a component of blended (also called composite) cements, their tonnages are included. Straight GGBFS is being increasingly referred to by the U.S. cement industry as "slag cement," but this is misleading because the material is an additive. Although these materials are not finished cements in their own right, they play an important role as a partial substitute for portland cement in the United States and many other countries. Except where otherwise specified, activity levels in this report exclude Puerto Rico. Unless otherwise specified, indications of percentage or other changes expressed in this report compare activity in 2002 with that of 2001.

Overall, U.S. production of portland and masonry cements in 2002 rose by about 1% to 89.7 million metric tons (Mt), a new record (table 1). Output of clinker—the intermediate product of cement manufacture—increased by almost 4% to a new record of 81.5 Mt. The United States ranked third in the world in hydraulic cement production; world output in 2002 was about 1.8 billion metric tons (Gt).

In contrast to the higher cement output, continued weakness in the general U.S. economy in 2002 led to lower overall cement consumption levels in most months during the year. Consumption was further aggravated in the fourth quarter by relatively severe winter weather (vs. several mild winters previously). Apparent consumption (a calculated statistic) for the year declined by 2.5% to about 110 Mt, and consumption measured by shipments to final customers declined by almost 4% to about 108 Mt (tables 1, 9). The large shortfall in cement (and clinker) production relative to consumption continued to be met with imported material, but import levels declined significantly. In line with lower sales volumes and stagnant or slightly lower unit prices, the overall value of cement sales in 2002 declined by about 4% to about $8.25 billion. Based on typical portland cement mixing ratios in concrete, the delivered value of concrete, excluding mortar, in the United States was estimated to be at least $40 billion in 2002.

The top five cement-producing States in 2002, in descending order, were California, Texas, Pennsylvania, Michigan, and Missouri. Cement producers in the United States ranged widely in size and in the number of plants operated. Ranking companies in terms of output or capacity is made difficult by the existence of some common parents and joint ventures. If companies with common parents are combined under the larger subsidiary's name and if joint ventures are apportioned, then the top 10 companies at yearend 2002, in descending order of cement production, were Holcim (US) Inc.; Lafarge North America, Inc.; CEMEX, Inc.; Lehigh Cement Co.; Ash Grove Cement Co.; Essroc Cement Corp.; Lone Star Industries, Inc.; Texas Industries Inc. (TXI); RC Cement Co. (including Alamo Cement Co.); and California Portland Cement Co. The top 5 of these had about 52% of total U.S. production, and all 10 together accounted for about 77% of total U.S. production. All the companies listed except Ash Grove cement and TXI were foreign-owned as of yearend.

Consolidation in the international cement industry continued in 2002, with the most important change, from a U.S. standpoint, being that of Buzzi Unicem S.p.A. of Italy acquiring control of Dyckerhoff AG of Germany, in which Buzzi already held a substantial stake. As of yearend, however, the merger had not yet led to a consolidation of management or other activities of the respective companies' U.S. subsidiaries—RC Cement and Alamo Cement, both owned by Buzzi Unicem; and Lone Star Industries, including 50% of Glens-Falls Lehigh Cement, owned by Dyckerhoff. At yearend, Votorantim Cementos Ltda. of Brazil arranged to buy a 50% stake in Suwannee American Cement Co., a new plant that started up at yearend in Florida.

Early in the year, Cemex S.A. de C.V. of Mexico purchased Puerto Rican Cement Co., which operated an integrated plant in San Juan, PR. Also early in the year, Essroc purchased Riverton Investment Corp., which owned Capitol Cement Corp. (an integrated plant at Martinsburg, WV) and Riverton Corp. (a plant at Front Royal, VA, that manufactured lime and colored masonry cements). In December, Hanson PLC announced that it was finalizing the sale of its 50% share in North Texas Cement Co., LP to its joint-venture partner Ash Grove. The sale was to take effect in January 2003 and would be the first return of cement production capacity to U.S. ownership since the January 1998 purchase of Riverside Cement by TXI.

The bulk of this report is based on data compiled from the USGS canvass of cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are not owned by U.S. cement manufacturers. For 2002, responses were received from 137 of 145 facilities canvassed, a response rate of 94%. Of the nonrespondents, only five were production sites. The respondent facilities accounted for about 97% of U.S. cement production and production capacity in 2002. In contrast, for 2001, responses were received from 125 of 144 facilities canvassed, a response rate of 87%, accounting for about 90% of production and capacity. The nonrespondents in 2001 included 13 production facilities.

For missing forms and for cases where forms were returned incomplete, an attempt was made to obtain the missing information by telephone. For 2002, cement production data were thus obtained for all nonrespondents, hence the production statistics for 2002 have 100% reporting. For data other than production where follow-up inquiries were not successful and for which applicable data were not available from the monthly surveys, estimates were incorporated. A number of district and national totals have been rounded to reflect this incorporation of estimates. State totals are listed individually where possible or combined within districts where needed to protect proprietary data. In several tables, a few States (and, for consumption, two metropolitan areas) are shown subdivided; the county basis for these divisions is given in table 2.

Legislation and Government Programs

Economic Issues.—Government economic policies and programs affecting the cement industry are those affecting cement trade, interest rates, and public sector construction spending. In terms of trade, the major issue in 2002 continued to be that of antidumping tariffs against Japan and Mexico; in a 2000 sunset review judgment, these tariffs were ruled as still necessary. On March 14, 2002, the U.S. Department of Commerce released its determination for the 10th review period, covering August 1999 to July 2000, for gray portland cement and clinker from Mexico; the dumping margin for the period was set at 50.98% (Southern Tier Cement Committee, 2002).

The major Government construction funding program in 2002 remained the Transportation Equity Act for the 21st Century (TEA-21), passed in 1998, which authorized $216.3 billion in funding for the 6-year period from 1998 to 2003 to upgrade the country's transportation infrastructure. Although Federal public sector expenditures on highways increased since the passage of TEA-21, the increases have been below expectations, as have been the levels of cement consumption for this work. Various factors have affected the actual TEA-21 funding and consumption levels, including delays in or unavailability of State cofunding of projects, greater than anticipated lag times between project initiation and actual cement consumption, greater than anticipated work not requiring significant concrete, delays related to environmental issues, and overall project cost increases. Efforts were underway to reauthorize TEA-21 to ensure its continuation beyond 2003 and at higher expenditure levels (Cement Americas, 2002a).

Environmental Issues.—The production of portland cement involves components of mining and manufacturing. Most of the environmental issues relate to the manufacturing process; an overall review of this process and its associated environmental issues is provided in van Oss and Padovani (2002, 2003). The largest emissions from cement (actually clinker) manufacture are of carbon dioxide (CO_2), amounting to nearly 1 metric ton (t) of gas per metric ton of clinker, about one-half of which is derived from the calcination of calcium carbonate raw materials, and the rest, from the combustion of fuels. Overall, generation of CO_2 by the U.S. industry in 2002 amounted to about 77 Mt.

As of June 10, U.S. portland cement plants were required to be in compliance with the National Emission Standards for Hazardous Air Pollutants for Source Categories; Portland Cement Industry ("PC MACT") and was to be in compliance with the equivalent rule for hazardous waste combustors by September 30, 2003. Ellis (2003) provides a review of the salient provisions of these MACT rules and related environmental proposals and a brief overview of the administrative requirements of the PC MACT rule (Egan and Holt, 2002).

Production

Cement in 2002 was produced in 37 States and in Puerto Rico (tables 3, 4). The State count, unchanged from 2001, reflects the cessation of production in Hawaii in 2001 and the incorporation of data in 2002 for a new grinding plant, Badger Cement Products LLC in Milwaukee, WI. Badger Cement actually commenced operations in late November 2001, but output data remain unavailable for that year.

One new portland cement plant, Suwannee American Cement Co., fired up its kiln at yearend 2002, but clinker output (likely very small) and most other data for it were unavailable, and the facility is not included in this report's tabulations. The plant at Branford, FL, has a capacity of about 0.75 million metric tons per year (Mt/yr). Suwannee's cement sales were expected to commence in early 2003.

Several existing portland cement plants completed major capacity upgrades during the year. Lafarge had its first full year of production from the new finish mill installed at its 0.8-Mt/yr Sugar Creek, MO, facility in December 2001. The plant's existing long dry kilns were shut down in November 2001, and the new precalciner kiln was fired in April 2002 (Cement Americas, 2002b; Gaal, 2003). The new 4,400-metric-ton-per-day (t/d) kiln at Lafarge's Roberta plant in Calera, AL, was fired in March, and the plant's existing long dry kilns were closed at about the same time (Seymour, 2003). In October, Phoenix Cement started up its new 3,000-t/d kiln at its Clarkdale, AZ, plant. The facility's existing long dry kilns were shut down (Skroski, 2003). After 10 months of work to repair structural problems in the preheater tower, Holcim refired the new 1.9-Mt/yr kiln at the Portland plant in Florence, CO. The new line was first fired in August 2001 but was shut down shortly thereafter when structural defects were discovered in the tower. The company had intended to close its Fort Collins plant at LaPorte, CO, in 2001 but kept it running until repairs at the Portland plant were complete. The Fort Collins plant was shut down at the end of August (Cement Americas, 2002c). This was the only U.S. plant closure during 2002.

Giant Cement Holding, Inc. was planning to install a 3,000-t/d precalciner kiln to replace the wet kilns at its Harleyville, SC, plant. Work was planned to commence in 2003 and to be completed in 2004 (Cement Americas, 2002d). Continental Cement Co. announced plans to double the production capacity of its Hannibal, MO, plant to about 1.2 Mt/yr (Portland Cement Association, 2002). Dragon Products Co., Inc. was planning to replace the existing wet kiln with a 0.64-Mt/yr precalciner dry kiln at its Thomaston, ME, plant. Work was planned to commence in March 2003, with completion targeted for mid-2004 (International Cement Review, 2003).

Portland Cement.—Portland cement was manufactured in the United States in 2002 at a total of 114 plants plus 2 in Puerto Rico. As in 2001, the count excludes a facility in Florida that reported simply regrinding imported portland cement from one variety into another (i.e., the facility grinds no clinker). Of the U.S. plants, six were simply grinding facilities that relied entirely on clinker made elsewhere (primarily foreign). The distribution, by district, of portland cement plants, cement production, grinding capacities, and yearend cement stockpiles, is listed in table 3. Although this activity is not shown in the tables, some portland cement plants also grind GGBFS as a separate product.

In 2002, U.S. production of portland cement overall rose by 1.0% to about 85.3 Mt, a new record. District-level performances were evenly split between districts reporting production increases and those recording decreases (table 3). Most of the larger increases could be attributed to the recent (2000-2002) completion of capacity upgrades.

The overall grinding capacity rose by about 1% to about 108 Mt; however, grinding capacity utilization fell slightly (0.5%). The capacity utilization percentages in table 3 are relative to portland cement production, but if they are calculated on a total cement (including masonry) basis, then the utilization percentage in 2002 becomes 83.1%, essentially unchanged from that in 2001. Many cement plants have excess grinding capacity because it is relatively inexpensive to provide it. Also, the capacities listed in table 3 for some districts include reported clinker grinding capacity that is currently used to produce GGBFS. This is especially true in Florida, which shows a relatively low capacity utilization level. Some low utilization rates also reflect plant upgrades late in the year; the full new capacities are credited without commensurate full year production at the upgraded levels. In contrast to recent years, a number of districts showed capacity utilization rates in 2002 that were perhaps slightly below full practical operational levels. In at least some cases, these reflected slow market conditions, in which extended shutdowns for maintenance were authorized.

Data are not collected on the production of specific varieties of portland cement, but it may be presumed that production levels approximate the ratios among types of portland cement sold (table 16). On this basis, production of Types I and II (or hybrids thereof) accounted for about 86% of total portland cement output in 2002, down from about 88% in 2001. The Type I production decline, if real, appears to have been substantially offset by an increase in production (sales) of Type V portland cement. Part of this shift, however, may be explained by a switch in type assignation by some California producers that have a product that meets the specifications for both types; the USGS canvass does not offer a hybrid reporting category. Although total production of blended cements did not change significantly, the ratio among blended cements appears to have shifted, with a significant apparent increase in blends containing GGBFS and an offsetting decline in blends containing fly ash. The increase in production of GGBFS blends is in accord with an increase in consumption of GGBFS material for cement manufacture (table 6), although the ratio of slag to blended cement declined during the 2-year period shown from almost 54% to 49%. This ratio decline may reflect a "dilution" of the blends (which is unlikely) or some other use of slag in the finish mill (more information can be found in the "Raw Materials and Energy Consumed in Cement Manufacture" discussion below). In contrast, the relative amount of fly ash consumed for blended cement declined significantly less than the overall apparent tonnage of blended cement produced, suggesting an increase in the average content of fly ash within blended cement from 18% to about 29%.

Ideally, if sales data are to be used as a proxy for production ratios, then the sales ratios should be adjusted for the import component of sales. Imports are dominated by Types I and II portland cement but include significant volumes of Type V (mainly into southern California) and white cement. Unfortunately, there is no tariff code distinction among gray portland cement types.

Masonry Cement.—Overall production of masonry cement was essentially unchanged in 2002 at about 4.45 Mt and reflected the continued strong housing construction sector during the year (table 4). Changes in yearend stockpiles, likewise, were insignificant. Unlike portland cement, little if any masonry cement is imported; accordingly, production (adjusted for changes in yearend stockpiles) is almost identical to the consumption levels (as defined by shipments to final customers) in table 9. The data in both tables 4 and 9, however, underrepresent true production and consumption levels of masonry cement because it is common for masonry cement (particularly the portland lime variety) to be made at the jobsite from purchased portland cement and lime. There are no data on this jobsite activity, but apart from its influence, the large district-level percentage changes in 2001-02 masonry cement production evident in table 4 (generally much larger than the relative shifts in portland cement production) may be explained by the focus of masonry cement on the housing sector of the construction industry and the fact that the overall tonnages of masonry cement are very small by comparison to portland cement. Hence small tonnage shifts can equate to large percentage changes. In 2002, about 95% of the reported masonry cement continued to be indicated as having been made directly from clinker rather than from finished portland cement.

Clinker.—District-level data pertaining to clinker are given in table 5; the production data therein represent 100% reporting, whereas some of the other data contain estimates. Production of clinker in 2002 reached a new record of 81.5 Mt, up by 3.9%. In descending order, California, Texas, Pennsylvania, Missouri, and Alabama were the top five clinker-producing States in 2002. The rankings are unchanged from the previous year except that Michigan was fifth in 2001. Only six districts showed clinker production decreases, and of these, only four had declines in excess of 50,000 t. The two largest declines (Michigan and the Georgia-Virginia-West Virginia district) appear to be largely weather related. About a dozen districts showed clinker production increases in excess of 50,000 t, while the remaining districts showed smaller increases. As with portland cement production, a number of the larger State-level increases could be related to recent plant upgrades.

In 2002, clinker was produced by a total of 110 integrated cement plants operating 195 kilns (down by 11); 2 of these plants and kilns were in Puerto Rico. Of the total, 80 plants were dry process facilities (including 1 semidry facility in Indiana). The number of wet process plants dropped by 1 to 27, reflecting the 2001 closure of the Kosmos cement plant in western Pennsylvania. The number of plants shown as operating both wet and dry kilns (combination plants) declined by three in 2002, with a corresponding increase in dry plants. The decline in combination plants represented facilities that completed new dry kiln lines in 2001 but which also had part-year production from obsolete wet kilns that were subsequently closed later that year.

Annual clinker capacity and capacity utilization statistics are highly sensitive to reported kiln shutdown periods, specifically those for routine maintenance. This downtime sensitivity means that changes of a few percentage points in regional annual clinker production capacity or capacity utilization rates have little statistical significance. Given that a plant generally has a total downtime in excess of that for routine maintenance, a capacity utilization rate of 85% or higher indicates that the facility is probably running at, or close to, full practical capacity; likewise for district-level utilization rates. A utilization rate below this could indicate the temporary idling of kilns or the permanent closure of old kilns following successful startup of new ones; as long as a kiln was active for 1-day or more during the year, its capacity will be included in the data in table 5. Apparent clinker capacity in 2002 increased slightly (0.6%) to 99.0 Mt/yr. Overall capacity utilization rose by almost 3% to about 82%, but quite a few districts showed overall utilization rate decreases. As with cement, some of these decreases were attributable to extended maintenance periods that had been authorized under slow market conditions.

Based on the data in table 5, average plant clinker capacity in 2002 was about 0.92 Mt/yr, up by about 2%, and average kiln capacity was 0.51 Mt/yr, up by about 7%. Plants operating only dry process kilns in 2002 produced almost 78% of the total clinker, up from about 75% the previous year (table 7). Wet kiln plants accounted for 17.6%, down from the 18.5% in 2001. Combination plants accounted for just 4.5% of the clinker compared with 6.3% in 2001; the 2001 figure, however, included three facilities listed as dry plants in 2002. Yearend stockpiles of clinker rose by about 24% to about 5.6 Mt, an apparent buildup[1] that, along with reduced levels of clinker imports (tables 1 and 22), reflected the lower overall levels of cement consumption during the year.

Raw Materials and Energy Consumed in Cement Manufacture.—The differentiation between raw materials consumed for clinker manufacture and those added in the finish mill to make cement is primarily of environmental interest. Materials used to make clinker are burned in the kiln and are associated with various chemical changes and emissions, whereas those used in the finish mill are just ground. The amounts of nonfuel raw materials consumed to make cement and clinker are listed in table 6. About 1.7 t of nonfuel raw materials is needed to make 1 t of clinker, and about the same ratio holds through to the final (portland) cement product. Limestone or other calcareous materials account for about 85% or more of the total raw materials needed to make cement and clinker.

Overall, the major ratios among raw materials types did not change appreciably in 2002. Some of the specific changes seen may reflect improved reporting rather than a net change in true consumption. Also, some materials may be classified somewhat differently from year to year or among plants; for example, one plant's limestone might be another's marble. The chemical grouping of materials under terms like "calcareous" and "siliceous" is somewhat arbitrary because many of the raw materials contain both. The cement kiln dust data for both years remain significantly underrepresented because few plants routinely measure consumption of this material; the apparent increase in consumption for clinker in 2002 thus likely reflects improved reporting. The changes in 2002 among slag varieties probably include a component of classification error by some plants.

Among the siliceous raw materials, the ratio between the consumption of certain pozzolans or other cementitious additives and the corresponding sales (as a proxy for production) of blended cements listed in table 16 appears to be out of balance. In particular, the amount of GGBFS consumed by the cement industry in recent years has included both material for blended cement and that for use as a grinding aid to make ordinary grades of portland cement; the latter is evident for survey respondents reporting GGBFS consumption but no sales of blended cement. In 2002, the consumption of GGBFS for cement increased by 23% but, as noted in the "Production—Portland Cement" section above, there was a decline in 2002 in the ratio of GGBFS slag consumed to the corresponding blended cement sales. It is more likely that this reflects a reduction in the use of slag as a grinding aid rather than a decrease in the average GGBFS content of blended cements. It is important to note that the overall consumption of GGBFS by the cement industry is only about 10% to 15% of that consumed directly by the concrete industry for use as a partial substitute for portland cement in concrete mixes.

The amount of fly ash consumed for cement declined by almost 9% but increased relative to the sales of fly ash blended cements, as noted earlier. This appears to reflect an increase in the average fly ash content of the blended cements made with it. Fly ash consumed as raw material for clinker increased significantly in 2002. As with GGBFS, the concrete industry consumes far more fly ash (about 11 Mt), again as a partial substitute for portland cement, than does the cement industry (American Coal Ash Association, 2001).

Cement plants generally are able to switch among a variety of primary fuel types, and many routinely burn a mix of fuels. The overall mix of fuels consumed by the cement industry is given in table 7. The major decline in coke (from coal) consumption in 2002 and increase in petroleum coke reflects improved reporting; in previous years, it is likely that much of the coke was improperly reported as petroleum coke. The decline in wet plant consumption of fuel oil may have been offset by part of the increase in consumption of liquid wastes; the latter commonly include off-specification fuel oil, and such may be variously reported under fuel oil or as a waste fuel.

[1]Yearend stockpiles of clinker are an artifact of data collection conveniences rather than reflecting true market conditions or production capacity. Generally, a plant will try to build up its stocks of clinker prior to scheduled extended kiln shutdowns so as to provide continuity of clinker feed to the finish (cement) mill. These shutdowns can happen any time of year.

Overall, however, it is difficult to evaluate shifts among fuel type tonnages.

Although not shown in table 7, the USGS annual survey also queries the heat energy realized for the fuels. Unit heat contributions of fuels, particularly those that are fluids and/or waste fuels, are subject to a number of reporting errors, and thus, the relative heat contributions of different fuels can only be determined to an approximate degree; changes of less than 5% are probably statistically insignificant. In 2002, coal accounted for about 68% of the total heat contribution compared with 71% in 2001. Coke and petroleum coke contributed about 16% of the heat compared with 15% the previous year. Fuel oil and natural gas, both primarily used for kiln warm-up, accounted for about 5.6% of the heat in 2002 and 4.8% in 2001; both fuels are also subject to significant reporting errors in terms of weight. Waste fuels, combined, accounted for 9% of total heat requirements in 2002 and 9.5% in 2001. Of the wastes, the contribution of tires was unchanged at 2.5% of total heat. Solid wastes contributed almost 1% of total heat in 2002 and about 1.7% in 2001. Although the tonnage of solid wastes is not prone to large reporting errors, the identification of the type of wastes tends to lack specificity because a wide variety of wastes can be burned as a mix, and the heat content of the solid waste fuel is thus subject to significant error. Liquid wastes contributed almost 6% of total heat in 2002 and about 5% in 2001; specificity of fuel type is also a problem with this category of fuels.

Wet plants accounted for 25% of the total heat requirements in 2002; dry plants, 68%; and combination plants, 7%. Overall, heat consumption in 2002 averaged about 4.4 million British thermal units per metric ton (MBtu/t) of clinker compared with 4.6 MBtu/t in 2001. Wet plants in 2002 averaged 6.2 MBtu/t, and dry plants, 3.9 MBtu/t; the corresponding individual plant-level breakout for 2001 has not been computed.

As in past years, dry process plants had a higher average electricity consumption per ton of product than wet process plants (table 8). This reflects the complex array of fans and blowers associated with modern dry kilns. The average unit consumptions for wet and dry plants were significantly unchanged in 2002. The increase shown for the remaining combination plants reflects the transfer of three modern facilities, temporarily in the combination category in 2001, into the dry category for 2002. The increase in unit electricity consumption for grinding plants followed increases in 2001 and 2000 and likely represents increased output of GGBFS from some of these facilities; GGBFS is harder to grind and is typically ground finer than clinker.

Consumption

Apparent consumption of portland and masonry cement, a calculated statistic, is listed in table 1 and fell by 2.5% to about 110 Mt in 2002. The measure of consumption preferred by the cement industry for its market analyses, however, is that of cement shipments to final customers (i.e., sales). The definition of "final customer" is left to the reporting cement producer but is generally understood to include concrete manufacturers, building supply dealers, construction contractors, and others (for example, the categories listed in table 16). The shipment data are published monthly by the USGS and are summed in this annual report in tables 9 and 10; the 2002 data incorporate all revisions to past data available through the June 2003 reporting cycle.

Significant tonnage differences (up to several million tons) existed in some past years between the annual U.S. sales totals derived from annual canvasses for portland cement listed in tables 1 and 11-16 and the monthly-survey-based totals listed in tables 9 and 10. The differences likely pertained to shipments (mainly of imported cement) by terminals that were missed by the annual forms but which were captured on the monthly surveys; the monthly surveys are commonly submitted on company-consolidated bases. The annual reporting protocols have been modified, and the discrepancy has now (2001-2) become insignificant. Past masonry cement data, in contrast, have tended not to show significant discrepancies between the monthly and annual reporting, largely because little of this material is imported.

Superficial similarities between table 9 and tables 12 and 13 belie key differences in their component data. The most important difference is that table 9 shows the shipment destinations and so directly reveals the location and amounts of consumption. In contrast, the regional data in tables 12, 13, and 15 pertain to the location of the reporting entity (chiefly, the production sites), not the location of consumption. Accordingly, certain States in tables 12 and 13 are grouped into districts for proprietary protection reasons, and most nonproducing States are not present at all. It is very common for shipments to cross State lines; where a State in table 9 shows a higher tonnage than the same State in tables 12 or 13, the State is a net importer of cement. Where the higher tonnage is in table 12 or 13, the State is a net exporter of cement.

In 2002, domestic portland cement consumption fell by 4% to 103.9 Mt, the first decline since 1991. Imported portland cement accounted for about 18% of total sales (including Puerto Rico) in 2002, down from about 20% in 2001. Total imports of both cement and clinker fell (tables 18, 22). The drops in imports reflected higher domestic cement and clinker production capacity and excess production in some regions (tables 3, 4). This was further reflected in the growth in yearend cement and clinker stockpiles. Overall monthly portland cement consumption levels in 2002 were lower than those in 2001 for all months except January, February, and September. The early year performance was owing to a mild 2001-02 winter, but the rest of the year's declines generally reflected the weak national economy. This was aggravated by severe weather from October onwards. As with production, masonry cement consumption in 2002 was essentially unchanged.

On a State basis, strong increases (50,000 t or more) in portland cement consumption were seen in 2002 only in southern California, Florida, eastern New York, Oregon, and possibly southern Texas. The qualifier on southern Texas in 2002 related to the fact that one major company had prior to midyear reported (erroneously) most of its Texas sales into the northern one-half of the State and corrected data were unavailable; overall consumption in Texas declined. Most States showed either strong declines in consumption or had relatively stagnant (changes of less than 50,000 t) consumption levels, although even small tonnage shifts can equate to large percentage changes in small consumption States. Some of the largest decreases were seen in the South Atlantic States, where some producers reported temporary shutdown of production, the Gulf Coast, and the Great Lakes region. The top 10 consuming States, in descending order, were California, Texas, Florida, Illinois, Ohio, Pennsylvania, Arizona, New York, Michigan, and Georgia. The top 5 States accounted for 39.1% of the national consumption total, and the top 10 accounted for 54.5% of the total.

Cement is a key construction material, and it may be expected that cement consumption levels will broadly reflect levels of construction spending, although there can be significant time lags between the onset or cutoff of spending and the consumption of cement or concrete. Lag times are particularly noticeable in sectors involving individual projects requiring high tonnages of concrete (for example, large office buildings and major public sector projects). According to U.S. Census Bureau data quoted by the Portland Cement Association (2003), overall construction spending levels in 2002 declined by 1.7% to $692.7 billion (constant 1996 dollars). Most of the spending decline was seen in nonresidential private buildings, spending for which fell by 17.8% to $136.9 billion overall, but was especially weak for industrial and office buildings (down by about 45% and 28%, respectively). Owing to continued very low mortgage and general interest rates, residential construction spending increased by 4.4% to $336.5 billion. Public sector construction increased by 3.6% to $167.9 billion, but much of the increase was in buildings; the important road category fell by 2.4% to $44.3 billion. Sewer construction increased by 5.1% to $8.2 billion, which correlates well with the trend in housing construction.

Another way of linking construction spending and cement consumption is to calculate the cement "penetration rate," which can be defined as the tonnage of cement consumed per $1 million in spending. Many variables affect this type of analysis, especially the distribution of spending among different types of construction; changes in penetration rates can reflect cost or performance advantages of concrete over competing construction materials, promotional efforts by the concrete industry, shifts in spending between new construction and repairs to existing infrastructure, lag times between construction spending and concrete consumption, and underreported cement consumption because of partial substitution in concrete mixes of portland cement by other cementitious materials. Using the apparent consumption data in table 1, the overall construction spending data show a generally increasing trend in penetration rates for 1998 to 2002; $1 million in construction spending bought, in chronological order, 155.5 t in 1998; 156.8 t in 1999; 155.3 t in 2000; 160.1 t in 2001; and 158.8 t in 2002.

Cement Customer Types.—Data on portland cement usage are collected on the basis of the types of customers to whom the cement is sold rather than the direct application itself (table 15). The distinction is that a customer, although classified in one category, may in fact use cement in more than one way. This data set includes a high proportion of estimates, many by the companies themselves, and likely understates consumption in the smaller user categories. As in past years, the dominant customers for cement are the ready-mixed concrete producers.

Types of Portland Cement Consumed.—Sales to final customers of varieties falling within the broad definition of portland cement are listed in table 16. In 2002, Types I and II combined accounted for almost 86% of total portland cement sales, a proportion similar to that in 2001 and recent years. Sales of white portland increased by 9.4%, likely reflecting the continued strong housing construction market. Type V sales increased by 50%, but the tonnage increase appears to offset much of the decline in Types I and II cement, and although part of this could be a shift related to strong consumption in southern California (a major market for Type V), most of the offset is more likely due to a simple reclassification by some California producers of their Types I and II (especially the later) cements to Type V based on their actual sulfate-resistance properties. Blended cement sales, overall, did not change significantly, but there were significant relative shifts in sales of blends containing GGBFS and fly ash, as discussed in the "Production" section. As noted earlier, most of the pozzolans and other cementitious additives are consumed directly by the concrete producers, not by the cement industry.

Prices

Data are collected by the USGS on the total and/or unit mill net values for shipments to final customers by plants and import terminals (terminal nets); the data are listed in tables 12 to 14. The values are not specific as to type of cement (for example, Type I vs. Type V portland); the values thus cannot be equated to prices, although they are broadly similar. Separate valuations are provided by each respondent for gray portland cement (all varieties combined), white portland cement, and masonry cement; however, in orer not to reveal proprietary data, the values for white portland cement are revealed only for the national totals in table 14 and for imports in table 21; elsewhere they are combined with gray portland cement (table 12). The value data make no distinction between bulk and container (bag or package) shipments; however, container shipments would be expected to have higher unit values.

Values are a data category that contains a high percentage of estimates. For gray portland cement, value estimates for 2002 were made for 11% of the facilities canvassed, including nonrespondents and facilities that declined to provide data; the estimated fraction in 2001 was 21.5% of facilities. However, even where provided to the USGS, many of the value data appear to be company estimates, and it is evident that there is not complete uniformity in how companies calculate their mill net values. For example, onward shipping costs to terminals and/or customers are not supposed to be included, and bagging charges are supposed to be included. Likewise, as the U.S. cement industry consolidates, there is increasing centralization of marketing functions, and production site personnel are thus increasingly divorced from data related to sales. Accordingly, even where they appear to be unrounded, all value data in this report should be taken as being estimated to at least some degree, and the values are better viewed as price indices for cement, suitable for crude comparisons among regions and over time. Value shifts of less than $0.50 per metric ton are probably of no statistical significance. Unit value shifts can reflect changes in actual unit prices within a region, changes in supply sources (for example. imports), changes in the type(s) of cement sold, and changes in the mix of bulk and container sales.

With the above caveats, the average mill net value of portland cement in 2002 was about $74.50 per ton, down slightly; total portland cement shipments were worth about $7.8 billion (table 12). The decline followed a larger drop in 2001, which was the first year showing lower unit values since 1992. The sales listed in table 12 are inclusive of white portland cement. The average unit values for gray portland and white portland cements are listed in table 14. The value data for white cement should be viewed with caution because there are only a few producers and importers of this product, and a significant share of white cement sales to final customers are as resales by gray cement companies. Additionally, white cement includes a larger component of relatively costly package shipments, of imported material, and of estimated values. Thus, the small increase in the white cement unit value in 2002, if real, may not be statistically significant. A discussion of prices for imported white cement is given in the "Foreign Trade" section. In (1998) constant dollar terms, overall portland cement prices have dropped since 1998. This has constrained profit margins, especially in the face of increasing fuel prices.

The average mill net value in 2002 for masonry cement was $108.00 per ton, an increase of just $1 per ton (probably not statistically significant). The total value of sales declined slightly to $476 million. It should be noted, however, that the mill net values for masonry cement contain more component estimates than those for portland cement, and for a number of respondents, the masonry cement mill net values appear to have been reported on a bulk-equivalent basis instead of being inclusive of bagging charges.

For most States, the unit values for portland cement did not change very much, although large declines were seen for portland cement sales by producers in Alabama, and in the Kentucky, Mississippi, Tennessee district (most of these States also had declines in cement consumption, though not to an exceptional degree).

The unit values in tables 12 and 13 are free on board (f.o.b.) at the plant. A crude estimate of delivery costs (to the customer) can be made by comparison to the U.S. 20-city average delivered cement prices (for Type I portland and masonry cements) reported monthly by the journal Engineering News-Record. For 2002, the monthly U.S. average Type I delivered price calculates to an average for the year of $90.73 per ton, suggesting an average delivery cost of about $16 per ton. This differential is higher than those of recent past years (i.e., about $14.50 per ton in 2001 and $12 per ton in 2000) and likely reflects higher fuel costs. For masonry cement, the Engineering News-Record average price for 2002 was almost $170 per ton (converted from prices per 70-pound bag); the large delivery differential appears to incorporate a variety of handling charges for this mainly bagged commodity.

Foreign Trade

Trade data from the U.S. Census Bureau are given in tables 17 to 22. Exports of hydraulic cement and clinker increased in 2002 but, except for sales to Canada, continued to be insignificant (tables 1, 17). Almost all exported material was cement.

Overall imports of cement and clinker declined significantly in 2002. Gray portland cement imports (including those into Puerto Rico) amounted to 21.3 Mt, down by 6.7% (table 20). Canada continued to be the largest source of imports, although its shipments into the United States fell by 1% in 2002. This modest decline reflects the fact that Canada serves a number of markets in the United States that, for the most part, are relatively insulated from competition from sources in other countries. Imports of gray portland from Thailand grew by 15.5%, with much of the growth appearing to be at the expense of imports from China. Overall import prices for gray portland cement were relatively unchanged in 2002. Imports of white cement appear to have fallen by 7.4%, which is in contrast to the increase in sales (tables 16, 21). The volume of white cement imports in recent years has appeared excessive given the volume of sales and the capacities of the three white cement plants in the United States. There are two main reasons for the apparent excess, which likely isn't real. First, white cement imports likely include material that gets incorporated into colored portland cements and various masonry cements (the latter are not included in table 16). Second, for a number of country entries in table 21, the unit values appear to be too low [less than $90 per ton cost, insurance, and freight value (c.i.f.)] to be white cement, indicating that the entries are or include a significant proportion of gray portland cement. This misreporting happens when importers erroneously use the white cement tariff number on their customs declarations, an easy mistake to make. The unit value of material from Venezuela is so low that it is likely to be misreported clinker.

Clinker imports appear to have fallen by 10% to just 1.6 Mt (table 22); the data have been corrected to remove "clinker" coming into Honolulu, HI, after March 2001, as this later material was actually gray portland cement. The decline in total (remaining) clinker imports appears to reflect the increase in domestic clinker production capacity, but the extent of this linkage is uncertain. This is because most imported clinker is used at grinding plants that almost exclusively use imported material. Further, although not revealed in table 22, clinker coming into the Seattle district is inadequate to service the grinding plant in Washington; the data for this district appears to be incomplete. Clinker coming into Michigan in 2002 appears to be insufficient to service the two large, import-dependent grinding plants in that State; it is likely that some clinker for these plants is being assigned a gray portland cement tariff code. Unit import values for clinker generally are lower than for gray portland cement. Where table 22 shows very high unit values, the material is likely to be for something other than for portland cement manufacture. For example, the material from France has an average unit value (c.i.f.) of $182.2 per ton and is almost certainly aluminous cement clinker.

World Review

The world hydraulic cement production data listed in table 23 were derived from data collected by USGS country specialists from a variety of sources. The data for some countries may include their exports of clinker. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may not be all-inclusive. World hydraulic cement production increased by about 4% in 2002 to an estimated 1.8 Gt.

More than 150 countries had cement production during the year, although production was very unevenly distributed among them. In terms of country rankings in 2002, China was overwhelmingly the largest cement producer with a preliminary reported production of almost 704.7 Mt, or about 39% of the world total. The remaining top 15 countries, in descending order, were India, the United States, Japan, the Republic of Korea, Spain, Italy, Brazil, Russia, Indonesia, Turkey, Thailand, Mexico, and Iran and Germany (tied). Cumulatively, the top 5 countries had almost 57% of total world output; the top 10 countries, almost 68%; the top 15 countries, about 76%; and the top 20 countries, almost 82%. Regionally, Asia contributed about 60.5% of world production and included 8 of the top 20 producers. Western Europe had about 11.1% of total output; North America, about 7.5%; the Middle East (including Turkey), about 6.5%; Central America and South America, about 4.8%; Africa, about 4.2 %; the Commonwealth of Independent States, about 3.2%; and Eastern Europe, 2.1%.

Outlook

The continued weakness in the U.S. economy augured poorly for cement consumption in 2003, which was likely to decline by 2% to 5%, depending on the severity of the winter, the amount of rainfall overall, and assuming continued low interest rates. Although reauthorization of TEA-21 funding for highway projects was likely, it is expected that States will continue to have difficulty cofunding the projects, which will constrain public sector use of cement and concrete. Medium-term cement consumption beyond 2003 is expected to be stagnant to only slightly increasing (1% to 2% per year growth); a factor in this and in long-term growth will be the degree to which suppliers of GGBFS, fly ash, and other cementitious products can displace portland cement in concrete mixes. Significant additional new cement production capacity is slated to come onstream during the next few years, which is expected to displace some imports. It was likely that ownership consolidation of the U.S. industry would continue.

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TABLE 1
SALIENT CEMENT STATISTICS[1]

(Thousand metric tons unless otherwise specified)

	1998	1999	2000	2001	2002
United States:[2]					
Production:					
Cement[3]	83,931	85,952	87,846	88,900	89,732
Clinker	74,523	76,003	78,138	78,451	81,517
Shipments from mills and terminals:[4, 5]					
Quantity	96,857	103,271	105,557	112,510	108,500
Value [6] thousands	$7,404,394 [7]	$8,083,247 [7]	$8,292,625 [7]	$8,600,000	$8,250,000
Average value[8] dollars per metric ton	$76.45 [7]	$78.27 [7]	$78.56 [7]	$76.50	$76.00
Stocks at mills and terminals, yearend	5,393	6,367	7,566	6,600	7,680
Exports[9]	743	694	738	746	834
Imports for consumption:					
Cement[10]	19,878	24,578	24,561	23,694 r	22,198
Clinker	3,905	4,164	3,673	1,782 r	1,603
Total[11]	23,783	28,742	28,234	25,475	23,801
Consumption, apparent[12]	103,457	108,862	110,470	112,810 r	110,020
World, production[e, 13]	1,540,000 r	1,600,000	1,650,000 r	1,730,000 r	1,800,000

[e]Estimated.

[1]Portland and masonry cements only unless otherwise indicated. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Excludes Puerto Rico.

[3]Includes cement produced from imported clinker.

[4]Includes imported cement and cement produced from imported clinker. Includes sales by import terminals.

[5]Shipments are to final domestic customers. Data are based on annual survey of individual plants and terminals and may differ from data in tables 9 and 10, which are based on consolidated monthly shipments data from companies.

[6]Value at mill or import terminal of portland and masonry cement shipments to final domestic customers.

[7]Although presented unrounded, the data contain estimates for survey nonrespondents.

[8]Total value at mill or import terminal of cement shipments to final customers divided by total tonnage sold.

[9]Portland, masonry, and other hydraulic cements, plus clinker.

[10]Hydraulic cement, all types.

[11]Data may not add to totals shown because of independent rounding.

[12]Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in stocks.

[13]Total hydraulic cement. May incorporate clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Chicago, metropolitan	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

	2001					2002				
			Capacity[2]		Stocks			Capacity[2]		Stocks
District[3]	Active plants	Production[4]	Finish grinding	Percentage utilized[5]	at yearend[6]	Active plants	Production[4]	Finish grinding	Percentage utilized[5]	at yearend[6]
Maine and New York	5	3,250 [7]	4,150 [7]	78.2 [7]	260 [7]	5	3,098	4,200 [7]	73.8 [7]	278 [7]
Pennsylvania, eastern[8]	7	4,866	5,374	90.5	312	7	4,665	5,311	87.8	326
Pennsylvania, western	4	1,670 [7]	2,540 [7]	65.7 [7]	120 [7]	3	1,460	1,724	84.7	156
Illinois	4	2,869	3,769	76.1	176	4	2,771	3,408	81.3	188
Indiana	4	2,903	3,493	83.1	244	4	2,935	3,502	83.8	278
Michigan and Wisconsin[9]	5	5,920 [7]	7,930 [7]	74.7 [7]	380 [7]	6	5,579	7,950 [7]	70.2 [7]	425
Ohio	2	1,037	1,497	69.3	60	2	1,024	1,497	68.4	58
Iowa, Nebraska, South Dakota	5	4,365	5,393	80.9	272	5	4,446	5,557	80.0	454
Kansas	4	1,830 [7]	2,320 [7]	78.8 [7]	110 [7]	4	2,352	3,100 [7]	75.9 [7]	204 [7]
Missouri	5	4,715	5,312	88.8	493	5	4,816	5,731	84.0	556
Florida[8, 10]	6	4,055	7,040 [7]	57.6 [7]	420 [7]	6	3,949	6,680 [7]	59.1 [7]	383 [7]
Georgia, Virginia, West Virginia	4	2,918	4,619	63.2	188	4	2,781	4,621	60.2	202
Maryland	3	1,718	2,321	74.0	149	3	1,880	2,420 [7]	77.7 [7]	193 [7]
South Carolina	3	2,555	3,406	75.0	83	3	2,508	3,406	73.6	150
Alabama	5	4,480 [7]	5,040 [7]	88.9 [7]	220 [7]	5	4,544	5,438	83.6	345
Kentucky, Mississippi, Tennessee	4	2,990 [7]	3,630 [7]	82.4 [7]	190 [7]	4	3,004	3,489	86.1	365
Arkansas and Oklahoma	4	2,650 [7]	3,160 [7]	83.9 [7]	190 [7]	4	2,498	3,230 [7]	77.3 [7]	194 [7]
Texas, northern[8]	6	5,793	7,581	76.4	373	6	5,955	7,044	84.5	423
Texas, southern	5	4,560 [7]	4,850 [7]	93.9 [7]	220 [7]	5	4,592	5,452	84.2	247
Arizona and New Mexico	3	2,189	2,638	83.0	120 [7]	3	2,270	3,035	74.8	136
Colorado and Wyoming	4	2,020 [7]	2,450 [7]	82.4 [7]	120 [7]	4	2,145	2,520	85.1	96
Idaho, Montana, Nevada, Utah	7	2,972	3,669	81.0	282	7	2,874	3,584	80.2	321
Alaska and Hawaii	1	112	288	39.1	64	--	--	--	--	51
California, northern	3	2,687	2,880	93.3	171	3	2,594	2,880	90.1	182
California, southern[8]	8	7,382	8,902	82.9	355	8	8,572	10,227	83.8	374
Oregon and Washington	4	1,947	2,500 [7]	78.0 [7]	190 [7]	4	1,970	2,432	81.0	163
Independent importers, n.e.c.[11]	--	--	--	--	350	--	--	--	--	466 [7]
Total or average[12]	115	84,450 [13]	107,000 [r, 13]	79.1 [13]	6,110 [13]	114	85,283	108,000 [7]	78.7 [7]	7,170
Puerto Rico	2	1,546	2,156	71.7	73	2	1,534	2,160 [7]	71.1 [7]	75 [7]
Grand total or average[12]	117	86,000 [7, 13]	109,000 [r, 7, 13]	79.0 [7, 13]	6,190 [7, 13]	116	86,817	111,000 [7]	78.6 [7]	7,250 [7]

[r]Revised. -- Zero.

[1]Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Reported annual grinding capacity is based on fineness necessary to grind individual plants' normal product mixes including masonry cement, making allowance for downtime requiring routine maintenance.

[3]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

[4]Includes cement produced from imported clinker.

[5]Calculated based on portland cement output.

[6]Includes imported cement. Includes mills and terminals.

[7]Data, even when they appear to be unrounded, contain estimates for nonrespondent or incompletely reporting facilities.

[8]Includes data for white cement.

[9]Data for 2001 are for Michigan only.

[10]Plant count excludes one plant that reported cement (clinker) grinding capacity but no output of portland cement.

[11]Data include only those importers for which regional assignations were not possible.

[12]Data may not add to totals shown because of independent rounding.

[13]Data exclude one small grinding plant that commenced operations late in the year in Wisconsin.

TABLE 4
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

	2001			2002		
District[2]	Active plants	Production[3]	Stocks at yearend[4]	Active plants	Production[3]	Stocks at yearend[4]
Maine and New York	4	130 [5]	10 [5]	4	116	8 [5]
Pennsylvania, eastern	6	239	43	6	247	51
Pennsylvania, western	4	90 [5]	10 [5]	3	94	11 [5]
Indiana	4	W	53	4	W	W
Michigan	5	290 [5]	40 [5]	5	292	50
Ohio	2	74	13	2	85	17 [5]
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	25	15	2	W	W
Missouri	2	111	23	2	W	W
Florida	5	556	37	5	591	34
Georgia, Virginia, West Virginia	5	318	32	5	343 [5]	33 [5]
Maryland	3	77	14	2	W	W
South Carolina	3	487	39	3	426	22
Alabama	4	380	58	4	380	75
Kentucky, Mississippi, Tennessee	3	80 [5]	10 [5]	3	83	13
Arkansas and Oklahoma	4	130 [5]	30 [5]	4	145	25 [5]
Texas, northern	4	165	11	4	160	11
Texas, southern	3	126	9	3	134	9
Arizona and New Mexico	3	109	8	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	1	W	W
Alaska and Hawaii	1	3	--	1	W	W
California, northern, Oregon, Washington	3	85	10	3	79	10
California, southern	4	479	13	4	488 [5]	12 [5]
Independent importers, n.e.c.	--	--	4	--	--	2 [5]
Total[6]	79	4,450 [5, 7]	490 [5]	77	4,449 [5, 7]	504 [5]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Includes masonry, portland-lime, and plastic cements. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

[3]Includes cement produced from imported clinker.

[4]Includes imported cement.

[5]Data, even when they appear to be unrounded, contain estimates for nonrespondent or incompletely reporting facilities.

[6]Data may not add to totals shown because of independent rounding.

[7]Production directly from clinker accounted for 95% of the total in 2001 and 2002. Production from portland cement accounted for the remainder.

TABLE 5

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2002, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

District	Active plants[2] Process used Wet	Dry	Both	Total	Number of kilns[3]	Daily capacity[4]	Average days of routine mainte-nance	Apparent annual capacity[5]	Produc-tion[6]	Percentage of capacity utilized	Yearend stocks[7]
Maine and New York	3	1	--	4	5	10.4 [8]	22.5 [8]	3,560 [8]	3,109	87.3 [8]	259 [8]
Pennsylvania, eastern	2	5	--	7	14	15.6	24.5	5,250 [8]	4,656	88.7 [8]	317
Pennsylvania, western	2	1	--	3	7	5.0 [8]	28.3 [8]	1,700 [8]	1,472	86.6 [8]	78 [8]
Illinois	--	4	--	4	8	8.6	15.6	2,964	2,550	86.0	222
Indiana	1	3 [9]	--	4	8	10.3	27.2	3,476	3,070	88.3	138
Michigan	1	2	--	3	8	13.8	27.9 [8]	4,620 [8]	4,082	88.3 [8]	395 [8]
Ohio	1	1	--	2	3	3.4	14.3	1,200	976	81.3	38
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.6	23.2 [8]	4,620 [8]	4,127	89.3 [8]	238
Kansas	1	3	--	4	10	9.2	19.2	3,143	2,373	75.5	148
Missouri	2	3	--	5	6	15.4	25.8	5,197	4,512	86.8 [8]	347
Florida[10]	1	4	--	5	7	12.7	19.8 [8]	4,400 [8]	3,677	83.6 [8]	160
Georgia, Virginia, West Virginia	1	3	--	4	7	10.7	29.2 [8]	3,590 [8]	2,647	73.6	216
Maryland	1	2	--	3	4	8.1	19.8	2,742	1,975	72.0	143
South Carolina	2	1	--	3	7	8.8	25.1 [8]	2,980 [8]	2,445	82.1 [8]	206
Alabama	--	5	--	5	7	18.4	22.9	6,108	4,397	72.0	159
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.7	25.0	3,604	2,968	82.3	251
Arkansas and Oklahoma	2	2	--	4	10	8.0	20.0	2,770	2,531	91.4	209
Texas, northern	2	3	1	6	16	21.5	17.9 [8]	7,470 [8]	6,099	81.7 [8]	502
Texas, southern	--	4	1	5	6	13.4	17.1 [8]	4,690 [8]	4,274	91.2 [8]	276
Arizona and New Mexico	--	3	--	3	10	10.6	15.2	3,708	2,147	57.9	152
Colorado and Wyoming[11]	--	4	--	4	5	10.3	16.2	3,627	1,916	52.8	114
Idaho, Montana, Nevada, Utah	3	4	--	7	9	8.6	21.1 [8]	2,970 [8]	2,670	90.0 [8]	138 [8]
California, northern	--	3	--	3	3	8.7	17.7 [8]	3,050 [8]	2,562	83.9 [8]	158
California, southern	--	8	--	8	17	28.7	31.6 [8]	9,580 [8]	8,625	90.0 [8]	639
Oregon and Washington	1	2	--	3	3	6.4	47.7	2,035	1,660	81.6	52
Total or average[12]	27	78	3	108	193	291.0	22.5 [8]	99,000 [8]	81,517	82.3 [8]	5,550 [8]
Puerto Rico	--	2	--	2	2	5.9	26.0	2,005	1,443	72.0	209
Grand total or average[12]	27	80	3	110	195	297.0	22.5 [8]	101,000 [8]	82,959	82.1 [8]	5,760 [8]

-- Zero.

[1]Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Includes white cement plants. Includes plants active for at least one day during the year.

[3]Kilns active at least one day during year. Excludes idle kilns (full year) that cannot be restarted (fully permitted) in less than 6 months.

[4]Sum of reported daily kiln capacities for each plant in district.

[5]Sum of apparent individual kiln capacities; for each kiln calculated as 365 days minus reported days shut down for routine maintenance and thus multiplied by the unrounded, reported, daily capacity.

[6]Several districts have one or more annual survey nonrespondent facilities for which estimates were made for most data categories. However, for all nonrespondent clinker producers, reported 12-month production data were available from monthly surveys and were incorporated.

[7]Includes imported clinker and clinker stockpiles at grinding plants.

[8]Data, even when they appear to be unrounded, contain estimates for nonrespondent or incompletely reporting facilities.

[9]Includes one semidry kiln.

[10]Excludes one plant (single day kiln) that started operations in December.

[11]Includes one plant in Colorado that closed during the year.

[12]Data may not add to totals shown because of independent rounding.

TABLE 6
RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

Raw materials	2001 Clinker	2001 Cement[3]	2002 Clinker	2002 Cement[3]
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	95,600	1,600	107,000	1,330
Cement rock (includes marl)	21,900	100	16,200	39
Cement kiln dust[4]	600	100	688	164
Lime[5]	300	40	196	34
Other	20	20	5	18
Aluminous:				
Clay	4,500	10	4,770	--
Shale	3,200	10	3,230	9
Other (includes staurolite, bauxite, aluminum dross, alumina, other)	500	--	540	--
Ferrous: iron ore, pyrites, millscale, other	1,500	--	1,260	--
Siliceous:				
Sand and calcium silicate	3,500	--	2,960	2
Sandstone, quartzite soils, other	500	--	692	--
Fly ash	1,600	70	1,960	64
Other ash, including bottom ash	800	--	990	--
Granulated blast furnace slag[6]	--	300	60	369
Other blast furnace slag	200	--	162	--
Steel slag	500	--	481	--
Other slags	50	5	67	4
Natural rock pozzolans[7]	--	50	--	28
Other pozzolans[8]	100	9	165	7
Other:				
Gypsum and anhydrite	--	4,800	--	4,740
Other, n.e.c.	40	50	21	52
Total[9]	135,000 r	7,250 r	141,000	6,860
Clinker, imported, x 1.7[10]	--	5,030	--	5,230
Grand total[9]	135,000	12,300 r	141,000	12,100

rRevised. -- Zero.
[1]Includes Puerto Rico nonfuel materials only.
[2]Data are rounded because they include estimates for a number of nonrespondent or incompletely reporting plants.
[3]Includes portland, blended, and masonry cements.
[4]Data are probably underreported.
[5]Data are probably underreported on the basis of reported volumes of masonry cements.
[6]Includes both ground and unground material.
[7]Includes pozzolana and burned clays and shales (where not reported directly as clay or shale).
[8]Includes diatomite, other microcrystalline silica, silica fume, and other pozzolans, whether or not used as such.
[9]Data may not add to totals shown because of independent rounding.
[10]Outside purchases of foreign clinker times 1.7; conversion factor is based on past raw materials ratios for U.S. clinker production.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS[1, 2]

	Clinker produced			Fuel consumed					Waste fuel		
Kiln process	Active plants	Quantity (thousand metric tons)	Percentage of total	Coal[3] (thousand metric tons)	Coke[4] (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil[5] (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
2001:[6]											
Wet	28	14,782	18.5	2,050	40	400	33,110	33,000	130	220	653,000
Dry	77	60,169	75.2	7,520	320	930	59,760	251,000	150	40	117,000
Both	6	5,029	6.3	670	60	40	450	113,000	20	60	59,000
Total[7]	111	79,979	100.0	10,240	420	1,370	93,320	397,000	300	320	829,000
2002:[6]											
Wet	27	14,599	17.6	1,990	15	500	22,870	45,000	87	73	725,400
Dry	80	64,633	77.9	7,170	3	1,380	69,720	367,000	210	39	188,400
Both	3	3,727	4.5	540	--	30	--	67,000	6	--	47,800
Total[7]	110	82,959	100.0	9,690	17	1,910	92,590	479,000	304	112	961,600

-- Zero.

[1]Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Includes Puerto Rico.

[3]All reported to be bituminous.

[4]Data are likely all or mostly misreported petroleum coke.

[5]Distillate and residual fuel oil; excludes used oils included under liquid wastes.

[6]Fuel consumption data are rounded as they contain estimated data for nonrespondent or incompletely reporting plants. For nonrespondent plants, however, clinker production data were available from monthly surveys and were incorporated without rounding.

[7]Data may not add to totals shown because of independent rounding.

TABLE 8

ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS[1]

	Electric energy used[2]							
	Generated at plant		Purchased		Total			
Plant process	Number of plants	Quantity (million kilowatt-hours)	Number of plants	Quantity (million kilowatt-hours)	Quantity (million kilowatt-hours)	Percentage	Finished cement produced[3] (thousand metric tons)	Average consumption (kilowatt-hours per ton of cement produced)
2001:								
Integrated plants:								
Wet	--	--	28	2,260	2,260	17.6	16,690	136
Dry	5	560	77	9,180	9,740	75.9	65,960	148
Both	--	--	6	830	830	6.5	5,400	154
Total or average[4]	5	560	111	12,300	12,800	100.0	88,050	146
Grinding plants[5]	--	--	6	160	160	--	2,280	75
Exclusions[6]	--	--	2	--	--	--	120	--
2002:								
Integrated plants:								
Wet	--	--	27	2,190	2,190	16.8	16,044	136
Dry	5	539	80	9,700	10,200	78.6	69,150	148
Both	--	--	3	595	595	4.6	3,742	159
Total or average[4]	5	539	110	12,500	13,000	100.0	88,936	146
Grinding plants[5]	--	--	6	175	175	--	2,192	80
Exclusions[6]	--	--	2	--	--	--	136	--

-- Zero.

[1]Includes Puerto Rico.

[2]Electricity data are rounded because they include estimates for a number of nonrespondent plants or incomplete reporting by respondent facilities.

[3]Includes portland and masonry cements.

[4]Data may not add to totals shown because of independent rounding.

[5]Excludes plants that reported production only of masonry cement.

[6]Tonnage of cement produced by plants that reported production of masonry cement only.

TABLE 9
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2001	Portland cement 2002[3]	Masonry cement 2001	Masonry cement 2002[3]
Destination:				
Alabama	1,569	1,479	141	145
Alaska[4]	133	137	--	--
Arizona	3,265	3,293	107	107
Arkansas	976	946	56	61
California, northern	4,668	4,567	111	106
California, southern	7,924	8,066	390	411
Colorado	2,660	2,612	45	24
Connecticut[4]	812	746	15	14
Delaware[4]	162	193	11	11
District of Columbia[4]	184	186	1	1
Florida	7,527	7,828	635	681
Georgia	3,412	3,087	310	292
Hawaii	280	312	4	5
Idaho	568	567	1	1
Illinois, excluding Chicago	1,698	1,728	23	22
Chicago, metropolitan[4]	2,464	2,384	66	62
Indiana	2,252	2,081	98	92
Iowa	1,698	1,734	6	8
Kansas	1,624	1,498	14	15
Kentucky	1,353	1,228	101	96
Louisiana[4]	1,770	1,679	50	52
Maine	225	208	6	5
Maryland	1,381	1,309	94	85
Massachusetts[4]	1,644	1,395	24	21
Michigan	3,557	3,146	160	146
Minnesota[4]	1,973	1,998	29	48
Mississippi	950	910	54	56
Missouri	2,672	2,500	43	44
Montana	353	323	1	1
Nebraska	1,201	1,184	9	9
Nevada	1,943	1,843	28	20
New Hampshire[4]	260	244	7	6
New Jersey[4]	2,069	1,975	78	79
New Mexico	888	824	7	8
New York, eastern	644	698	30	28
New York, western[4]	1,044	804	34	30
New York, metropolitan[4]	1,651	1,655	65	67
North Carolina[4]	2,734	2,510	327	294
North Dakota[4]	303	311	2	3
Ohio	4,029	3,763	194	192
Oklahoma	1,543	1,363	46	48
Oregon	981	1,040	1	1
Pennsylvania, eastern	2,312	2,187	62	65
Pennsylvania, western	1,283	1,133	69	68
Rhode Island[4]	182	167	4	3
South Carolina	1,386	1,369	140	135
South Dakota	460	423	2	2
Tennessee	1,963	1,809	215	210
Texas, northern	6,810	6,270	217	195
Texas, southern	5,942	6,002	126	141
Utah	1,297	1,166	1	1
Vermont[4]	122	116	4	3
Virginia	2,326	2,119	160	157
Washington	1,961	1,899	3	2
West Virginia	461	424	27	26
Wisconsin	2,298	2,054	32	29
Wyoming	365	413	1	1
Total[5]	108,212	103,905	4,482	4,435

See footnotes at end of table.

TABLE 9--Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2001	Portland cement 2002	Masonry cement 2001	Masonry cement 2002
Destination--Continued:				
Foreign countries[6]	442	438	--	(7)
Puerto Rico	1,865	1,882	--	--
Grand total[5]	110,520	106,225	4,482	4,436
Origin:				
United States	86,602	85,431	4,435	4,400
Puerto Rico	1,523	1,542	--	--
Foreign countries[8]	22,395	19,250	48	37
Total shipments[5]	110,520	106,225	4,482	4,436

-- Zero.

[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.

[2]Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 11-13, 15, and 16, which are from annual surveys of individual plants and importers. Although presented unrounded, data are believed to be accurate to no more than three significant figures.

[3]Data incorporates monthly revisions available through the June 2003 data cycle.

[4]Has no cement plants.

[5]Data may not add to totals shown because of independent rounding.

[6]Includes shipments to U.S. possessions and territories.

[7]Less than 1/2 unit.

[8]Imported cement distributed in the United States as reported by domestic producers and other importers. Data do not match the imports calculated from tables 19 and 22.

TABLE 10

CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT)[1, 2]

Region and census district	Portland cement: Quantity (thousand metric tons) 2001	Portland cement: Quantity (thousand metric tons) 2002	Portland cement: Percentage of U.S. total 2001	Portland cement: Percentage of U.S. total 2002	Masonry cement: Quantity (thousand metric tons) 2001	Masonry cement: Quantity (thousand metric tons) 2002	Masonry cement: Percentage of U.S. total 2001	Masonry cement: Percentage of U.S. total 2002
Northeast:								
New England[3]	3,245	2,877	3	3	58	52	1	1
Middle Atlantic[4]	9,003	8,452	8	8	337	338	8	8
Total[5]	12,249	11,329	11	11	395	390	9	9
South:								
South Atlantic[6]	19,572	19,024	18	18	1,705	1,683	38	38
East South Central[7]	5,834	5,426	5	5	511	507	11	11
West South Central[8]	17,041	16,259	16	16	494	497	11	11
Total[5]	42,447	40,709	39	39	2,710	2,686	60	60
Midwest:								
East North Central[9]	16,298	15,154	15	15	573	542	13	12
West North Central[10]	9,931	9,649	9	9	105	130	2	3
Total[5]	26,230	24,803	24	24	678	672	15	15
West:								
Mountain[11]	11,339	11,041	10	11	191	163	4	4
Pacific[12]	15,948	16,021	15	15	508	525	11	11
Total[5]	27,287	27,063	25	26	699	688	16	16
Grand total[5]	108,212	103,905	100	100	4,482	4,435	100	100

See footnotes at end of table.

TABLE 10--Continued

CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT)[1, 2]

[1]Excludes Puerto Rico. Includes imported cement shipped by importers and cement ground from imported clinker. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Data are based on table 9.

[3]New England includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

[4]Middle Atlantic includes New Jersey, New York, and Pennsylvania.

[5]Data may not add to totals shown because of independent rounding.

[6]South Atlantic includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.

[7]East South Central includes Alabama, Kentucky, Mississippi, and Tennessee.

[8]West South Central includes Arkansas, Louisiana, Oklahoma, and Texas.

[9]East North Central includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.

[10]West North Central includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.

[11]Mountain includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

[12]Pacific includes Alaska, California, Hawaii, Oregon, and Washington.

TABLE 11

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total shipments to consumer
	In bulk	In containers[3]	In bulk	In containers[3]	In bulk	In containers[3]	
2001:							
Railroad	11,610	140	1,840 r	--	420	(4)	2,260
Truck	2,600	280	57,950	2,480	46,360	690	107,480
Barge and boat	9,880	--	130	--	50	--	180
Other	--	--	--	--	--	--	--
Total[5]	24,100	420	59,900	2,480	46,800	690	109,920 [6]
2002:							
Railroad	11,600	29	1,620	--	368	1	1,990
Truck	2,590	220	55,700	2,350	45,100	586	104,000
Barge and boat	9,320	--	127	1	108	--	236
Other	--	--	--	--	--	--	--
Total[5]	23,500	248	57,400	2,350	45,600	587	106,000 [6]

[r]Revised. -- Zero.

[1]Includes Puerto Rico. Includes imported cement and cement made from imported clinker. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Data are rounded because they include estimates from a number of nonrespondent or incompletely reporting plants.

[3]Includes bags and jumbo bags.

[4]Less than 1/2 unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

TABLE 12

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1]

	2001			2002		
		Value[2]			Value[2]	
District[3, 4]	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	3,690 [5]	$275,000 [5]	$74.50 [5]	3,440 [5]	$264,000 [5]	$76.50 [5]
Pennsylvania, eastern	5,602	387,855	69.24	4,608	336,981	73.13
Pennsylvania, western	1,630 [5]	126,000 [5]	77.50 [5]	1,407	110,000 [5]	78.50 [5]
Illinois	3,095	230,612	74.50	2,844	209,835	73.77
Indiana	3,108	209,113	67.29	2,900	194,945	67.23
Michigan and Wisconsin	7,270 [5]	561,000 [5]	77.00 [5]	6,540 [5]	490,000 [5]	75.00 [5]
Ohio	1,116	86,508	77.49	1,051	80,446	76.52
Iowa, Nebraska, South Dakota	5,100	391,907	76.84	4,892	379,492	77.57
Kansas	1,850 [5]	142,000 [5]	76.50 [5]	2,048	157,373	76.85
Missouri	5,918	433,764	73.30	5,886	407,544	69.24
Florida	7,120 [5]	516,000 [5]	72.50 [5]	7,413	558,389	75.32
Georgia, Virginia, West Virginia	3,021	232,372	76.92	2,747	209,000 [5]	76.00 [5]
Maryland	1,986	143,220	72.12	2,094	155,565	74.30
South Carolina	3,113	200,476	64.40	2,857	200,330	70.13
Alabama	4,280 [5]	336,000 [5]	78.50 [5]	4,290 [5]	282,000 [5]	65.50 [5]
Kentucky, Mississippi, Tennessee	2,720 [5]	205,000 [5]	75.50 [5]	2,990	208,000 [5]	69.50 [5]
Arkansas and Oklahoma	2,700 [5]	204,000 [5]	75.50 [5]	2,520 [5]	181,000 [5]	72.00 [5]
Texas, northern	6,735	510,215	75.75	6,004	434,000 [5]	72.00 [5]
Texas, southern	6,040 [5]	407,000 [5]	67.00 [5]	5,967	404,128	67.72
Arizona and New Mexico	3,740 [5]	346,000 [5]	92.50 [5]	3,509	318,164	90.66
Colorado and Wyoming	2,640 [5]	207,000 [5]	78.00 [5]	2,521	191,479	75.96
Idaho, Montana, Nevada, Utah	2,984	237,462	79.57	2,860	232,000 [5]	81.00 [5]
Alaska and Hawaii	379	50,984	134.61	410	53,313	130.11
California, northern	3,546	289,400	81.62	3,441	273,661	79.53
California, southern	8,815	665,368	75.48	9,546	720,350	75.46
Oregon and Washington	2,010 [5]	157,000 [5]	78.00 [5]	2,099	165,000 [5]	78.50 [5]
Independent importers, n.e.c.[6]	7,850 [5]	568,000 [5]	72.00 [5]	7,213	558,000 [5]	77.50 [5]
Total or average[7, 8]	108,050 [5]	8,121,000 [5]	75.00 [5]	104,000 [5]	7,770,000 [5]	74.50 [5]
Puerto Rico	1,873	W	W	1,885	W	W
Grand total[7, 8]	109,920 [5]	W	W	106,000 [5]	W	W

W Withheld to avoid disclosing company proprietary data.

[1]Includes imported portland cement (gray and white) and cement produced from imported clinker. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Values represent mill net or ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded, but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per ton.

[3]The district location is that of the reporting facility. Shipments may include material sold into other districts.

[4]Includes shipments by independent importers where district assignation is possible.

[5]Data are rounded because they contain estimates for nonrespondent or incompletely reporting facilities.

[6]Importers for which district assignations were not possible.

[7]Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

[8]Data may not add to totals shown because of independent rounding.

TABLE 13

MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1, 2]

	2001			2002		
		Value[3]			Value[3]	
District[4]	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	140 [5]	$13,000 [5]	$95.00 [5]	97 [5]	$9,640 [5]	$100.00 [5]
Pennsylvania, eastern	225	26,866	119.49	230	25,400 [5]	110.00 [5]
Pennsylvania, western	100 [5]	11,000 [5]	110.00 [5]	88	9,980 [5]	114.00 [5]
Illinois, Indiana, Ohio	511	57,005	111.47	484	55,184 [5]	114.00 [5]
Michigan	290 [5]	29,000 [5]	100.00 [5]	273	28,400	104.00
Iowa, Nebraska, South Dakota	35	3,789	108.58	44 [5]	4,940 [5]	113.00 [5]
Kansas and Missouri	137	12,202	88.84	131	11,746	89.90
Florida	559	62,905	112.55	610	65,583	107.50
Georgia, Maryland, Virginia, West Virginia	385	49,197	127.78	388	54,800 [5]	141.00 [5]
South Carolina	442	47,753	108.01	389	37,616	96.59
Alabama	430 [5]	44,000 [5]	102.00 [5]	428 [5]	47,300 [5]	111.00 [5]
Kentucky, Mississippi, Tennessee	80 [5]	9,000 [5]	110.00 [5]	93	10,900 [5]	117.00 [5]
Arkansas and Oklahoma	130 [5]	13,000 [5]	103.00 [5]	135 [5]	13,800 [5]	102.00 [5]
Texas, northern	137	16,359	119.06	133	16,100 [5]	121.00 [5]
Texas, southern	140 [5]	14,000 [5]	106.00 [5]	139	13,454	96.49
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	143	14,311	100.06	143	14,500 [5]	102.00 [5]
Alaska and Hawaii	4	841	223.76	4	887	223.77
California, Oregon, Washington[6]	560	51,110	91.31	79	7,933	100.00
California, southern	W	W	W	487	44,237	90.75
Independent importers, n.e.c.[7]	30 [5]	4,000 [5]	145.00 [5]	27	3,370	124.00
Total or average[8, 9]	4,460 [5]	479,000 [5]	107.00 [5]	4,400 [5]	476,000 [5]	108.00 [5]

W Data combined into other States (California, Oregon and Washington) to avoid disclosing company proprietary data.

[1]Shipments are to final domestic customers and include shipments of imported cement and cement made from imported clinker. Excludes Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.

[2]Includes gray, white, and colored varieties of masonry, portland-lime, and plastic cements.

[3]Values represent ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded, but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[4]District location is that of the reporting facilities. Shipments may include material sold into other districts.

[5]Data are rounded because they contain estimates for nonrespondent or incompletely reporting facilities.

[6]Data for 2001 include northern and southern California. Data for 2002 exclude southern California.

[7]Importers for which district assignations were not possible.

[8]Tonnages based on annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

[9]Data may not add to totals shown because of independent rounding.

TABLE 14

AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
2001	74.50	155.00	75.00	107.00	76.50
2002	74.00	157.00	74.50	108.00	76.00

[1]Excludes Puerto Rico. Mill net value is the actual value of sales to customers, free on board plant or import terminal, less all discounts and allowances, less any freight charges from U.S. producing plant to distribution terminal and to final customers.

[2]Data are rounded because of an unusually large number of nonrespondents for which estimates for both sales tonnages and values were made.

TABLE 15
PORTLAND CEMENT SHIPMENTS IN 2002, BY DISTRICT AND TYPE OF CUSTOMER[1]

(Thousand metric tons)

District[2, 3]	Ready-mixed concrete	Concrete product manufacturers[4]	Contractors[5]	Building material dealers	Oil well, mining, waste[6]	Government and miscellaneous[7]	Total[8, 9]
Maine and New York	2,670	539	16	168	2	44	3,440
Pennsylvania, eastern	2,970	1,080	254	298	--	12	4,608
Pennsylvania, western	1,030	163	162	--	6	42	1,407
Illinois	2,180	360	133	18	156	--	2,844
Indiana	2,240	392	169	88	12	4	2,900
Michigan and Wisconsin	5,130	571	623	113	18	83	6,540
Ohio	857	123	41	26	--	4	1,051
Iowa, Nebraska, South Dakota	3,810	580	355	51	61	31	4,892
Kansas	1,550	168	248	50	26	4	2,048
Missouri	4,680	458	373	69	--	308	5,886
Florida	5,530	1,430	95	349	--	7	7,413
Georgia, Virginia, West Virginia	2,110	332	164	124	11	6	2,747
Maryland	1,600	382	57	30	--	26	2,094
South Carolina	2,060	530	197	47	--	19	2,857
Alabama	3,190	658	85	208	27	126	4,290
Kentucky, Mississippi, Tennessee	2,420	235	163	37	2	131	2,990
Arkansas and Oklahoma	1,730	302	338	48	57	46	2,520
Texas, northern	4,060	492	1,050	112	210	77	6,004
Texas, southern	4,030	690	796	136	298	20	5,967
Arizona and New Mexico	2,700	361	183	111	35	125	3,509
Colorado and Wyoming	1,900	240	50	1	39	291	2,521
Idaho, Montana, Nevada, Utah	2,340	192	71	43	158	58	2,860
Alaska and Hawaii	332	53	4	20	--	1	410
California, northern	2,830	264	186	153	--	11	3,441
California, southern	6,580	2,070	423	399	59	11	9,546
Oregon and Washington	1,680	133	78	156	--	55	2,099
Independent importers, n.e.c.[10]	5,710	928	256	234	3	78	7,213
Total[8]	77,900	13,700	6,570	3,090	1,180	1,620	104,000
Puerto Rico	817	237	70	493	--	269	1,885
Grand total[8]	78,700	14,000	6,640	3,580	1,180	1,890	106,000

-- Zero.

[1]Includes shipments of imported cement and cement ground from imported clinker. Data other than district totals are presented rounded to three significant digits but are likely accurate to only two significant digits. District totals are accurate to no more than three significant digits.

[2]District location is that of the reporting facility. Shipments may include material sold into other districts.

[3]Includes shipments by independent importers, where district assignations were possible.

[4]Grand total shipments to concrete product manufacturers include brick-block--6,170; precast-prestressed--3,160; pipe--1,840; and other or unspecified--2,800.

[5]Grand total shipments to contractors include airport--471; road paving--4,060; soil cement--865; and other or unspecified--1,240.

[6]Grand total shipments to oil well, mining, and waste include oil well drilling--919; mining--141; and waste stabilization--121.

[7]Includes shipments for which customer types were not specified.

[8]Data may not add to totals shown because of independent rounding.

[9]District totals are rounded as they include estimates for nonrespondent facilities.

[10]Shipments by independent importers for which district assignations were not possible.

TABLE 16
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE
UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE[1, 2]

(Thousand metric tons)

Type	2001	2002
General use and moderate heat (Types I and II) (gray)	96,970	90,800
High early strength (Type III)	3,830	3,820
Sulfate resisting (Type V)	4,870	7,300
Block	550	607
Oil well	1,150	889
White[3]	870	952
Blended:		
Portland, natural pozzolans	192	187
Portland, granulated blast furnace slag	560	753
Portland, fly ash	391	218
Other blended cement[4]	362	365
Total[5]	1,510	1,520
Expansive and regulated fast setting	64	66
Miscellaneous[6]	110	55
Grand total[5, 7]	109,920	106,000

[1]Includes imported cement. Includes Puerto Rico. Even where presented unrounded, data are believed to be accurate to no more than three significant digits.
[2]Data are rounded as they contain estimates for nonrespondent facilities.
[3]Mostly Type I, II, but may include Types III-V and block varieties.
[4]Includes blends with other pozzolans, such as cement kiln dust and silica fume.
[5]Data may not add to totals shown because of independent rounding.
[6]Includes low heat (Type IV), waterproof, and other portland cements.
[7]Shipments are derived from an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

TABLE 17
U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2001		2002	
Country of destination	Quantity	Value[2]	Quantity	Value[2]
Bahamas, The	14	1,789	17	1,822
Belize	4	175	(3)	167
Brazil	2	237	1	90
Canada	614	41,553	704	45,809
Chile	1	80	1	39
China	8	367	1	149
Costa Rica	2	272	(3)	34
Dominican Republic	2	342	2	277
Jamaica	6	296	37	1,510
Japan	2	192	2	270
Korea, Republic of	3	228	1	70
Mexico	43	6,335	46	4,860
Netherlands Antilles	(3)	35	2	112
Nigeria	2	87	1	53
Norway	3	158	(3)	11
Panama	1	138	1	90
Portugal	1	38	1	33
Russia	4	194	1	80
Saudi Arabia	1	60	1	35
Singapore	6	253	2	79
Spain	1	31	2	117
Taiwan	1	82	1	128
Turkey	3	126	(3)	4
Ukraine	1	56	1	30
United Arab Emirates	1	34	2	98
United Kingdom	2	131	(3)	5
Venezuela	3	651	1	83
Other	15 r	2,051 r	6	1,688
Total[4]	746	55,991	834	57,743

[r]Revised.
[1]Includes portland and masonry cements.
[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.
[3]Less than 1/2 unit.
[4]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY [1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Country of origin	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Australia	146	3,294	6,018	(4)	17	19
Bahamas, The	32	989	1,335	--	--	--
Brazil	--	--	--	99	4,236	4,276
Bulgaria	360	13,675	18,496	356	14,467	18,902
Canada	5,110	287,078	302,684	5,181	302,930	321,946
China	3,266	99,214	137,635	2,165	66,204	88,884
Colombia	1,704 r	64,675	85,278	1,579	57,158	75,475
Croatia	23 r	4,413	5,292	25	5,052	6,214
Cyprus	--	--	--	75	1,845	1,849
Denmark	527	21,700	32,624	333	17,013	24,903
France	71	13,041	13,635	85	15,544	16,761
Germany	(4)	240	288	42	381	810
Greece	1,552	53,647	65,622	1,785	58,637	78,030
Indonesia	318	8,878	15,058	272	5,568	9,698
Italy	135	4,974	6,739	(4)	113	122
Korea, Republic of	1,326	32,646	53,572	1,625	40,312	61,792
Lebanon	--	--	--	94	1,877	3,117
Mexico	1,645	66,873	81,844	1,228	52,366	64,620
Netherlands	2	1,106	1,254	41	3,009	3,974
Norway	412 r	17,992	18,973	508	21,558	22,418
Peru	247	7,524	10,624	372	12,433	17,303
Philippines	374	7,895	12,083	294	6,841	10,567
Spain	651 r	27,676	35,616	327	15,449	19,771
Sweden	989	31,311	40,698	1,047	33,504	42,954
Taiwan	551	16,256	25,375	115	3,628	4,643
Thailand	4,070	108,884	170,513	4,259	117,969	177,581
Turkey	766 r	27,285	36,988	684	22,412	30,388
Venezuela	1,565	61,209	82,391	1,530	52,021	72,614
Other	19 r	4,599 r	5,683 r	48	6,512	8,087
Total[5]	25,861	987,074	1,266,318	24,169	939,056	1,187,718

[r]Revised. -- Zero.

[1]Includes portland, masonry, and other hydraulic cements. Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than 1/2 unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Anchorage, AK:						
Canada	1	51	113	8	449	850
China	--	--	--	18	779	1,089
Korea, Republic of	--	--	--	66	1,900	2,810
Thailand	108	2,572	5,023	--	--	--
Total[4]	109	2,623	5,135	93	3,128	4,748
Baltimore, MD:						
Belgium	--	--	--	(5)	4	6
Greece	305	11,626	14,598	250	9,648	12,826
Netherlands	(5)	349	371	1	613	672
Total[4]	305	11,975	14,969	251	10,266	13,504
Boston, MA:						
Netherlands	(5)	181	215	(5)	133	164
Norway	23 r	1,264	1,267	--	--	--
Venezuela	249	9,472	11,968	210	7,593	10,061
Total[4]	273	10,917	13,450	210	7,725	10,225
Buffalo, NY:						
Canada	646	35,435	37,363	639	39,470	41,700
Denmark	--	--	--	(5)	5	5
France	(5)	7	7	--	--	--
Norway	(5)	8	8	--	--	--
United Kingdom	6 r	1,035	1,059	4	742	792
Total[4]	652 r	36,486	38,438	642	40,217	42,498
Charleston, SC:						
Australia	31	553	1,075	--	--	--
Colombia	368	13,298	19,363	593	20,692	29,225
Greece	471	15,391	15,394	429	13,514	17,595
Indonesia	--	--	--	158	2,550	4,950
Spain	--	--	--	44	275	660
Thailand	--	--	--	70	1,153	2,299
United Kingdom	2 r	1,012	1,183	2	815	946
Venezuela	335	11,825	17,416	--	--	--
Total[4]	1,208 r	42,079	54,431	1,296	38,999	55,674
Chicago, IL:						
Canada	18	1,021	1,095	31	1,737	1,934
Japan	(5)	64	73	(5)	69	75
Netherlands	(5)	34	39	1	391	495
United Kingdom	(5)	15	22	(5)	3	4
Total[4]	18	1,133	1,229	32	2,199	2,508
Cleveland, OH:						
Belgium	(5)	9	12	--	--	--
Canada	855	45,063	46,374	744	40,333	41,147
Denmark	(5)	22	29	--	--	--
Netherlands	(5)	46	56	--	--	--
Spain	(5)	3	4	--	--	--
United Kingdom	1	277	357	--	--	--
Total[4]	856 r	45,420	46,832	744	40,333	41,147
Columbia-Snake, ID-OR-WA						
Canada	80	4,032	4,280	104	5,479	5,780
China	544	17,767	24,698	412	13,379	18,081
Total[4]	625	21,799	28,978	516	18,859	23,861
Detroit, MI:						
Brazil	--	--	--	99	4,236	4,276
Canada	1,269	78,175	79,599	1,244	82,524	84,182
Denmark	--	--	--	(5)	36	41
Total[4]	1,269	78,175	79,599	1,344	86,795	88,499

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY [1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Duluth, MN, Canada	284	16,115	18,486	221	11,966	15,251
El Paso, TX, Mexico	561 r	20,264	25,464	406	15,250	19,284
Great Falls, MT:						
Canada	6 r	385	400	9	403	531
United Kingdom	(5)	8	10	--	--	--
Total[4]	6	393	410	9	403	531
Honolulu, HI:						
China	159 r	3,475	5,325	126	3,339	4,762
Philippines	--	--	--	153	3,728	5,282
Thailand	109	2,692	3,783	39	937	1,328
Total[4]	269	6,167	9,108	318	8,005	11,373
Houston-Galveston, TX:						
Chile	--	--	--	2	483	558
Colombia	120	4,895	7,343	116	4,887	7,301
Denmark	181	5,508	7,772	5	187	340
Egypt	--	--	--	9	837	1,030
France	(5)	234	278	(5)	209	252
Germany	(5)	138	167	(5)	13	15
India	(5)	2	2	--	--	--
Japan	(5)	8	9	(5)	22	30
Korea, Republic of	1,286	31,944	52,220	1,394	34,606	52,180
Mexico	(5)	2	4	--	--	--
Netherlands	(5)	19	22	--	--	--
Peru	188	5,751	8,149	284	9,346	13,068
Philippines	374	7,895	12,083	82	1,739	2,784
Thailand	186	4,862	6,848	167	10,302	11,850
Turkey	161	5,512	7,736	14	1,207	1,625
United Kingdom	(5)	42	46	(5)	133	153
Venezuela	18	684	903	65	2,043	2,649
Total[4]	2,514 r	67,497	103,584	2,137	66,015	93,835
Laredo, TX, Mexico	163	18,376	19,358	147	16,344	17,179
Los Angeles, CA:						
Australia	(5)	9	9	(5)	17	19
China	1,870 r	57,121	77,400	1,219	35,732	47,462
Colombia	--	--	--	1	254	317
Germany	--	--	--	(5)	6	7
Netherlands	--	--	--	(5)	9	12
Taiwan	--	--	--	115	3,628	4,643
Thailand	447	12,192	18,077	607	15,586	23,032
United Kingdom	(5)	34	40	(5)	69	79
Total[4]	2,318	69,356	95,525	1,943	55,302	75,571
Miami, FL:						
Belgium	2 r	623	660	2	379	402
Colombia	22	1,056	1,349	23	1,138	1,490
Germany	(5)	21	27	(5)	11	14
Greece	162	5,940	7,694	351	11,716	14,847
Mexico	(5)	47	51	--	--	--
Netherlands	(5)	34	42	--	--	--
Spain	583	25,202	32,235	283	15,164	19,099
Sweden	810	25,259	33,462	809	25,688	32,620
Thailand	19	579	830	--	--	--
Turkey	37	1,181	1,606	217	6,088	8,041
United Kingdom	(5)	76	97	(5)	104	132
Venezuela	52	2,116	2,882	57	1,725	2,264
Total[4]	1,688 r	62,135	80,935	1,743	62,012	78,908

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Milwaukee, WI:						
Canada	111	6,280	6,711	143	8,049	8,569
Cyprus	--	--	--	75	1,845	1,849
Total[4]	111	6,280	6,711	218	9,894	10,417
Minneapolis, MN, Germany	(5)	5	8	(5)	7	11
Mobile, AL:						
Australia	33	578	1,188	--	--	--
Korea, Republic of	40	702	1,352	--	--	--
Lebanon	--	--	--	94	1,877	3,117
Peru	33	895	1,279	--	--	--
Thailand	288	6,258	11,801	399	8,492	14,772
United Kingdom	--	--	--	1	174	199
Venezuela	--	--	--	7	221	276
Total[4]	393 r	8,432	15,620	501	10,765	18,364
New Orleans, LA:						
Bulgaria	129 r	5,013	7,123	121	4,698	6,373
China	9	968	1,148	11	1,072	1,263
Colombia	197	8,100	9,939	28	967	1,255
Croatia	22	3,991	4,871	21	4,181	5,106
Denmark	(5)	9	10	--	--	--
France	(5)	4	5	--	--	--
Germany	(5)	37	39	--	--	--
Greece	--	--	--	206	6,833	8,865
India	--	--	--	(5)	10	10
Israel	--	--	--	(5)	13	19
Italy	135 r	4,878	6,632	--	--	--
Korea, Republic of	--	--	--	165	3,805	6,802
Netherlands	(5)	17	20	(5)	44	53
Peru	--	--	--	56	2,062	2,883
Thailand	1,519 r	43,250	69,412	1,171	30,522	45,944
Turkey	152	6,401	8,038	71	2,945	3,510
Venezuela	127	6,559	7,306	--	--	--
Total[4]	2,291	79,228	114,541	1,850	57,151	82,082
New York City, NY:						
Bahamas, The	32	989	1,335	--	--	--
Croatia	1 r	421	421	1	326	363
Denmark	(5)	43	54	8	684	684
France	(5)	2	2	--	--	--
Germany	--	--	--	(5)	8	9
Greece	282 r	9,395	12,711	131	4,255	5,826
India	(5)	2	3	--	--	--
Italy	(5)	7	11	(5)	3	3
Netherlands	1	333	378	3	1,177	1,452
Norway	389	16,719	17,698	508	21,558	22,418
Peru	26	879	1,196	--	--	--
Sweden	167	5,681	6,676	238	7,815	10,334
Switzerland	--	--	--	18	557	778
Turkey	300	10,269	14,244	179	4,993	7,330
United Kingdom	1	373	482	5	1,521	1,994
Venezuela	22	821	1,184	101	4,002	5,497
Total[4]	1,220	45,935	56,396	1,192	46,898	56,685
Nogales, AZ:						
Germany	--	--	--	(5)	25	29
Mexico	911	27,198	35,806	668	19,938	27,234
Netherlands	(5)	30	39	--	--	--
Total[4]	911	27,228	35,845	668	19,963	27,263

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY [1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Norfolk, VA:						
Bulgaria	231 r	8,661	11,373	235	9,770	12,529
Canada	--	--	--	48	1,546	1,793
Denmark	(5)	14	20	--	--	--
France	70 r	12,781	13,327	85	15,335	16,509
Germany	(5)	25	32	(5)	7	10
Greece	260	8,951	11,925	211	6,999	9,911
Indonesia	197	5,427	8,545	114	3,018	4,748
Netherlands	(5)	39	45	1	291	359
United Kingdom	1 r	176	238	1	181	256
Total[4]	761 r	36,075	45,505	694	37,147	46,114
Ogdensburg, NY:						
Canada	210	10,851	11,162	306	16,424	16,881
France	(5)	11	12	--	--	--
Germany	--	--	--	(5)	2	2
Ireland	(5)	2	2	--	--	--
United Kingdom	(5)	9	9	(5)	15	15
Total[4]	211 r	10,872	11,184	306	16,440	16,898
Pembina, ND, Canada	286 r	12,713	12,998	217	9,287	9,694
Philadelphia, PA:						
Belgium	(5)	11	11	(5)	12	12
Colombia	--	--	--	22	750	814
Germany	--	--	--	42	300	714
Netherlands	(5)	25	27	36	272	645
Thailand	358	8,146	8,838	39	876	950
United Kingdom	(5)	72	136	--	--	--
Total[4]	359	8,254	9,013	139	2,210	3,135
Portland, ME, Canada	90	8,187	8,970	83	7,814	8,157
Providence, RI:						
Philippines	--	--	--	59	1,374	2,501
Spain	30	1,051	1,597	--	--	--
Turkey	--	--	--	118	3,616	5,402
Venezuela	489	18,461	25,371	536	18,944	27,372
Total[4]	519	19,512	26,968	713	23,934	35,275
San Diego, CA:						
China	144	4,532	6,054	4	430	433
Mexico	3	118	164	--	--	--
Thailand	401	12,698	18,014	500	16,728	22,480
Total[4]	548	17,348	24,232	503	17,158	22,913
San Francisco, CA:						
China	391	11,772	16,124	260	7,797	10,082
Taiwan	551	16,256	25,375	--	--	--
Thailand	78	3,050	4,172	505	15,062	23,109
United Kingdom	(5)	4	25	--	--	--
Total[4]	1,020	31,082	45,696	765	22,859	33,191
San Juan, PR:						
Belgium	5	327	602	3	211	392
China	113 r	2,445	5,029	114	3,649	5,678
Colombia	28	1,344	1,669	29	1,029	1,268
Denmark	235	7,313	12,538	215	7,858	12,623
Italy	(5)	28	31	--	--	--
Mexico	7 r	869	997	7	834	923
Panama	--	--	--	(5)	5	6
Spain	(5)	11	12	(5)	10	12
Total[4]	387 r	12,337	20,879	369	13,596	20,902

See footnotes at end of table.

TABLE 19--Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER,
BY CUSTOMS DISTRICT AND COUNTRY [1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Savannah, GA:						
Egypt	--	--	--	(5)	76	85
Germany	(5)	13	16	--	--	--
Indonesia	76	1,448	3,373	--	--	--
Italy	(5)	61	66	(5)	110	119
Netherlands	--	--	--	(5)	80	122
Thailand	51	1,169	2,382	144	3,445	6,902
Turkey	3 r	281	281	3	213	213
United Kingdom	(5)	8	11	(5)	16	21
Total[4]	130	2,979	6,129	147	3,939	7,463
Seattle, WA:						
Australia	82 r	2,154	3,746	--	--	--
Canada	1,053 r	52,389	57,558	1,187	60,879	67,795
China	35 r	1,135	1,858	--	--	--
Japan	1	344	500	(5)	50	83
Thailand	24	574	978	173	4,153	6,682
United Kingdom	(5)	3	4	--	--	--
Total[4]	1,195	56,599	64,643	1,360	65,082	74,560
St. Albans, VT:						
Canada	202 r	16,383	17,577	199	16,571	17,681
France	--	--	--	(5)	12	13
Total[4]	202 r	16,383	17,577	199	16,583	17,695
Tampa, FL:						
Colombia	968	35,915	45,529	766	27,441	33,806
Denmark	111 r	8,790	12,201	105	8,242	11,209
France	(5)	2	3	--	--	--
Greece	73	2,343	3,299	207	5,671	8,160
India	(5)	7	9	--	--	--
Peru	--	--	--	33	1,025	1,352
Spain	38	1,409	1,767	--	--	--
Sweden	12	371	559	--	--	--
Thailand	483	10,842	20,356	424	10,191	17,081
Turkey	112	3,640	5,083	82	3,350	4,269
Venezuela	213	8,165	11,240	494	15,186	21,186
Total[4]	2,009	71,484	100,047	2,111	71,108	97,063
U.S. Virgin Islands:						
Barbados	1	56	77	--	--	--
Colombia	2	67	87	--	--	--
Venezuela	60 r	3,106	4,122	53	2,071	2,965
Total[4]	64	3,229	4,285	53	2,071	2,965
Washington, DC, Venezuela	(5)	--	--	2	64	95
Wilmington, NC:						
Indonesia	45	2,003	3,140	--	--	--
Thailand	--	--	--	24	523	1,152
Venezuela	--	--	--	5	173	249
Total[4]	45	2,003	3,140	29	696	1,401
Grand total[4]	25,861	987,074	1,266,318	24,169	939,056	1,187,718

[r]Revised. -- Zero.
[1]Includes all varieties of hydraulic cement and clicker.
[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
[4]Data may not add to totals shown because of independent rounding.
[5]Less than 1/2 unit.

Source: U.S. Census Bureau.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Australia	113	2,707	4,821	(4)	10	11
Bahamas, The	32	989	1,335	--	--	--
Bulgaria	360	13,675	18,496	356	14,467	18,902
Canada	4,148	220,077	234,274	4,108	223,559	240,196
China	3,223 r	97,600 r	135,478 r	2,150	64,614	87,072
Colombia	1,477	55,699	74,214	1,456	52,284	69,271
Denmark	407	11,705	18,889	216	7,416	12,347
Germany	(4)	78	92	42	340	764
Greece	1,414	48,354	58,529	1,523	51,016	67,171
Indonesia	273	6,875	11,918	272	5,568	9,698
Italy	135	4,885	6,643	(4)	3	3
Korea, Republic of	1,286	31,944	52,220	1,625	40,312	61,792
Mexico	1,404	39,864	53,052	1,017	29,426	39,980
Netherlands	(4)	30	39	36	263	637
Norway	367	14,906	15,801	488	19,957	20,698
Peru	214	6,630	9,346	340	11,408	15,951
Philippines	374	7,895	12,083	294	6,841	10,567
Spain	532	17,867	23,166	210	5,493	7,256
Sweden	989	31,311	40,698	1,047	33,504	42,954
Taiwan	551	16,256	25,375	115	3,628	4,643
Thailand	3,392 r	92,637 r	143,599 r	3,919	107,949	162,793
Turkey	738	25,093	34,316	658	20,325	27,984
Venezuela	1,417	55,971	76,722	1,452	48,746	68,718
Other	1	120	154	1	525	601
Total[5]	22,847 r	803,168 r	1,051,260 r	21,325	747,654	970,009

[r]Revised. -- Zero.
[1]Includes imports into Puerto Rico.
[2]The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
[4]Less than 1/2 unit.
[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21

U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Belgium	7	950	1,263	5	595	799
Canada	213	25,674	26,323	219	27,314	28,542
China	--	--	--	4	433	438
Colombia	11	981	1,250	13	1,518	1,934
Denmark	120	9,995	13,736	117	9,596	12,556
Egypt	--	--	--	9	837	1,030
Greece	14	1,173	1,497	6	497	641
Indonesia	45	2,003	3,140 [4]	--	--	--
Mexico	197	23,146	24,478	175	20,139	21,466
Norway	45	3,077	3,164 [4]	21	1,601	1,719 [4]
Spain	119	9,805	12,445	118	9,956	12,515
Thailand	37	3,291	3,403	120	6,394	7,364 [4]
Turkey	28	2,192	2,671	26	2,087	2,404
Venezuela	100	3,807	3,849 [4]	35	1,299	1,398 [4]
Other	(5)	391	421	1	518	555
Total[6]	936	86,486	97,641	867	82,784	93,361

-- Zero.

[1]Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[5]Less than 1/2 unit.

[6]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2001			2002		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Australia	33	578	1,188	--	--	--
Brazil	--	--	--	99	4,236	4,276
Canada	661	35,622	36,013	704	39,530	39,953
China	42 r	1,597 r	2,136 r	11	1,099	1,297
Colombia	217	7,996	9,814	109	3,355	4,270
Cyprus	--	--	--	75	1,845	1,849
France	69	11,730	12,258	84	14,229	15,305
Germany	--	--	--	(4)	8	9
Greece	--	--	--	173	4,496	6,554
Korea, Republic of	40	702	1,352	--	--	--
Lebanon	--	--	--	94	1,877	3,117
Peru	33	895	1,279	33	1,025	1,352
Thailand	639 r	12,412 r	22,545 r	221	3,625	7,423
Venezuela	48	1,431	1,821	--	--	--
Total[5]	1,782 r	72,963 r	88,406 r	1,603	75,325	85,405

[r]Revised. -- Zero.

[1]For all types of hydraulic cement. Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than 1/2 unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 23
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	1998	1999	2000	2001	2002[e]
Afghanistan[e]	116	116	50	50	60
Albania[e]	84	106	110	39 r	50
Algeria[e]	7,500	7,500	8,300	8,300	9,000
Angola[e]	350	350	350	350	350
Argentina	7,091	7,187	6,114 r	5,545 r	3,910 3
Armenia	300	287	219	300	400 3
Australia[e]	6,850	7,450	7,500	7,500	7,550
Austria	3,850 e	3,817	3,776	3,863 r	3,800
Azerbaijan	201	177	200 e	500	800 3
Bahrain	230	156	89	89	67 3
Bangladesh[4]	1,240	2,085	3,580	5,005	5,000
Barbados	259	253	268	250 r	298 3
Belarus	2,035	2,100	1,847	1,803	2,200
Belgium	7,000 e	7,277	7,150	7,500 e	8,000
Benin[e]	200	200	250	250	250
Bhutan[e]	150	150	150	160	160
Bolivia	1,169	1,201	1,072	1,100 e	1,214 p
Bosnia and Herzegovina[e]	300	300	300	300	300
Brazil	39,942	40,270	39,208	38,927 r	39,500
Brunei	216	208	232	227 r	230
Bulgaria	1,742	2,060	2,209	2,200 e	2,200
Burkina Faso[e]	40	50	50	50	50
Burma	365	338	393	378 r	379 3
Cambodia[e]	150	--	--	50	50
Cameroon	740	850	890	930 e	950
Canada	12,124	12,634	12,612	12,986	13,200 p
Chile	3,888	3,036	3,491	3,500 e	3,600
China	536,000	573,000	597,000	661,040 r	704,720 p
Colombia[e]	9,190 3	9,200	9,750	9,800	9,800
Congo (Brazzaville)	--	--	20 e	-- r	--
Congo (Kinshasa)	134	159 r	161 r	192 r	190
Costa Rica[e]	1,085 3	1,100	1,150	1,100	1,100
Côte d'Ivoire[e]	650	650	650	650	650
Croatia	2,295	2,712	2,852	3,246 r	3,378 3
Cuba	1,713	1,785	1,633	1,324 r	1,300
Cyprus	1,207	1,157	1,398	1,369	1,600
Czech Republic	4,604	4,241	4,093	3,550	3,500
Denmark	2,528	1,926	2,009	2,010 e	2,010
Dominican Republic	1,885	2,945 r	3,122 r	2,976 r	3,071 3
Ecuador	2,600	2,300	2,800 e	2,850 r	2,860
Egypt	21,000 e	23,313	24,143	24,500 e	23,000
El Salvador	1,065	1,031 r	1,064 r	1,174 r	1,318 3
Eritrea[e]	45 r	45 r	45	45 r	45
Estonia	321	358	329	405	420 3
Ethiopia	750	638	880	950 e	1,000
Fiji[e]	90 3	95	95	95	95
Finland	1,098	1,310	1,422	1,325	1,350 3
France	19,500 e	20,219	20,137	19,839	20,000
French Guiana	88 r	88 r, e	88 r, e	58 r	62
Gabon	196	180 r	210	210 e	200
Georgia	200	342	348	300	300
Germany	36,610	35,912	34,727	30,989 r	30,000
Ghana	1,630	1,870	1,950	1,900 e	1,900
Greece	15,000 e	13,908	14,530	15,000 r	15,500 3
Guadeloupe[e]	230	230	230	230	230
Guatemala	1,500	1,600	1,600	1,600 e	1,600
Guinea	277	297	300	300 e	300
Haiti	--	--	--	204	290 3
Honduras	896	980	1,100	1,100 e	1,100
Hong Kong	1,539	1,387	1,284	1,300 e	1,300

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	1998	1999	2000	2001	2002[e]
Hungary	2,999	2,979	3,326 [r]	3,452 [r]	3,500
Iceland	118	131	144	125 [r]	130
India[e]	85,000	90,000	95,000	100,000	100,000
Indonesia	22,341	23,925	27,789	31,300	33,000
Iran	21,300 [e]	22,080	23,880	26,650	30,000
Iraq[e]	2,000	2,000	2,000	2,000	2,000
Ireland[e]	2,000	2,466 [3]	2,620 [3]	2,600	2,500
Israel	6,476	6,354	6,600 [e]	6,900 [e]	7,000
Italy	35,512	37,299	38,925	39,804	40,000
Jamaica	558	504	521	596 [r]	614 [3]
Japan	81,328	80,120	81,097 [r]	76,550	71,800 [3]
Jordan	2,650	2,687	2,640	3,173 [r]	3,455 [3]
Kazakhstan	600 [e]	838	1,175	2,029 [r]	2,129 [3]
Kenya	1,426	1,204	1,146	1,085	1,229 [3]
Korea, North[e]	3,200 [r]	4,000 [r]	4,000 [r]	5,160	5,320
Korea, Republic of	46,091	48,157	51,255	52,046 [r]	55,514 [3]
Kuwait	1,345 [r]	1,435 [r]	1,540 [r]	1,600 [r, e]	1,600
Kyrgyzstan	709	386	500	469 [r]	533 [3]
Laos[e]	80	80	92	92	240
Latvia	366	W	W	W	W
Lebanon	3,316	2,714	2,808	2,890 [r]	2,852 [3]
Liberia[e]	10	15	15	15	15
Libya[e]	3,000	3,000	3,000	3,000	3,000
Lithuania	788	666	570	529 [r]	605 [3]
Luxembourg	699	742	749	750 [e]	750
Macedonia	461	520	585	450 [r]	450
Madagascar	44	46	51	52 [r]	15
Malawi	134	187	156	181	174 [3]
Malaysia	10,397	10,104	11,445	13,820	14,336 [3]
Mali[e]	-- [r]	-- [r]	-- [r]	-- [r]	--
Martinique[e]	220	220	220	220	220
Mauritania[e]	100	100	110	110	110
Mexico	27,744	29,413	31,677	29,966	31,069 [3]
Moldova	74	50	222	200	300 [3]
Mongolia	109	104	92	68	148 [3]
Morocco	7,414	7,530	8,100	10,000 [r, e]	10,200
Mozambique	212 [r]	216 [r]	270 [r]	265 [r]	274 [3]
Namibia[e]	150 [r]	(5) [r]	-- [r]	-- [r]	--
Nepal[e, 4]	280	290	300	285 [e]	290
Netherlands[e]	3,200	3,480 [3]	3,450 [3]	3,450	3,400
New Caledonia[e]	--	--	100 [r]	93 [r]	100 [3]
New Zealand[e]	950	960	950	950	950
Nicaragua	377	350	360	360 [e]	360
Niger[e]	30	30	40	40	55
Nigeria[e]	2,700	2,500	2,500	3,000	3,000
Norway	1,676	1,827	1,851	1,870 [e]	1,850
Oman	1,333 [r]	1,217 [r]	1,238 [r]	1,370 [r]	1,400
Pakistan[e]	8,901 [3]	9,600	9,900	9,900	9,900
Panama	750	760	760 [e]	760 [e]	760
Paraguay	730 [r]	730 [r]	650 [r]	650 [r]	650
Peru	4,340	3,799	3,906 [r]	3,950 [r]	4,000
Philippines	12,888	12,556	11,959	8,653	9,000
Poland	14,970	15,555	15,046	11,918	12,000
Portugal[e]	9,500	10,147 [3]	10,343 [3]	10,300	10,000
Qatar	986 [r]	1,025	1,050 [e]	1,050 [e]	1,100
Réunion	380 [r]	380 [r]	400 [r, e]	400 [r, e]	400
Romania	7,300	6,252	6,058	5,668	5,680 [3]
Russia	26,000	28,400	32,400	35,300 [r]	37,700 [3]
Rwanda	59	66	71	83 [r]	83
Saudi Arabia	15,786 [r]	16,313	18,107	20,608	21,000

See footnotes at end of table.

TABLE 23--Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	1998	1999	2000	2001	2002[e]
Senegal[e]	1,000	1,000	1,000	1,000	1,000
Serbia and Montenegro	2,253	1,575	2,117	2,418	2,396 [3]
Sierra Leone[e]	100 [r]	100	100	100 [r]	100
Singapore	2,340 [r]	1,660 [r]	1,150 [r]	600 [r, e]	200
Slovakia	4,705	4,718	3,045	3,123	3,100
Slovenia[e]	1,149 [3]	1,224 [3]	1,300	1,300	1,250
South Africa, sales[6]	8,738 [r]	8,068 [r]	7,971 [r]	8,036 [r]	8,525 [3]
Spain, including Canary Islands	33,080 [r]	35,782	38,115	40,512	42,500
Sri Lanka	874	976	1,008	1,108 [r]	1,018 [3]
Sudan	198	231	146	190 [r]	190
Suriname[e]	60	60	60	65 [r, 3]	65
Sweden	2,252	2,298	2,651	2,600 [r]	2,700
Switzerland	3,600 [e]	3,548	3,771	3,950	4,000
Syria[e]	4,607 [3]	4,781 [3]	4,830	4,840	4,900
Taiwan	19,652	18,283	17,572	18,128	19,363 [3]
Tajikistan	18	30	50	70	100 [3]
Tanzania	778	833	833	900 [r]	950
Thailand	22,722	25,354	25,499	27,913	31,679 [3]
Togo[e]	500	600	700	800	800
Trinidad and Tobago	690	688	743	708	700
Tunisia	4,588	4,864	5,657	5,721	6,022 [3]
Turkmenistan[e]	450	450	450	450	450
Turkey	38,200	34,258	35,825	30,125 [r]	32,577 [3]
Uganda	321	347	368	420 [r, e]	420
Ukraine	5,591	5,828	5,311	5,800	7,142 [3]
United Arab Emirates[e]	7,066 [r, 3]	7,069 [r, 3]	6,100	6,100	6,500
United Kingdom	12,409	12,697	12,452	11,854	12,000
United States, including Puerto Rico[7]	85,522	87,777	89,510	90,450 [8]	91,266 [3]
Uruguay	872 [r]	789 [r]	700 [e]	1,015 [r]	1,000
Uzbekistan[e]	3,400	4,471 [3]	3,521 [3]	4,000	4,000
Venezuela[e]	8,202 [3]	8,500	8,600	8,700	7,000
Vietnam	9,738	10,489	13,298 [r]	15,374 [r]	19,481 [3]
Yemen[e]	1,201 [3]	1,454 [3]	1,400	1,400	1,400
Zambia[e]	351 [3]	300	380	350 [r]	350
Zimbabwe[e]	1,100	1,000	1,000	800 [r]	600
Total	1,540,000 [r]	1,600,000	1,650,000 [r]	1,730,000 [r]	1,800,000

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are believed to be accurate to no more than three significant digits.

[2]Table includes data available through August 17, 2003. Data may include clinker exports for some countries.

[3]Reported figure.

[4]Data for year ending June 30 of that stated.

[5]Less than 1/2 unit.

[6]Data are revised to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted to: 1998--843; 1999--940; 2000--1,020; 2001--1,129; and 2002--1,099.

[7]Portland and masonry cements only.

[8]Data are rounded to four significant digits.

Cement

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Shawn P. Danhauser, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Hydraulic cements primarily are used as the binding agents in concrete and most mortars. The hydraulic cements covered in this report are mostly limited to those that can be loosely classified as portland cement and/or masonry cement. Varieties covered within portland cement are listed in table 16 and include blended cements.[1] Masonry cements include true masonry cements, portland-lime cements, and plastic cements. Certain other hydraulic cements, most notably aluminous cement, are included within the world hydraulic cement production data given in table 23 and the trade data in tables 17-19 and 22 (clinker). Excluded from the U.S. data, and to the degree possible from international data, are pure (unblended) pozzolans or supplementary cementitious materials (SCM), such as fly ash and ground granulated blast furnace slag (GGBFS); GGBFS is increasingly being referred to as slag cement. Although SCM are not finished cements in their own right, they play an important role as components of blended cements or as partial substitutes for portland cement in concrete. Indications of percentage or other changes expressed in this report compare activity in 2003 with that of 2002 unless specified otherwise. Except where otherwise indicated, activity levels in this report exclude those in Puerto Rico.

Production of portland and masonry cements in the United States in 2003 rose by about 3.5% to 92.8 million metric tons (Mt), a new record (table 1). Output of clinker—the intermediate product of cement manufacture—increased by about 0.5% to a new record of 81.9 Mt. The United States ranked third in the world in hydraulic cement production; world output in 2003 was nearly 2 billion metric tons (Gt).

The construction economy in the United States was fairly strong in 2003, especially that for housing. Although relatively severe weather hurt overall cement sales to final customers in January and February, all but two of the remaining months showed sales increases, and sales in July, September, October, and December were the highest on record. Apparent consumption of cement (a calculated statistic) for the year rose by 3.7% to about 114 Mt (table 1). Consumption measured by shipments (sales) to final domestic customers rose by 3.8% to about 112.4 Mt (table 9); this was second only to the record sales in 2001 of 112.7 Mt. The country continued to rely, albeit at lower levels, upon imports to offset the large shortfall in cement production relative to sales. In contrast to the higher sales tonnages, the unit prices (measured as mill net values) for portland cement declined slightly (table 1). Overall, the value of cement sales in 2003 was about $8.3 billion (tables 1, 12, 13) or $8.4 billion for the slightly higher monthly data-based tonnages (table 9). Based on typical portland cement mixing ratios in concrete, the delivered value of concrete (excluding mortar) in the United States in 2003 was estimated to be at least $41 billion.

The bulk of this report is based on data compiled from U.S. Geological Survey (USGS) annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are independent of U.S. cement manufacturers. For 2003, responses were received for 144 of 151 facilities canvassed; a response rate of 95%. Of the nonrespondents, only three were production sites, and one of these closed during the year. The responding facilities accounted for 99% of the U.S. cement production in 2003. For 2002, responses were received from 137 of 145 facilities canvassed, a response rate of 94%. The 2002 responding facilities included all but five production sites and accounted for about 97% of U.S. cement production in that year.

An attempt was made to obtain any missing information by telephone, resulting in cement and clinker production data being obtained for all facilities (that is, 100% reporting) for both 2002 and 2003. For cases where followup inquiries (for data other than production) were not successful and for which applicable data were not available from the monthly surveys, estimates were incorporated. A number of district and national totals have been rounded to reflect this incorporation of estimates.

State totals are shown individually where possible or combined within districts where necessary to protect proprietary data. In several tables, a few States are shown subdivided (and for consumption, two metropolitan areas are split out); the county basis for these divisions is given in table 2.

Legislation and Government Programs

Economic Issues.—Government economic policies and programs that affect the cement industry are those affecting cement trade, interest rates, and public sector construction spending. The major trade issue in 2003 continued to be that of antidumping tariffs against Japan and Mexico. On January 9, 2003, the U.S. Department of Commerce (DOC) released its final determination for the 11th review period (August 2000 to July 2001) for gray portland cement and clinker from Mexico; the dumping margin for the period was set at 73.74% (Southern Tier Cement Committee, 2003). Then, on September 30, the DOC released its findings for the 12th review period (August 2001 to July 2002) wherein the dumping margin was assessed to be 79.81%. Both assessments were expected to be appealed (Cement Americas, 2003b).

The major Government construction funding program in 2003 remained the Transportation Equity Act for the 21st

[1]Sales data for blended cements (also called composite cements) listed separately from portland cement are available within the monthly cement reports of the U.S. Geological Survey Mineral Industry Surveys series, starting January 1998.

Century (TEA-21), which authorized $216.3 billion in funding for the 6-year period from 1998 to 2003 to upgrade the country's transportation infrastructure. The TEA-21 expired on September 30, but Congress authorized continuation of its funding at 2003 levels for a further 5 months pending reconciliation of conflicting proposals for its full-scale reauthorization; the House proposal was for $375 billion, the Senate proposal was at $311 billion, and the White House was at $247 billion (Cement Americas, 2004).

Environmental Issues. —The major environmental issues relating to cement stem from the production of clinker manufacturing (van Oss and Padovani, 2002, 2003). The most significant emissions from clinker manufacture are of carbon dioxide (CO_2), amounting to nearly 1 metric ton (t) of CO_2 per ton of clinker, about one-half of which is derived from the calcination of calcium carbonate raw materials, and the rest, from the combustion of fuels. Overall, generation of CO_2 by the U.S. cement industry in 2003 amounted to about 79 Mt; this excluded emissions, assigned to the utility companies, associated with generating the electricity used by the cement industry. The cement industry was working on ways to reduce the unit emissions of CO_2. One way to do this is to increase the use of blended cements; that is, incorporate SCM to reduce the clinker component of the finished cement. The Portland Cement Association has long proposed altering the ASTM International C-150 specification for portland cement to allow for the incorporation of up to 5% ground (but unburned) limestone into finished portland cement as a nondeleterious filler. In December, this proposal was passed by the ASTM review committee (Portland Cement Association, 2003).

As of September 30, U.S. cement plants that burned hazardous wastes either as fuels or as raw materials were required to be in compliance with the U.S. Environmental Protection Agency's National Emission Standards for Hazardous Air Pollutants (NESHAP) from Hazardous Waste Combustors (HW MACT). This followed the June 10, 2002, requirement for all portland cement plants to be in compliance with the NESHAP for Source Categories; Portland cement industry (PC MACT) (Ellis, 2003).

Production

Cement in 2003 was produced in 37 States and Puerto Rico (tables 3, 4). The 2003 data reflect the first year of operations for a new plant in Florida (Suwannee American) and the closure of one small plant in Nevada (Royal Cement).

The five leading cement-producing States in 2003, in descending order, were California, Texas, Pennsylvania, Michigan, and Missouri; the order was unchanged from that in 2002. Cement producers in the United States ranged widely in size and in the number of plants operated. Ranking companies in terms of output or capacity is made difficult by the existence of some common parent companies and joint ventures. If companies with common parents are combined under the larger subsidiary's name, with joint ventures apportioned, then the leading 10 companies at yearend 2003, in descending order of cement production, were Holcim (US) Inc.; CEMEX, Inc.; Lafarge North America, Inc.; RC Lonestar, Inc. (including Alamo Cement Co.); Lehigh Cement Co.; Ash Grove Cement Co.; Essroc Cement Corp.; Texas Industries Inc. (TXI); California Portland Cement Co.; and Centex Construction Products, Inc. The largest 5 of these had about 58% of total U.S. portland cement production, and the leading 10 together accounted for about 77% of total U.S. production. Of these companies, all except Ash Grove, Centex, and TXI were foreign-owned as of yearend.

Ownership consolidation in the U.S. cement industry continued in 2003. Early in the year, Hanson PLC sold its 50% share of the North Texas Cement Co., L.P. joint venture to its partner Ash Grove, giving Ash Grove 100% ownership of the company. The major assets of North Texas Cement were a 0.9-million-metric ton-per-year (Mt/yr) integrated plant at Midlothian, TX, and a large import terminal in Houston, TX. In July, Ash Grove changed the legal name of the former joint venture to Ash Grove Texas, L.P., but was conducting business under the general name Ash Grove Cement Co. In July, Lafarge sold its subsidiary Lafarge Florida, Inc. to Florida Rock Industries, Inc. The facilities transferred included two grinding plants and import terminals (Tampa and Port Manatee) on the Florida west coast as well as terminals on the Florida east coast. Not included in the sale was the large Jacksonville, FL, terminal that Lafarge had acquired in 2001 when it purchased Blue Circle Industries.

In late September, CEMEX purchased Dixon-Marquette Cement Co. from Prairie Material Sales, Inc. The main asset in the purchase was the 0.6-Mt/yr Dixon integrated plant at Dixon, IL. In October, the Brazilian company Votorantim Cimentos Ltda. purchased Badger Cement Products LLC, a grinding plant in Milwaukee, WI. The facility was to be operated by Votorantim's Canadian subsidiary St. Marys Cement, Inc., which also operated a grinding plant in Detroit, MI. The acquisition followed the yearend 2002 purchase by Votorantim of a 50% (and operational) stake in the (then) new Suwannee American Cement Co. plant at Branford, FL.

Following the 2002 takeover of Dyckerhoff AG of Germany by Buzzi Unicem S.p.A of Italy, most of the U.S. assets of the two companies (owned under Lone Star Industries, Inc. and RC Cement, respectively) were merged in October 2003 under the temporary name RC Lonestar, Inc., which then was changed in January 2004 to Buzzi Unicem USA, Inc. Not included in the merger was the Buzzi subsidiary Alamo Cement Co. of San Antonio, TX.

Owing to the May 2003 internal split of Australian companies Rinker Group Ltd. and CSR Ltd., Rinker became the sole owner of Rinker Materials Corp. (formerly CSR Rinker Materials), which operated two integrated cement plants in Florida.

The Suwannee American plant at Branford, FL, was commissioned in February; this was the only plant that opened during the year (the plant had first fired its kiln in late December 2002 but produced no cement until early 2003). The only plant closure during the year was that of Royal Cement Co., Inc.'s small integrated facility at Logandale, NV, in August. The plant had been in intermittent production for several years.

Major upgrades were announced for a number of U.S. cement plants during the year. In March, Dragon Products Co., Inc. began conversion of its Thomaston, ME, facility from wet process to dry precalciner process. The conversion was designed to boost the plant's capacity by 40% to about 0.7 Mt/yr as well as improve its environmental performance. The kiln line upgrade was expected to be completed in mid-2004 (Cement Americas, 2003a). Work commenced at Giant Cement Co.'s Harleyville, SC, plant to replace its four wet kilns with a single dry precalciner kiln line, thereby increasing overall clinker capacity by about 25% to 1 Mt/yr. The new kiln was expected to come online around yearend 2004, at which time two of the wet kilns would be closed down, with the other two to follow at yearend 2005. Holcim completed construction of a 2.25-Mt/yr dry precalciner kiln line (plus new raw and finish mills) at its plant at Holly Hill, SC. The new facility replaced a pair of old wet kilns and associated mills. The wet plant was closed in May, and the new plant started up in June (International Cement Review, 2004). Holcim continued the permitting process for its proposed 4-Mt/yr Lee Island plant in Ste. Genevieve County, MO. When built, this facility will have one of the largest capacity kilns in the world.

Lafarge was planning to add a new finish mill at its Roberta plant in Calera, AL. The mill was expected to be completed by yearend 2004 and would complement the new 4,400-metric-ton-per-day (t/d) kiln that was brought online in 2002. In the interim, and possibly to continue on a long-term basis, the plant began supplying excess clinker to the company's Atlanta, GA, plant, allowing the Atlanta facility to significantly reduce operations on its own, less efficient kiln line (Seymour and Schureck, 2003).

Rockland Materials, Inc., a Phoenix, AZ, concrete company, was planning to build a very small (about 0.3 Mt/yr) cement plant near Drake, AZ, under the name Sterling Bridge Cement, Inc. However, in early 2003, Rockland filed for Chapter 11 protection and sold Sterling Bridge (including its permit applications and limestone reserves) to ARPL Tecnologia, S.A. (owner of the Peruvian cement producer Cementos Lima SA). Sterling Bridge was then reformed by ARPL into a new company called Drake Cement, LLC, and the projected size of the plant has been boosted to almost 0.6 Mt/yr. Construction work was planned to commence in early 2003, with a target completion date of early 2007 (Niemuth, 2003§[2]).

Portland Cement.—In 2003, portland cement was made in the United States at a total of 114 plants plus 2 in Puerto Rico. Of the U.S. plants, six were grinding facilities that relied entirely on clinker made elsewhere (primarily foreign). The distribution, by district, of portland cement plants, cement production, grinding capacities, and yearend cement stockpiles, is listed in table 3. Although the activity is not shown in the tables, a number of portland cement plants also grind GGBFS as a separate product.

In 2003, production of portland cement rose overall by 3.3% to about 88.1 Mt, a new record. Most districts showed production increases, many of which could be related to recent capacity upgrades at specific plants. The effect of an entirely new plant, as in Florida in 2003, will not necessarily be significant during the first year of operations, as the startup may have been late in the year, the plant will generally have an extended period of ramp-up operations, and the company will need to capture market share. The overall cement grinding capacity rose by about 5% to 113 Mt, but the capacity data for the year contain an unusually high component of estimates and are less reliable than the data for production. As listed in table 3, capacity utilization fell slightly to about 78%. The utilization percentages are relative to portland cement production, but if they are calculated on a total cement (including masonry) basis, then the utilization percentage in 2003 improves to about 82%, slightly lower than in 2002. Many cement plants have excess grinding capacity because it is relatively inexpensive to provide for such. Also, the capacities listed in table 3 for some districts include reported clinker grinding capacity that is currently utilized to grind granulated slag into GGBFS. This is especially true in Florida, which shows a relatively low capacity utilization level. Further, some low utilization rates reflect plant upgrades late in the year; the full new capacity is credited without commensurate full year production at the upgraded levels.

Data are not collected on the production of specific varieties of portland cement, but it may be assumed that production levels approximate the ratios among types of portland cement sold (table 16). On this basis, production of Types I and II (or hybrids thereof) accounted for about 83% of total portland cement output in 2003, down from about 86% in 2002. This relative decline appears to reflect the growing market for sulfate-resistant cements (Types II and V). Several companies market cements that meet both requirements (hence are rated Type II/V) but the USGS canvass form does not offer this "hybrid" as an entry choice. Accordingly, it appears that, increasingly, these cements are being reported as Type V; indeed, Type V sales showed a significant increase in 2003.

Based on the data in table 16, the overall production of blended cements appears to have increased modestly in 2003, but perhaps not for all blended cement varieties. In particular, the production of blends incorporating natural pozzolans (for example, volcanic ash) appears to have declined significantly. The shifts in apparent production of blends containing GGBFS, fly ash, and miscellaneous synthetic pozzolans at least roughly mirror the consumption of these SCM as raw materials (table 6; more information can be found in the "Raw Materials and Energy Consumed in Cement Manufacture" section).

Ideally, if sales data are to be used as a proxy for production ratios, then the sales ratios should be adjusted for the import component of sales. Imports are dominated by Types I and II portland cement but include significant volumes of Type V (mainly into southern California) and white cement. There is no tariff code distinction among gray portland cement types.

Yearend stockpiles declined by almost 14% to about 6.2 Mt. Because cement sales at any moment can represent a combination of current production and stockpiles (which can fluctuate), the apparent drawdown of yearend stocks is of qualitative interest only, but does suggest a shortfall in production relative to cement demand beyond what can be satisfied with imported material.

Masonry Cement.—Production of masonry cement rose by 6.5% in 2003 to about 4.7 Mt and reflected the continued strong housing construction sector of the economy (table 4).

[2]A reference that includes a section mark (§) is found in the Internet Reference Cited section.

Yearend stocks fell by 14% to about 0.4 Mt. Unlike portland cement, little if any masonry cement is imported, and thus masonry cement production is very close to consumption levels (as defined by shipments to final customers) listed in table 9. The data in both tables 4 and 9, however, underrepresent true production and consumption levels of masonry cement because it is common for masonry cement (particularly the portland-lime variety) to be made at the jobsite from purchased portland cement and lime. There are no data on this jobsite activity. As in recent years, about 95% of the (reported) masonry cement output continued to be reported as having been made directly from clinker rather than from finished portland cement.

Clinker.—District-level data pertaining to clinker are listed in table 5; the production data are all reported, but some of the other data in the table incorporate estimates. Production of clinker in 2003 increased only slightly to 81.9 Mt, but this was a new record. The leading five producing States continued to be, in descending order, California, Texas, Pennsylvania, Missouri, and Alabama. A slight majority of districts showed increases in clinker production in 2003. Most of the larger increases, as with portland cement production, could be attributed to recent capacity upgrades.

In 2003, clinker was made by a total of 110 integrated plants, including 2 in Puerto Rico. The kiln count dropped by 7 to 188, owing largely to the replacement of multiple wet kilns with single dry kilns. Of the total plants, 78 were exclusively dry process facilities (including 1 semidry facility in Indiana), 26 were exclusively wet process plants, and 4 operated both wet and dry kilns at least part year. The count reflects the addition of one dry plant in Florida, the subtraction of a dry plant in Colorado (closed in 2002), and the midyear conversion of a wet plant to dry technology in South Carolina (hence reported as combined technology for the year).

Annual clinker capacity and capacity utilization statistics are very sensitive to reported kiln shutdown periods, specifically those for routine maintenance. Because of ambiguities in the characterization of downtime, this downtime sensitivity means that changes of a few percentage points in regional annual clinker production capacity or capacity utilization rates have little statistical significance. Given that a plant generally has a total downtime in excess of routine maintenance requirements, a capacity utilization rate of 85% or higher indicates that the facility is probably running at or close to full practical capacity; this also applies to district-level utilization rates. A utilization rate below this could indicate the temporary idling of kilns or the permanent closure of old kilns following successful startup of new ones. As long as a kiln was active for 1 day or more during the year, its capacity will be included in the data in table 5. Apparent U.S. clinker capacity in 2003 increased by 1% to 100 Mt/yr, although many individual districts showed capacity decreases. Overall capacity utilization fell slightly (0.4%) to 81.9%, but a few districts (notably southern California, Florida, Missouri, and South Carolina) showed large utilization increases. Some of the utilization decreases were attributable to extended maintenance. The average number of days of downtime for routine maintenance increased by 1.2 days.

Based on the data in table 5, the average plant clinker capacity in 2003 rose by about 1% to 0.93 Mt/yr, and the average kiln capacity increased by about 5% to 0.54 Mt/yr. Plants operating only dry process kilns produced almost 78% of the total clinker in 2003, about the same as in the previous year (table 7). Wet kiln plants accounted for about 16%, down from about 18% in 2002. Combination plants accounted for 5.8% of the clinker, compared with 4.5% in 2002; the 2002 figure, however, included one facility listed as a wet plant in 2002. Significantly, yearend stockpiles[3] of clinker fell by 20% to 4.4 Mt, an apparent drawdown that, along with higher levels of clinker imports, reflected increased overall levels of cement consumption during the year and especially strong demand for cement towards yearend (tables 1, 5, 22).

Raw Materials and Energy Consumed in Cement Manufacture.—Nonfuel raw materials may be differentiated between those for the manufacture of clinker and those added subsequently in the finish mill to make cement (table 6). Materials used to make clinker are of environmental interest because they are burned in the kiln and are thus associated with various chemical changes and emissions. Materials added in the finish mill are just ground. Typically, about 1.7 t of nonfuel raw materials is needed to make 1 t of clinker, and about the same ratio holds through to the final (portland) cement product. Limestone or other calcareous materials account for about 85% or more of the total raw materials needed.

Overall, the major ratios among raw materials types did not change appreciably in 2003, and some specific changes seen may reflect improved reporting rather than a net change in true consumption. Also, some materials may be classified somewhat differently from year to year or among plants; for example, one plant's limestone might be another's marble. The chemical grouping of materials under terms like "calcareous" and "aluminous" is somewhat arbitrary because many of the raw materials supply more than one oxide. The cement kiln dust (CKD) data for 2002 and 2003 continue to be significantly underrepresented because few plants routinely measure consumption of this material. The apparent significant drop in CKD consumed for clinker in 2003 could thus reflect even less complete reporting. As in past years, the changes seen among slag varieties probably include a component of classification error by some plants.

Among the siliceous raw materials, the ratio between the consumption (to make cement) of certain pozzolans or SCM and the corresponding sales (as a proxy for production) of blended cements (listed in table 16), is within the range of typical mixing proportions for the respective blended cements. Year-to-year variations in these ratios are difficult to interpret owing to wide variations in the SCM contents of various blended cements. For example, the decline in the apparent proportion of granulated slag (mostly GGBFS) within blended cement (45% in 2003 compared with 49% in 2002) could represent lower sales volumes of the more slag-rich blends, or it could represent

[3]Yearend stockpiles of clinker are an artifact of data collection convenience rather than reflecting full-year market conditions or production capacity. Generally, if the clinker is not required for immediate cement market needs, a plant will try to build up its stocks of clinker prior to scheduled extended kiln shutdowns so as to provide continuity of clinker feed to the finish (cement) mill. These shutdowns can be at any time of year.

a decrease in the use of slag as a grinding aid to make Type I portland cement. It is important to note that by far the largest customer for SCM is the concrete industry directly, which prefers to directly blend these materials within concrete mixes (in effect making a blended cement) rather than purchasing finished blended cements from the cement industry. Thus the 0.33 Mt of granulated slag listed as consumed in 2003 in table 6 is only about 10% of the 3.4 Mt of granulated slag sold by slag processors as a cementitious additive during the year (per data collected in the USGS "Iron & Steel Slag" canvass for 2003); the excess is material sold to the concrete industry. Similarly, the 2.3 Mt of fly ash and 1.1 Mt of "other ash, including bottom ash" consumed by the cement industry in 2003 (table 6) may be compared with data published by the American Coal Ash Association (2004) that differentiate sales to the cement industry from those to the concrete industry. Sales to the cement industry in 2003 amounted to about 2.7 Mt of fly ash and 0.45 Mt of bottom ash, and sales to the concrete industry were about 11.1 Mt of fly ash and 0.3 Mt of bottom ash. Bottom ash sold to the concrete industry, however, was likely being used as an aggregate rather than as an SCM.

Cement plants commonly can switch among a variety of primary fuel types, and many routinely burn a mix of fuels. Fuels consumed by the cement industry are listed in table 7. The quantity ratios among fuels in 2003 appear to be broadly similar to those in 2002 save for a large, possibly cost-related decrease in the amount of natural gas consumed, particularly by dry process plants. Natural gas, for the most part, is used to warm up a kiln after an extended kiln shutdown, and for this task, fuel oil and sometimes liquid waste fuels may be substituted. The evidence of somewhat more extensive downtimes for routine maintenance and for longer unscheduled outages (lower capacity utilization percentages) in table 5 might support the lower natural gas consumption in 2003 if it is assumed that the periods of downtime were fewer but longer (that is, fewer restarts). However, natural gas reporting is subject to larger reporting errors than most other fuels because of the cumbersome reporting units used, and it may be that the 2003 consumption of natural gas is underreported. Continuing a trend, the use of used tires as fuel was up significantly during the year. Apart from overall fuel cost savings (companies are actually paid to burn tires) compared with the use of coal or petroleum coke, using tires can help reduce emissions of nitrogen oxides.

Although not listed in table 7, overall heat consumption in 2003 averaged about 4.4 million British thermal units (MBtu) per metric ton of clinker, about the same as in 2002. Wet plants in 2003 averaged 6.6 MBtu per ton of clinker compared with about 6.2 MBtu per ton in 2002; the increase may reflect operational inefficiencies experienced during the shutdown of some wet kilns in 2003. Dry plants in 2003 averaged 3.8 MBtu per ton compared with 3.9 MBtu per ton in 2002; the decline was owing to the increase in the number of more efficient, modern precalciner dry kilns.

As in past years, dry process plants had a higher average electricity consumption per ton of cement product than wet process plants (table 8). This reflects the complex array of fans and blowers associated with modern dry kilns and clinker coolers. But the difference between wet and dry plants in 2003 was very much smaller than in past years, evidently owing to the continuing decline in the number of wet kilns and the increase in the number of more efficient dry process plants, including more efficient finish mills. In 2003, the average unit power consumption for wet plants increased significantly, and that for dry plants decreased. Further, as plants have been upgraded, there has been a general decline in the number of kilns in operation. For the same general technology, plants operating multiple kilns almost invariably have higher electrical power (and general energy) requirements per ton of overall output capacity than do plants with the same overall capacity but which operate a single kiln.

Consumption

Apparent consumption of portland and masonry cement increased by 3.7% to about 114 Mt in 2003 (table 1). The measure of consumption preferred by the cement industry for its market analyses, however, is that of cement shipments to final customers (that is, sales). The definition of "final customer" is left to the reporting cement producer but is generally understood to include concrete manufacturers, building supply dealers, construction contractors, and others (for example, the categories listed in table 15). The data for shipments are published monthly by the USGS and are summed in this annual report in tables 9-10.

Significant tonnage differences (up to several million tons) existed in some past years between the U.S. portland cement sales totals derived from annual canvasses (tables 1, 11-12, 15-16) and the monthly survey-based totals (tables 9, 10). The differences likely pertained to shipments (mainly of imported cement) by terminals that were missed by the annual survey but which were captured on the monthly surveys; the monthly data are more complete because they contain a lot of data submitted on a company-total rather than site-total basis. When missing terminals were identified, they were added to the canvass, with the result that the tonnage discrepancy declined and became insignificant for the period 2001-02. However, a significant discrepancy (1.7 Mt) reappeared for 2003. It is unclear if this discrepancy is related to missed terminals or whether it represents erroneous reporting on the monthly surveys (such as double-counting by companies of cement sold to or swapped with other cement companies).

In contrast to portland cement, data for masonry cement have tended to not show significant discrepancies between the monthly and annual reporting because little of this material is imported.

Superficial similarities between table 9 and tables 12-13 belie key differences in their component data. The most important difference is that table 9 reveals the shipment destinations and so directly provides the location and amounts of consumption. In contrast, the regional data in tables 12, 13, and 15 pertain to the location of the reporting entity (chiefly the production sites), not the location of consumption. It is very common for shipments to cross State lines; where a State shows a higher tonnage in table 9 than in table 12 or 13, the State is a net importer of cement. Where the higher tonnage is in table 12 or 13, the State is a net exporter of cement.

Based on table 9, domestic portland cement consumption (sales or shipments to final customers) increased by 3.7% in 2003 to just under 108 Mt, the second highest year on record (consumption was slightly more than 108 Mt in 2001). The import component of these sales fell by about 1.5% to about 19.0 Mt, reflecting higher domestic cement production and drawdown of cement and clinker stocks, as noted earlier. The leading 10 consuming States were, in descending order, California, Texas, Florida, Illinois, Ohio, Arizona, Georgia, New York, Pennsylvania, and Michigan. The leading 5 States accounted for about 40% of total U.S. consumption, and the leading 10 States accounted for about 55% of the total.

Cement is a key construction material and it may be expected that cement consumption levels will broadly reflect levels of construction spending, although there can be significant time lags between the onset or cutoff of spending corresponding changes in the consumption of cement or concrete. Lag times are particularly noticeable in sectors involving individual projects requiring high tonnages of concrete (for example, large office buildings or major public sector projects).

According to U.S. Census Bureau data quoted by the Portland Cement Association (2004), overall construction spending levels in 2003 were essentially unchanged (relative to revised 2002 data) at about $700 billion (constant 1996 dollars). Residential construction overall was up by 7.6% to about $364 billion largely owing to an 11.3% increase (to about $238 billion) in construction of new single-family houses; this activity reflected continued very low mortgage and general interest rates. Multifamily residential construction was up by a more modest 2.3% to $27 billion. Virtually all other construction categories showed spending declines in 2003. Nonresidential private construction (for example, office buildings and factories) declined by 8.4% to about $123 billion. Public sector construction spending fell by 2% to about $174 billion, led by a 0.9% fall in public building construction to about $79 billion and a 2.4% decline in the highways and street construction to about $48 billion.

Because nonresidential private and public construction projects tend to be more concrete-intensive than single-family housing construction, it is difficult to reconcile these general spending declines with the higher cement consumption levels noted earlier unless they are related to lag times or to significantly higher use of concrete relative to competing construction materials. The latter can be crudely evaluated through use of a calculated statistic called the "penetration rate" for cement. This can be defined as the tonnage of cement consumed per $1 million in spending. Many variables affect this type of analysis, especially the distribution of spending among different types of construction. Changes in penetration rates can reflect cost or performance advantages of concrete over competing construction materials, promotional efforts by the concrete industry, shifts in spending between new construction and repairs to existing infrastructure, lag times between construction spending and concrete consumption, and underreported cement consumption because of partial substitution in concrete mixes of portland cement by other cementitious materials. Using the apparent consumption data in table 1, the overall construction spending data show a generally increasing trend in penetration rates for 1999 to 2002; $1 million in construction spending bought, in chronological order, about 157 t in 1999; 155 t in 2000; 160 t in 2001; 159 t in 2002; and 163 t in 2003.

Cement Customer Types.—Data on portland cement usage are collected on the basis of the types of customers to whom the cement is sold rather than the direct application itself (table 15). The distinction is that a customer, although classified in one category, may in fact use cement in more than one way. This data set includes a high proportion of estimates, many by the companies themselves, and likely understates consumption in the smaller use(r) categories. As in past years, the dominant customers for cement are the ready-mixed concrete producers, concrete products manufacturers, and road paving contractors.

Types of Portland Cement Consumed.—Sales to final customers of different types of portland cement are listed in table 16. Traditionally, sales of Types I and II, have overwhelmingly been the major cement types sold. In 2003, these two types accounted for about 83% of total portland cement sales, somewhat lower than the 86% in 2002 and lower still than in 2001. The reason for the relative decline is that the market for sulfate-resistant cements (Types II, V, and II/V hybrids) has increased owing largely to the long-lasting construction boom in the Southwestern States. In recent years, some Type II cements sold also have met the specifications of Type V cement or have been labeled as Type II/V hybrids, and these Type II or II/V cements have increasingly been recorded as sales of Type V portland cement on the USGS annual canvass. Sales of Types I, II, and V combined accounted for 92.7% of total sales in 2003, essentially unchanged from 2002. Sales of Type III (high early strength) cements declined somewhat in 2003; owing to the popularity of this type of cement for concrete tilt-up construction, the decline may reflect lower spending levels for multifamily residential and private nonresidential buildings as noted earlier. Sales of some types of blended cements decreased somewhat, but the significance of this is unclear given the preference of the concrete industry to buy SCM directly as additives to their concrete mixes. Blended cements in concrete offer improved performance, especially regarding decreased porosity, improved resistance to chemical attack, and reduced heat of hydration. The latter property, particularly through the use of fly ash as an SCM, has virtually eliminated sales of Type IV (low heat) portland cements.

Prices

Data are collected by the USGS on the mill net values for shipments to final customers by plants and import terminals (terminal nets); the data are listed in tables 12-14. The values are not specific as to type of cement (for ecample, Type I versus Type V portland); the values thus cannot be equated to prices, although they are broadly similar and are casually referred to as prices. Separate valuations are provided by each respondent for gray portland cement (all varieties combined), white portland cement, and masonry cement. In order to protect proprietary data, the values for white portland cement are revealed only for the national totals in table 14 and for imports (table 21); elsewhere they are combined with gray portland cement (table 12). The value data make no distinction between bulk and container (bag or package) shipments; however, container shipments would be expected to have higher unit values.

Relative to most of the other data in this report, mill net value data contain a high percentage of estimates. For gray portland cement, value estimates for 2003 were made for 8% of the facilities canvassed and the estimated fraction in 2002 was 11% of facilities. Values for districts that contain a significant component of estimated values have been rounded; unit values have been rounded to the nearest $0.50. Many of the reported value data appear to be company estimates, and it is evident that some variation exists in how companies calculate their mill net values. Within many companies, increasing centralization of marketing functions has led to respondent personnel at production sites being increasingly divorced from sales data. Accordingly, even where they appear to be unrounded, all value data in this report should be taken as being estimated to some degree, and the values are better viewed as price indices for cement, suitable for crude comparisons among regions and over time. Unit value shifts of less than $0.50 per metric ton ($0.50 per ton) are probably of no statistical significance. Value shifts can reflect changes in actual unit prices within a region, changes in supply sources (for example, imports), changes in the types of cement sold, and changes in the mix of bulk and container sales.

With the above caveats, the average mill net value of portland cement in 2003 was about $73.50 per ton, down by about $1 per ton; this decline partly offset the higher sales tonnages (table 12). Total portland cement shipments were worth about $7.8 billion (table 12). Unit value declines were reported in all but a few districts; some of the larger declines, however, may represent a degree on inconsistent reporting.

The average unit values for gray portland and white portland cements are listed in table 14. The value data for white cement should be viewed with caution because the data incorporate a significant fraction of resales by gray cement companies; such resales are invariably at much higher prices than the values reported by the few producers and importers of white cement. Additionally, white cement includes a larger component of relatively costly package shipments and estimated values. Thus, the modest increase in the white cement unit value in 2003, if real, may not be statistically significant. A discussion of prices for imported white cement is given in the "Foreign Trade" section of this report.

The average mill net value in 2003 for masonry cement was $109 per ton, up by about $1 per ton (table 13). Given the fact that value estimates had to be made for 16% of the respondents reporting masonry cement sales, this apparent increase is probably not statistically significant. Also, some of the reported values for masonry cement suggest the omission of bagging charges, which are supposed to be included. Accordingly, although the market for masonry cement was very strong during the year, some of the unit value changes in table 13 appear to be excessive. The overall increase in the total value of sales, however, is consistent with the significantly higher sales tonnages reported in 2003.

The unit values in tables 12 and 13 are free on board (f.o.b.) the plant. A crude estimate of delivery costs to the customer can be made by comparison to the U.S. 20-city average delivered cement prices (for Type 1 portland and masonry cements) reported monthly by the journal Engineering News-Record. For 2003, the monthly U.S. average Type-1 delivered price for the year was calculated (after conversion to metric units) to be $91.30 per ton; a comparison of this with the average gray portland mill net value of $72.50 per ton in table 14 suggests an average delivery cost of almost $19 per ton. This was considerably higher than the $16 per ton estimate for 2002 and continued a trend (for example, about $12 per ton in 2000 and $14.50 per ton in 2001) that most likely reflects higher fuel costs. Fuel-related higher delivery charges appear to be the main factor responsible for the 3% average price increase for concrete to about $83 per cubic yard (for 4,000 pounds per square inch strength—the middle of the strength range reported). For masonry cement, the Engineering News-Record average price for 2003 was up slightly to about $172 per ton (converted from prices per 70-pound bag). The large difference between this and the average mill net value for masonry appears to incorporate a variety of handling charges for this mainly bagged commodity.

Foreign Trade

Trade data from the U.S. Census Bureau are listed in tables 17-22. Exports of hydraulic cement and clinker increased slightly in 2003 but, except for sales to Canada, remained insignificant (tables 1, 17). Almost all of the exported material was cement.

Overall imports (including into Puerto Rico) of hydraulic cement and clinker in 2003 appear to have decreased by 3.8% to 23.2 Mt (tables 18, 19). The cement component of these imports (table 18 data minus data in table 23) declined by an apparent 5.2% to 21.4 Mt, and the apparent clinker component increased by 14.7% to 1.8 Mt (table 22). The use of the "apparent" qualifier is deliberate because the trade data for 2003 and for an unknown number of recent previous years are incomplete with regards to overland imports from Canada, as discussed below. The clinker data for 2002-03 have been manually corrected to remove "clinker" coming into the Honolulu, HI, district; the material was actually gray portland cement incorrectly registered with the tariff code for clinker. The Honolulu data have been transferred to table 20 (gray portland cement).

The problem with the import data for Canada was first evident for clinker, but is thought to apply to cement imports as well, although the discrepancy with cement is much harder to quantify. The official trade data show insufficient clinker from Canada coming into the Detroit, MI; Milwaukee, WI; and Seattle, WA, customs districts to feed the grinding plants that are located in Michigan, Wisconsin, and Washington, respectively. These plants are essentially reliant on Canadian clinker and do not purchase significant quantities of domestic clinker. The unreported Canadian clinker appears to be that material coming in overland by truck, including material that may be transshipped after truck entry into the United States. Because the individual truckloads are worth less than $2,000 (customs value), the shipments are classified as "informal entries," and data on them are not routinely transmitted by the U.S. Customs Service to the U.S. Census Bureau for recordation into the official trade data (reproduced in tables 18-22). This recordation problem does not exist for imports by rail or by barge or ship because these shipments are larger. Clinker imports from Canada have been estimated to be higher than those reported by about 0.7 Mt for 2002 and about 0.4 Mt for 2003 (tables 1, 22).

Likewise, certain U.S. cement companies with plants in Canada near the U.S. border may allow some of their U.S. final customers to pick up cement at the Canadian plants. Although these sales are being recorded correctly in the companies' monthly reporting to the USGS (table 9), an informal entry data recordation problem could exist for individual truckloads worth less than $2,000. Given the large volumes of Canadian cement that do get recorded by the U.S. Census Bureau and the fact that the USGS monthly canvass form cannot distinguish the mode of entry of imported cement, the magnitude of the underreporting of cement imports from Canada is difficult to estimate.

With the above caveats in mind, the busiest customs district of entry in 2003 was Tampa, FL; this was followed closely by Miami, FL; Houston-Galveston, TX; and Los Angeles, CA (table 19). The leading country suppliers of cement and clinker in 2003 were, in descending order, Canada, Thailand, China, Colombia, the Republic of Korea, Venezuela, Greece, Turkey, Sweden, and Mexico.

White cement imports are listed in table 21. Although no attempt has been made to correct the data, it is evident that a few of the country entries, notably the 2003 entries for the United Arab Emirates and for Venezuela, have unit values that are too low to be white cement. It is likely that this relatively inexpensive material is actually gray portland cement or even gray clinker for which a white cement tariff code was recorded by the importer. Some other entries have values that seem slightly too low and these may contain a component of gray portland cement.

Owing to fuel cost increases during the year, there were widespread informal reports of substantially higher shipping costs for imports as well as steep rises in the chartering rates for cement ships and other bulk carriers owing to a shortage of such vessels. An examination of the unit price data for imports, however, does not appear to bear out these informal reports to a significant degree for 2003. For example, if the data for Canada and Mexico are deducted (to remove the likely overland imports) from the gray portland cement imports in table 20, the average unit value of imports was $30.54 per ton in 2002 and $31.61 per ton in 2003 on a customs value basis and $42.58 per ton and $44.30 per ton, respectively, on a cost, insurance, and freight (c.i.f.) basis. The difference in the two value types (c.i.f. minus customs value) approximates the shipping costs. At $12.04 per ton in 2002 and $12.69 per ton in 2003, the approximate shipping costs rose by only 5.4%. Likewise, the value of oceanic clinker imports (that is, deducting for material from Canada and aluminous cement clinker from France) yields an average shipping rate of $10.53 per ton in 2002 and $12.03 per ton in 2003, a rise of 14.3%. Thus it would appear that, at least for cement, most of the imports did not experience large shipping cost increases in 2003, possibly owing to the existence of long-term import contracts.

World Review

The world hydraulic cement production data listed in table 23 were derived from data collected by USGS country specialists from a variety of sources. The data for some countries may include their exports of clinker. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may not be all inclusive. World cement production increased by about 6% in 2003 to an estimated 1.95 Gt.

More than 150 countries had cement production during the year, although production was very unevenly distributed among them. In terms of country rankings in 2003, China remained by far the leading cement producer with a provisional production of about 813 Mt, or about 42% of the world total. The remaining top 15 countries were, in descending order, India, the United States, Japan, the Republic of Korea, Spain, Russia, Brazil and Italy (tied), Indonesia, Turkey, Thailand, Mexico, and Germany and Iran (tied). Cumulatively, the top 5 countries had about 59% of total world output; the top 10 countries, almost 69%; and the top 15 countries, about 77%.

Regionally, Asia contributed almost 63% of world production and included 6 of the leading 15 producing countries. Western Europe had about 10% of total output; North America, about 7%; the Middle East (including Turkey), about 6%; Central America and South America, about 4%; Africa, about 4%; the Commonwealth of Independent States, about 3%; and Eastern Europe, 2%.

Outlook

Continued low interest rates and very high levels of cement consumption late in 2003 allowed for predictions of about 5% growth in cement consumption in 2004. Indeed, yearend 2003 sales were so strong that many cement plants were finding it difficult to amass clinker stockpiles in advance of their expected early 2004 kiln shutdowns for maintenance. Without the clinker stockpiles, it would be difficult to continue making and supplying cement during the shutdown periods.

Rising fuel costs were of concern because they were increasing the costs of cement production and delivery; general cement price hikes of several dollars per ton were expected in 2004. Renewal of import contracts was expected to be possible only at significantly higher shipping and ship-chartering rates, and with the slow but steady recovery in the economies of several Southeast Asian countries, the availability of hitherto inexpensive cement from these countries was expected to become constrained. The TEA-21 bill was expected to be reauthorized in 2004 but perhaps at lower funding levels than had been proposed. States were anticipated to face continued difficulty in cofunding their share of public sector highway projects. Interest rates were expected to be raised modestly in 2004, and it was likely that continued higher rates would eventually slow the growth in cement consumption during the medium term (2005-10) to a modest 1% to 3% per year. The degree to which suppliers of fly ash, GGBFS, and other cementitious products can displace portland cement in concrete mixes will also affect mid- and long-term growth in cement consumption.

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TABLE 1
SALIENT CEMENT STATISTICS[1]

(Thousand metric tons unless otherwise specified)

		1999	2000	2001	2002	2003
United States:[2]						
Production:						
Cement[3]		85,952	87,846	88,900	89,732	92,843
Clinker		76,003	78,138	78,451	81,517	81,882
Shipments from mills and terminals:[4, 5]						
Quantity		103,271	105,557	112,510	108,500	111,000
Value[6]	thousands	$8,083,247 [7]	$8,292,625 [7]	$8,600,000	$8,250,000	$8,340,000
Average value[8]	dollars per metric ton	$78.27	$78.56	$76.50	$76.00	$75.00
Stocks at mills and terminals, yearend		6,367	7,566	6,600	7,680	6,610
Exports[9]		694	738	746	834	837
Imports for consumption:						
Cement[10]		24,578	24,561	23,694	22,198	21,015
Clinker		4,164	3,673	1,782	1,603	1,808
Total[11]		28,742	28,234	25,474	23,801	22,823
Consumption, apparent[12]		108,862	110,470	112,810	110,020	114,090
World, production[e, 13]		1,600,000	1,660,000 r	1,730,000	1,840,000 r	1,950,000

See footnotes at end of table.

TABLE 1--Continued
SALIENT CEMENT STATISTICS[1]

[e]Estimated. [r]Revised.
[1]Unless otherwise indicated, data are for portland (including blended) and masonry cements only. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.
[2]Excludes Puerto Rico.
[3]Includes cement produced from imported clinker.
[4]Includes imported cement and cement made from imported clinker. Includes sales by import terminals.
[5]Shipments to final domestic customers. Data are from an annual survey of plants and terminals and may differ from the totals in tables 9 and 10, which are based on consolidated monthly surveys from companies.
[6]Value at mill or import terminal of cement shipments to final domestic customers.
[7]Although presented unrounded, the data contain estimates for survey nonrespondents.
[8]Total value at mill or import terminal divided by the total tonnage sold.
[9]All forms of hydraulic cement plus clinker.
[10]All forms of hydraulic cement or clinker, respectively.
[11]Data may not add to totals shown because of independent rounding.
[12]Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in yearend cement stocks.
[13]Total hydraulic cement. May include clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Illinois, metropolitan Chicago	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois, excluding Chicago	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3
PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

	2002					2003				
			Capacity[2]		Stocks			Capacity[2]		Stocks
District[3]	Active plants	Production[4]	Finish grinding	Percentage utilized[5]	at yearend[6]	Active plants	Production[4]	Finish grinding	Percentage utilized[5]	at yearend[6]
Maine and New York	5	3,098	4,200 [7]	73.8 [7]	278 [7]	5	3,117	4,480 [7]	69.5 [7]	277 [7]
Pennsylvania, eastern[8]	7	4,665	5,311	87.8	326	7	4,327	5,320	81.3	321
Pennsylvania, western	3	1,460	1,724	84.7	156	3	1,393	1,660 [7]	83.8 [7]	128
Illinois	4	2,772 [r]	3,408	81.3	188	4	2,925	3,390 [7]	86.2 [7]	243
Indiana	4	2,935	3,502	83.8	278	4	2,928	3,663	79.9	177
Michigan and Wisconsin[9]	6	5,579	7,950 [7]	70.2 [7]	425	6	5,541	7,510 [7]	73.7 [7]	370 [7]
Ohio	2	1,024	1,497	68.4	58	2	1,032	1,530 [7]	67.4	36
Iowa, Nebraska, South Dakota	5	4,446	5,557	80.0	454	5	4,390	5,962	73.6	384
Kansas	4	2,352	3,100 [7]	75.9 [7]	204 [7]	4	2,270	3,024	75.1	193
Missouri	5	4,816	5,731	84.0	556	5	5,182	6,823	75.9	384
Florida[8]	6	3,949	6,680 [7]	59.1 [7]	383 [7]	7	4,190	7,390 [7]	56.7 [7]	452
Georgia, Virginia, West Virginia	4	2,781	4,621	60.2	202	4	2,803	4,620 [7]	60.7 [7]	200 [7]
Maryland	3	1,880	2,420 [7]	77.7 [7]	193 [7]	3	2,203	2,388	92.3	126
South Carolina	3	2,508	3,406	73.6	150	3	3,148	4,340 [7]	72.6	136
Alabama	5	4,544	5,438	83.6	345	5	4,332	5,220 [7]	83.0 [7]	218
Kentucky, Mississippi, Tennessee	4	3,004	3,489	86.1	365	4	3,151	3,490 [7]	90.3 [7]	196
Arkansas and Oklahoma	4	2,498	3,230 [7]	77.3 [7]	194 [7]	4	2,742	3,330 [7]	82.4 [7]	142
Texas, northern[8]	6	5,955	7,044	84.5	423	6	6,400	7,410 [7]	86.4 [7]	302
Texas, southern	5	4,592	5,452	84.2	247	5	4,652	5,450 [7]	85.3	241
Arizona and New Mexico	3	2,270	3,035	74.8	95 [r]	3	2,618	3,035	86.3	102
Colorado and Wyoming	4	2,145	2,520	85.1	96	3	2,470	3,310 [7]	74.6 [7]	115
Idaho, Montana, Nevada, Utah	7	2,874	3,584	80.2	321	7	2,992	4,060 [7]	73.7 [7]	304 [7]
Alaska and Hawaii	--	--	--	--	51	--	--	--	--	35
California, northern	3	2,594	2,880	90.1	182	3	2,489	2,880	86.4	185 [7]
California, southern[8]	8	8,572	10,227	83.8	374	8	9,103	10,300 [7]	88.3 [7]	315 [7]
Oregon and Washington	4	1,970	2,432	81.0	163	4	1,707	2,432	70.2	213
Independent importers, n.e.c.[9]	--	--	--	--	466 [7]	--	--	--	--	382 [7]
Total or average[10]	114	85,283	108,000 [7]	78.7 [7]	7,170 [7]	114	88,106	113,000 [7]	77.9 [7]	6,180 [7]
Puerto Rico	2	1,534	2,160 [7]	71.1 [7]	75 [7]	2	1,485	2,462	60.3	64
Grand total or average[10]	116	86,817	111,000 [7]	78.6 [7]	7,250 [7]	116	89,592	116,000 [7]	77.6 [7]	6,240 [7]

[r]Revised. -- Zero.
[1]Even when presented unrounded, data are thought to be accurate to no more than three significant digits. Includes data for white cement.
[2]Reported grinding capacity is based on fineness needed to produce a plant's normal product mix, including masonry cement, and allowing for downtime for routine maintenance.
[3]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.
[4]Includes cement produced from imported clinker.
[5]Calculated relative to portland cement output.
[6]Includes imported cement. Includes mills and terminals.
[7]Data, even where they appear to be unrounded, contain estimates for nonrespondent or incompletely reporting facilities.
[8]Data, except for stockpiles, exclude one plant that reported cement (clinker) grinding capacity but reported no production of portland cement.
[9]Not elsewhere classified. Data include only those importers or terminals for which regional assignations were not possible.
[10]Data may not add to totals shown because of independent rounding.

TABLE 4
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

	2002			2003		
District[2]	Active plants	Production[3]	Stocks at yearend[4]	Active plants	Production[3]	Stocks at yearend[4]
Maine and New York	4	116	8 [5]	4	117	15 [5]
Pennsylvania, eastern	6	247	51	6	246	44
Pennsylvania, western	3	94	11 [5]	3	96	9
Indiana	4	W	W	4	W	W
Michigan	5	292	50	5	237	37
Ohio	2	85	17 [5]	2	75	12
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	W	W	2	W	W
Missouri	2	W	W	1	W	W
Florida	5	591	34	5	674	35
Georgia, Virginia, West Virginia	5	343 [5]	33 [5]	5	371 [5]	38 [5]
Maryland	2	W	W	2	W	W
South Carolina	3	426	22	3	425	23
Alabama	4	380	75	4	565	51
Kentucky, Mississippi, Tennessee	3	83	13	3	W	W
Arkansas and Oklahoma	4	145	25 [5]	4	149	14
Texas, northern	4	160	11	4	155	11
Texas, southern	3	134	9	3	152	7
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	1	W	W
Alaska and Hawaii	1	W	W	1	4	--
California, northern, Oregon, Washington	3	79	10	3	73	8
California, southern	4	488 [5]	12 [5]	4	519	9
Independent importers, n.e.c.	--	--	2 [5]	--	--	5 [5]
Total[6]	77	4,449 [5, 7]	504 [5]	76	4,737 [5, 7]	434 [5]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.
[1]Includes masonry, portland-lime, and plastic cements. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.
[2]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.
[3]Includes cement produced from imported clinker.
[4]Includes imported cement.
[5]Data, even where apparently unrounded, contain estimates for nonrespondent or incompletely reporting facilities.
[6]Data may not add to totals shown because of independent rounding.
[7]Production from clinker accounted for 95% of the total. Production from finished cement accounted for the remainder.

TABLE 5
CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2003, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

District	Active plants[2]				Number of kilns[3]	Daily capacity[4]	Average days of routine maintenance	Apparent annual capacity[5]	Production[6]	Percentage of capacity utilized	Yearend stocks[7]
	Process used										
	Wet	Dry	Both	Total							
Maine and New York	3	1	--	4	5	10.6	22.6 [8]	3,620 [8]	2,905	80.2 [8]	191 [8]
Pennsylvania, eastern	2	5	--	7	14	16.5	32.1	5,375	4,121	76.7	293
Pennsylvania, western	2	1	--	3	7	5.0	26.6 [8]	1,680 [8]	1,377	81.9 [8]	91
Illinois	--	4	--	4	8	8.6	19.9	2,923	2,572	88.0	197
Indiana	1	3 [9]	--	4	8	10.4	24.6	3,503	2,975	84.9	98
Michigan	1	2	--	3	8	14.0	39.3	4,584	4,001	87.3	334
Ohio	1	1	--	2	3	3.3	23.1	1,138	993	87.2	21
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.9	20.9	4,729	4,060	85.8	192
Kansas	1	3	--	4	9	8.8	37.5	2,924	2,203	75.3	162
Missouri	2	3	--	5	6	15.8	17.5	5,481	4,869	88.8	194
Florida	1	5	--	6	8	15.3	23.4 [8]	5,220 [8]	3,868	74.1 [8]	153
Georgia, Virginia, West Virginia	1	3	--	4	6	9.6	26.8 [8]	3,230 [8]	2,422	75.0 [8]	241
Maryland	1	2	--	3	4	8.1	15.3	2,898	2,083	71.9	40
South Carolina	1	1	1	3	8	14.8	20.5	4,950	2,628	53.1	113
Alabama	--	5	--	5	5	16.4	15.2	5,765	4,590	79.6	222 [8]
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.1	23.5	3,426	3,041	88.8	205
Arkansas and Oklahoma	2	2	--	4	10	8.1	19.1	2,806	2,489	88.7	103
Texas, northern	2	3	1	6	15	20.5	19.8	7,100	6,077	85.6	243
Texas, southern	--	4	1	5	6	13.6	15.9	4,722	4,231	89.6	206
Arizona and New Mexico	--	3	--	3	7	8.6	9.9	3,101	2,554	82.4	187
Colorado and Wyoming	--	3	--	3	4	8.8	18.0	2,996	2,350	78.4	130
Idaho, Montana, Nevada, Utah	3	4	--	7	9	8.9 [8]	20.2 [8]	3,060 [8]	2,759	90.1 [8]	81 [8]
California, northern	--	3	--	3	3	8.7	16.6	3,066	2,363	77.1	93
California, southern	--	8	--	8	17	28.9	11.7	9,814	8,920	90.9	561
Oregon and Washington	1	2	--	3	3	6.3	59.9	1,878	1,430	76.1	84
Total or average[10]	26	78	4	108	186	293.7 [8]	23.7 [8]	100,000 [8]	81,882	81.9 [8]	4,440 [8]
Puerto Rico	--	2	--	2	2	5.9	36.5	1,919	1,434	74.7	118
Grand total or average[10]	26	80	4	110	188	299.6 [8]	23.6 [8]	102,000 [8]	83,315	81.8 [8]	4,560 [8]

-- Zero.
[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits.
[2]Includes white cement plants. Includes all plants active for at least one day during the year.
[3]Kilns active at least one day during year. Excludes idle kilns (full year) that cannot be restarted, fully permitted in less than 6 months.
[4]Sum of reported daily kiln capacities for each plant in district.
[5]Sum of apparent annual kiln capacities; for each kiln calculated as 365 days minus reported days as shut down for routine maintenance and then multiplied by the reported (unrounded) daily capacity.
[6]If annual survey data were unavailable for an annual survey nonrespondent plant, monthly survey clinker production data for the facility were summed and incorporated.
[7]Includes imported clinker and clinker stockpiles at grinding plants.
[8]Data, even where apparently unrounded, contain estimates for nonrespondent or incompletely reporting facilities.
[9]Includes one semidry kiln.
[10]Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

Raw materials	2002 Clinker	2002 Cement[3]	2003 Clinker	2003 Cement[3]
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	107,000	1,330	109,000	1,530
Cement rock (includes marl)	16,200	39	12,700	44
Cement kiln dust (CKD)[4]	688	164	289	149
Lime[5]	196	34	22	27
Other	5	18	235	32
Aluminous:				
Clay	4,770	--	3,950	--
Shale	3,230	9	2,630	8
Other[6]	540	--	618	--
Ferrous, iron ore, pyrites, millscale, other	1,260	--	1,340	--
Siliceous:				
Sand and calcium silicate	2,960	2	2,860	2
Sandstone, quartzite soils, other	692	--	587	2
Fly ash	1,960	64	2,250	39
Other ash, including bottom ash	990	--	1,100	--
Granulated blast furnace slag[7]	60	369	17	333
Other blast furnace slag	162	--	214	--
Steel slag	481	--	448	--
Other slags	67	4	113	--
Natural rock pozzolans[8]	--	28	--	25
Other pozzolans[9]	165	7	129	49
Other:				
Gypsum and anhydrite	--	4,740	--	5,000
Other, n.e.c.	21	52	70	68
Total[10]	141,000	6,860	139,000	7,300
Clinker, imported, raw materials equivalent[11]	--	5,230	--	4,240
Grand total[10]	141,000	12,100	139,000	11,500

-- Zero.

[1]Nonfuel raw materials. Includes Puerto Rico.

[2]Data have been rounded to three significant digits to reflect inherent reporting accuracy and the incorporation of estimates for some facilities.

[3]Includes portland, blended, and masonry cements.

[4]Data are underreported.

[5]Data are probably underreported, especially regarding incorporation within masonry cements.

[6]Includes alumina, aluminum dross, bauxite, catalysts, staurolite, and other materials.

[7]Includes both ground (GGBFS) and unground material.

[8]Includes pozzolana and burned clays and shales except where reported directly as clay or shale.

[9]Includes diatomite, silica fume, other microcrystalline silica, and other pozzolans, whether or not used as such.

[10]Data may not add to totals shown because of independent rounding.

[11]Converted as the weight of foreign clinker consumed times 1.7.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS[1, 2]

Kiln process	Clinker produced[3]: Active plants	Clinker produced[3]: Quantity (thousand metric tons)	Clinker produced[3]: Percentage of total	Fuel consumed: Coal[4] (thousand metric tons)	Fuel consumed: Coke[5] (thousand metric tons)	Fuel consumed: Petroleum coke (thousand metric tons)	Fuel consumed: Oil[6] (thousand liters)	Fuel consumed: Natural gas (thousand cubic meters)	Waste fuel: Tires (thousand metric tons)	Waste fuel: Solid (thousand metric tons)	Waste fuel: Liquid (thousand liters)
2002:											
Wet	27	14,599	17.6	1,990	15	500	22,900	45,000	87	73	725,000
Dry	80	64,633	77.9	7,170	3	1,380	69,700	367,000	210	39	188,000
Both	3	3,727	4.5	540	--	30	--	67,000	6	--	47,800
Total[7]	110	82,959	100.0	9,690	17	1,910	92,600	479,000	304	112	962,000
2003:											
Wet	26	13,259	15.9	1,830	--	528	24,300	33,400	92	234	686,000
Dry	79	65,201	78.3	6,940	3	1,420	61,200	286,000	291	52	185,000
Both	4	4,855	5.8	696	--	26	--	58,100	5	31	39,000
Total[7]	109	83,315	100.0	9,460	3	1,980	85,400	377,000	387	317	910,000

-- Zero.

[1]All fuel data have been rounded to three significant digits.

[2]Includes Puerto Rico.

[3]Clinker data were all reported; although not rounded, data are thought to be accurate to no more than three significant digits.

[4]All reported to be bituminous.

[5]Data are likely to be all or mostly misreported petroleum coke.

[6]Distillate and residual fuel oils; excludes used oils included under liquid wastes.

[7]Data may not add to totals shown because of independent rounding.

TABLE 8

ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS[1]

Plant process	Electric energy used[2]: Generated at plant: Number of plants	Generated at plant: Quantity (million kilowatthours)	Purchased: Number of plants	Purchased: Quantity (million kilowatthours)	Total: Quantity (million kilowatthours)	Total: Percentage	Finished cement produced[3] (thousand metric tons)	Average consumption (kilowatthours per metric ton of cement produced)
2002:								
Integrated plants:								
Wet	--	--	27	2,190	2,190	16.8	16,044	136
Dry	5	539	80	9,700	10,200	78.6	69,150	148
Both	--	--	3	595	595	4.6	3,742	159
Total or average[4]	5	539	110	12,500	13,000	100.0	88,936	146
Grinding plants[5]	--	--	6	175	175	--	2,192	80
Exclusions[6]	--	--	2	--	--	--	136	--
2003:								
Integrated plants:								
Wet	--	--	26	2,190	2,190	16.5	15,618	140
Dry	5	526	79	9,760	10,300	77.4	72,895	141
Both	--	--	4	814	814	6.1	5,816	140
Total or average[4]	5	526	109	12,800	13,300	100.0	94,329	141
Grinding plants[5]	--	--	6	166	166	--	2,169	77
Exclusions[6]	--	--	2	--	--	--	139	--

-- Zero.

[1]Includes Puerto Rico.

[2]Electricity data are rounded because they include estimates for a number of nonrespondent plants or incomplete reporting by respondent facilities.

[3]Includes portland and masonry cements. Data are all reported and have not been rounded.

[4]Data may not add to totals shown because of independent rounding.

[5]Excludes plants that reported production only of masonry cement.

[6]Tonnage of cement produced by plants that reported production of masonry cement only.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2002	Portland cement 2003[3]	Masonry cement 2002	Masonry cement 2003[3]
Destination:				
Alabama	1,479	1,598	145	162
Alaska[4]	137	165	--	(5)
Arizona	3,293	3,608	107	109
Arkansas	946	1,094	61	69
California, northern	4,567	4,681	106	111
California, southern	8,066	8,574	411	450
Colorado	2,612	2,290	24	27
Connecticut[4]	746	757	14	15
Delaware[4]	193	174	11	11
District of Columbia[4]	186	195	1	(5)
Florida	7,828	8,588	681	766
Georgia	3,087	3,445	292	321
Hawaii	312	340	5	5
Idaho	567	590	1	1
Illinois, excluding Chicago	1,728	1,756	22	26
Illinois, metropolitan Chicago[4]	2,384	2,234	62	62
Indiana	2,081	2,176	92	93
Iowa	1,734	1,718	8	7
Kansas	1,498	1,540	15	15
Kentucky	1,228	1,337	96	107
Louisiana[4]	1,679	1,832	52	62
Maine	208	219	5	5
Maryland	1,309	1,343	85	85
Massachusetts[4]	1,395	1,264	21	20
Michigan	3,146	3,052	146	142
Minnesota[4]	1,998	2,068	48	50
Mississippi	910	983	56	64
Missouri	2,500	2,664	44	47
Montana	323	375	1	1
Nebraska	1,184	1,207	9	8
Nevada	1,843	2,026	20	23
New Hampshire[4]	244	233	6	5
New Jersey[4]	1,975	1,886	79	75
New Mexico	824	813	8	9
New York, eastern	698	645	28	26
New York, western[4]	804	819	30	29
New York, metropolitan[4]	1,655	1,685	67	75
North Carolina[4]	2,510	2,469	294	305
North Dakota[4]	311	330	3	3
Ohio	3,763	3,830	192	189
Oklahoma	1,363	1,481	48	54
Oregon	1,040	1,005	1	1
Pennsylvania, eastern	2,187	1,948	65	61
Pennsylvania, western	1,133	1,166	68	68
Rhode Island[4]	167	197	3	3
South Carolina	1,369	1,499	135	138
South Dakota	423	452	2	2
Tennessee	1,809	1,885	210	223
Texas, northern	6,270	6,680	195	192
Texas, southern	6,002	6,359	141	191
Utah	1,166	1,200	1	(5)
Vermont[4]	116	136	3	3
Virginia	2,119	2,100	157	169
Washington	1,899	1,903	2	2
West Virginia	424	432	26	27
Wisconsin	2,054	2,229	29	30
Wyoming	413	424	1	1
Total[6]	103,905	107,699	4,435	4,745

See footnotes at end of table.

TABLE 9--Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

	Portland cement		Masonry cement	
Destination and origin	2002	2003[3]	2002	2003[3]
Destination--Continued:				
Foreign countries[7]	438	483	(5)	(5)
Puerto Rico	1,882	1,858	--	--
Grand total[6]	106,225	110,040	4,436	4,745
Origin:				
United States	85,431	89,598	4,400	4,701
Puerto Rico	1,542	1,484	--	--
Foreign countries[8]	19,250	18,960	37	44
Total shipments[6]	106,225	110,042	4,436	4,745

-- Zero.

[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.

[2]Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 11-13, 15, and 16, which are from annual surveys of individual plants and importers. Includes any revisions to monthly data available through September 30, 2004. Although presented unrounded, data are thought to be accurate to no more than three significant digits.

[3]Data incorporate monthly revisions available through the June 2003 data cycle.

[4]Has no cement plants.

[5]Less than 1/2 unit.

[6]Data may not add to totals shown because of independent rounding.

[7]Includes shipments to U.S. possessions and territories.

[8]Imported cement distributed in the United States as reported by domestic producers and other importers. Data do not match the imports calculated from tables 19 and 22.

TABLE 10

CEMENT SHIPMENTS, BY DESTINATION (REGION AND CENSUS DISTRICT)[1, 2]

	Portland cement				Masonry cement			
	Quantity (thousand metric tons)		Percentage of U.S. total		Quantity (thousand metric tons)		Percentage of U.S. total	
Region and census district	2002	2003	2002	2003	2002	2003	2002	2003
Northeast:								
New England[3]	2,877	2,806	3	3	52	51	1	1
Middle Atlantic[4]	8,452	8,149	8	8	338	334	8	7
Total[5]	11,329	10,955	11	10	390	385	9	8
South:								
South Atlantic[6]	19,024	20,245	18	19	1,683	1,822	38	38
East South Central[7]	5,426	5,803	5	5	507	556	11	12
West South Central[8]	16,259	17,446	16	16	497	568	11	12
Total[5]	40,709	43,494	39	40	2,686	2,946	60	62
Midwest:								
East North Central[9]	15,154	15,277	15	14	542	542	12	11
West North Central[10]	9,649	9,979	9	9	130	132	3	3
Total[5]	24,803	25,256	24	23	672	674	15	14
West:								
Mountain[11]	11,041	11,326	11	11	163	171	4	4
Pacific[12]	16,021	16,668	15	15	525	569	11	12
Total[5]	27,063	27,994	26	26	688	740	16	16
Grand total[5]	103,905	107,699	100	100	4,435	4,745	100	100

[1]Excludes Puerto Rico. Includes imported cement shipped by importers and cement ground from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Data are based on table 9.

[3]Includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

[4]Includes New Jersey, New York, and Pennsylvania.

[5]Data may not add to totals shown because of independent rounding.

[6]Includes Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia.

[7]Includes Alabama, Kentucky, Mississippi, and Tennessee.

[8]Includes Arkansas, Louisiana, Oklahoma, and Texas.

[9]Includes Illinois, Indiana, Michigan, Ohio, and Wisconsin.

[10]Includes Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.

[11]Includes Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming.

[12]Includes Alaska, California, Hawaii, Oregon, and Washington.

TABLE 11

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total shipments to consumer
	In bulk	In containers[3]	In bulk	In containers[3]	In bulk	In containers[3]	
2002:							
Railroad	11,600	29	1,620	--	368	1	1,990
Truck	2,590	220	55,700	2,350	45,100	586	104,000
Barge and boat	9,320	--	127	1	108	--	236
Total[4]	23,500	248	57,400	2,350	45,600	587	106,000 [5]
2003:							
Railroad	12,200	7	1,770	--	411	19	2,200
Truck	4,380	142	56,800	2,030	46,300	745	106,000
Barge and boat	7,910	--	141	1	44	--	186
Total[4]	24,400	149	58,700	2,030	46,800	764	108,000 [5]

-- Zero.

[1]Includes Puerto Rico. Includes imported cement and cement made from imported clinker.

[2]Data are rounded to no more than three significant digits because they include estimates.

[3]Includes packages, bags, and jumbo bags.

[4]Data may not add to totals shown because of independent rounding.

[5]Shipments calculated on the basis of an annual survey of plants and importers; may differ from totals in tables 9 and 10, which are based on consolidated monthly data.

TABLE 12

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1]

	2002			2003		
		Value[2]			Value[2]	
District[3, 4]	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	3,440 [5]	$264,000 [5]	$76.50 [5]	2,142	$158,000 [5]	$74.00 [5]
Pennsylvania, eastern	4,608	336,981	73.13	4,336	317,000 [5]	73.00 [5]
Pennsylvania, western	1,407	110,000 [5]	78.50 [5]	1,404	106,000 [5]	75.50 [5]
Illinois	2,844	209,835	73.77	2,988	215,000 [5]	72.00 [5]
Indiana	2,900	194,945	67.23	2,830 [5]	196,379	69.39
Michigan and Wisconsin	6,540 [5]	490,000 [5]	75.00 [5]	6,600 [5]	490,000 [5]	74.00 [5]
Ohio	1,051	80,446	76.52	1,078	85,872	79.64
Iowa, Nebraska, South Dakota	4,892	379,492	77.57	4,869	378,034	77.65
Kansas	2,048	157,373	76.85	2,051	156,000 [5]	76.00 [5]
Missouri	5,886	407,544	69.24	6,291	426,931	68.87
Florida	7,413	558,389	75.32	8,289	638,000 [5]	77.00 [5]
Georgia, Virginia, West Virginia	2,747	209,000 [5]	76.00 [5]	2,730	193,000 [5]	70.50 [5]
Maryland	2,094	155,565	74.30	2,483	165,935	66.82
South Carolina	2,857	200,330	70.13	3,210	198,000 [5]	61.50 [5]
Alabama	4,290 [5]	282,000 [5]	65.50 [5]	4,275	269,000 [5]	63.00 [5]
Kentucky, Mississippi, Tennessee	2,990	208,000 [5]	69.50 [5]	3,183	218,000 [5]	68.50 [5]
Arkansas and Oklahoma	2,520 [5]	181,000 [5]	72.00 [5]	2,797	196,459	70.24
Texas, northern	6,004	434,000 [5]	72.00 [5]	6,660 [5]	449,000 [5]	67.50 [5]
Texas, southern	5,967	404,128	67.72	6,020 [5]	408,030	67.78
Arizona and New Mexico	3,509	318,164	90.66	3,676	342,180	93.08
Colorado and Wyoming	2,521	191,479	75.96	2,329	169,619	72.82
Idaho, Montana, Nevada, Utah	2,860	232,000 [5]	81.00 [5]	3,097	245,000 [5]	79.00 [5]
Alaska and Hawaii	410	53,313	130.11	454	58,952	129.80
California, northern	3,441	273,661	79.53	3,751	302,695	80.69
California, southern	9,546	720,350	75.46	9,881	740,801	74.97
Oregon and Washington	2,099	165,000 [5]	78.50 [5]	1,897	145,334	76.61
Independent importers, n.e.c.[6]	7,213	558,000 [5]	77.50 [5]	7,140 [5]	555,000 [5]	78.00 [5]
Total or average[7]	104,000 [5, 8]	7,770,000 [5]	74.50 [5]	106,000 [5, 8]	7,820,000 [5]	73.50 [5]
Puerto Rico	1,885	W	W	1,848	W	W
Grand total[7]	106,000 [5]	W	W	108,000 [5, 8]	W	W

W Withheld to avoid disclosing company proprietary data.

[1]Includes portland cement (gray and white) and cement produced from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Values represent mill net or ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded, but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded value data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per ton.

[3]District is the location of the reporting facility, not the location of sales.

[4]Includes shipments by independent importers where regional assignations were possible.

[5]Data are rounded (unit values to the nearest $0.50) because they contain estimated data.

[6]Importers for which district assignations were not possible.

[7]Data may not add to totals shown because of independent rounding.

[8]Shipments calculated on the basis of an annual survey of plants and importers; may differ from tables 9 and 10, which are based on consolidated company monthly data.

TABLE 13

MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1, 2]

	2002			2003		
		Value[3]			Value[3]	
District[4]	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	97 [5]	$9,640 [5]	$100.00 [5]	112 [5]	$11,600 [5]	$104.00 [5]
Pennsylvania, eastern	230	25,400 [5]	110.00 [5]	317 [5, 6]	36,700 [5, 6]	116.00 [5, 6]
Pennsylvania, western	88	9,980 [5]	114.00 [5]	W	W	W
Illinois, Indiana, Ohio	484	55,184 [5]	114.00 [5]	494	57,040	115.43
Michigan	273	28,400	104.00	269	27,500 [5]	102.50 [5]
Iowa, Nebraska, South Dakota	44 [5]	4,940 [5]	113.00 [5]	32	5,291	165.72
Kansas and Missouri	131	11,746	89.90	146	13,804	94.76
Florida	610	65,583	107.50	675	83,093	123.04
Georgia, Maryland, Virginia, West Virginia	388	54,800 [5]	141.00 [5]	428	53,200 [5]	124.50 [5]
South Carolina	389	37,616	96.59	416	42,767	102.71
Alabama	428 [5]	47,300 [5]	111.00 [5]	488	48,100 [5]	98.50 [5]
Kentucky, Mississippi, Tennessee	93	10,900 [5]	117.00 [5]	118	13,500 [5]	114.00 [5]
Arkansas and Oklahoma	135 [5]	13,800 [5]	102.00 [5]	159	15,220	95.52
Texas, northern	133	16,100 [5]	121.00 [5]	130	17,500 [5]	134.50 [5]
Texas, southern	139	13,454	96.49	160	16,586	103.45
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	143	14,500 [5]	102.00 [5]	148	14,500 [5]	98.00 [5]
Alaska and Hawaii	4	887	223.77	4	724	173.05
California, northern; Oregon; Washington	79	7,933	100.00	76	6,487	85.08
California, southern	487	44,237	90.75	535	48,379	90.51
Independent importers, n.e.c.[7]	27	3,370	124.00	28	3,600 [5]	130.00 [5]
Total or average[8]	4,400 [5, 9]	476,000 [5]	108.00 [5]	4,740 [5, 9]	516,000 [5]	109.00 [5]

W Withheld to avoid disclosing company proprietary data; included in "Pennsylvania, eastern."

[1]Shipments are to final customers and include imported cement and cement made from imported clinker. Data excludes Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes gray, white, and colored varieties of masonry, portland-lime, and plastic cements.

[3]Values represent ex-plant (free-on-board) valuations of total sales to final customers, including sales from distribution terminals. Data, even where unrounded, should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per ton.

[4]District location is that of the reporting facilities, not necessarily the location of sales.

[5]Data are rounded (unit values to the nearest $0.50) because they contain a component of estimates.

[6]Data include "Pennsylvania, western."

[7]Importers for which district assignations were not possible.

[8]Data may not add to totals shown because of independent rounding.

[9]Tonnages based on an annual survey of plants and terminals and may differ from the totals in tables 9 and 10, which represent consolidated monthly surveys of companies.

TABLE 14

AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

Year	Gray portland cement	White portland cement	All portland cement	Prepared masonry cement	All classes of cement
2002	74.00	157.00	74.50	108.00	76.00
2003	72.50	159.00	73.50	109.00	75.00

[1]Excludes Puerto Rico. Values are the average of sales to final customers, free on board plant or import terminal, less all discounts, allowances, and onward delivery charges to customers or distribution terminals, but inclusive of bagging charges.

[2]Data are rounded to the nearest $0.50 because of the inclusion of a significant component of estimates.

TABLE 15
PORTLAND CEMENT SHIPMENTS IN 2003, BY DISTRICT AND TYPE OF CUSTOMER[1]

(Thousand metric tons)

District[2, 3]	Ready-mixed concrete	Concrete product manufacturers[4]	Contractors[5]	Building material dealers	Oil well, mining, waste[6]	Government and miscellaneous[7]	Total[8, 9]
Maine and New York	1,480	450	8	198	--	9	2,142
Pennsylvania, eastern	2,600	1,260	136	236	2	104	4,336
Pennsylvania, western	904	223	119	144	7	7	1,404
Illinois	2,410	190	78	36	167	104	2,988
Indiana	2,070	432	227	80	7	10	2,830
Michigan and Wisconsin	5,200	729	349	265	10	48	6,600
Ohio	907	97	48	26	--	--	1,078
Iowa, Nebraska, South Dakota	3,610	603	440	52	80	83	4,869
Kansas	1,570	132	281	34	12	2	2,051
Missouri	5,090	524	549	91	1	34	6,291
Florida	6,140	1,470	229	391	--	54	8,289
Georgia, Virginia, West Virginia	2,130	332	161	84	12	3	2,730
Maryland	1,830	394	119	65	1	74	2,483
South Carolina	2,150	653	240	130	2	32	3,210
Alabama	3,240	677	159	168	22	12	4,275
Kentucky, Mississippi, Tennessee	2,580	366	146	78	11	4	3,183
Arkansas and Oklahoma	2,070	186	416	37	66	19	2,797
Texas, northern	4,390	588	1,250	81	306	40	6,660
Texas, southern	4,470	552	481	158	343	20	6,020
Arizona and New Mexico	2,550	564	219	191	19	130	3,676
Colorado and Wyoming	1,740	295	172	62	48	12	2,329
Idaho, Montana, Nevada, Utah	2,510	201	95	55	208	33	3,097
Alaska and Hawaii	391	57	5	1	--	--	454
California, northern	3,190	299	128	132	--	2	3,751
California, southern	6,790	2,340	349	325	63	9	9,881
Oregon and Washington	1,510	189	50	93	14	45	1,897
Independent importers, n.e.c.[10]	5,410	875	333	397	41	78	7,140
Total[9]	79,000	14,700	6,790	3,610	1,440	969	106,000
Puerto Rico	1,110	193	73	475	--	1	1,848
Grand total[9]	80,100	14,900	6,860	4,090	1,440	970	108,000

-- Zero.

[1]Includes imported cement and cement ground from imported clinker. Except for district totals, data have been rounded to three significant digits but are likely to be accurate to only two significant digits. District totals are accurate to no more than three significant digits.

[2]District location is that of the reporting facilities and may include sales by them into other districts.

[3]Includes shipments by independent importers for which district assignations were possible.

[4]Grand total shipments to concrete product manufacturers include brick and block--6,230; precast and prestressed--3,810; pipe--1,890; and other or unspecified--2,943.

[5]Grand total shipments to contractors include airport--215; road paving--3,600; soil cement--660; and other or unspecified--2,385.

[6]Grand total shipments include oil well drilling--1,190; mining--180; and waste stabilization--73.

[7]Includes shipments for which customer types were not specified.

[8]District totals are not rounded except in accord with the data in table 12.

[9]Data may not add to totals shown because of independent rounding.

[10]Shipments by independent importers for which district assignations were not possible.

TABLE 16
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE[1, 2]

(Thousand metric tons)

Type	2002	2003
General use and moderate heat (Types I and II) (gray)	90,800	89,500
High early strength (Type III)	3,820	3,750
Sulfate resisting (Type V)	7,300	10,600
Block	607	752
Oil well	889	1,090
White[3]	952	985
Blended:		
Portland, natural pozzolans	187	142
Portland, granulated blast furnace slag	753	747
Portland, fly ash	218	240
Other blended cement[4]	365	438
Total[5]	1,520	1,570
Expansive and regulated fast setting	66	52
Miscellaneous[6]	55	88
Grand total[5, 7]	106,000	108,000

[1]Includes Puerto Rico. Includes imported cement.
[2]Data have been rounded to three significant digits.
[3]Mostly Types I and II, but may include Types III-V and block varieties.
[4]Includes blends with other pozzolans, such as cement kiln dust and silica fume.
[5]Data may not add to totals shown because of independent rounding.
[6]Includes low heat (Type IV), waterproof, and other portland cements.
[7]Data are based on an annual survey of plants and importers; may differ from tables 9 and 10, which are based on monthly consolidated data from companies.

TABLE 17

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

Country of destination	2002 Quantity	2002 Value[2]	2003 Quantity	2003 Value[2]
Bahamas, The	17	1,822	11	1,416
Brazil	1	90	1	108
Canada	704	45,809	720	50,291
China	1	149	4	251
Dominican Republic	2	277	24	1,672
Egypt	(3)	8	1	54
El Salvador	--	--	1	98
Finland	--	--	2	75
Greece	(3)	127	1	190
Hong Kong	(3)	59	1	97
Israel	(3)	19	1	40
Jamaica	37	1,510	(3)	59
Japan	2	270	1	109
Korea, Republic of	1	70	3	156
Mexico	46	4,860	35	3,817
Netherlands Antilles	2	112	(3)	31
Nigeria	1	53	1	30
Oman	(3)	46	8	401
Panama	1	90	1	97
Peru	(3)	100	1	45
Portugal	1	33	--	--
Russia	1	80	1	34
Saudi Arabia	1	35	1	33
Singapore	2	79	1	23
Spain	2	117	1	99
Switzerland	(3)	19	1	59
Taiwan	1	128	2	158
Thailand	(3)	26	1	22
Trinidad and Tobago	(3)	101	1	124
Turks and Caicos Island	(3)	10	6	305
Ukraine	1	30	(3)	11
United Arab Emirates	2	98	1	101
United Kingdom	(3)	5	1	31
Venezuela	1	83	2	338
Other	7 r	1,428 r	2	1,221
Total[4]	834	57,743	837	61,596

[r]Revised. -- Zero.

[1]Includes portland and masonry cements.

[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

[3]Less than 1/2 unit.

[4]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 18

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Country of origin	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Brazil	99	4,236	4,276	266	8,927	11,677
Bulgaria	356	14,467	18,902	151	6,318	7,770
Canada	5,181	302,930	321,946	5,601	299,839	333,191
China[4]	2,165	66,204	88,884	1,823	58,315	80,752
Colombia	1,579	57,158	75,475	1,766	65,167	85,618
Croatia	25	5,052	6,214	36	6,700	8,122
Cyprus	75	1,845	1,849	--	--	--
Denmark	333	17,013	24,903	433	19,581	29,497
Egypt	9	913	1,115	58	2,972	4,177
France	85	15,544	16,761	90	9,535	10,703
Germany	42	381	810	3	970	2,181
Greece	1,785	58,637	78,030	1,188	36,602	50,550
Indonesia	272	5,568	9,698	--	--	--
Italy	(5)	113	122	(5)	29	31
Korea, Republic of	1,625	40,312	61,792	1,745	46,463	69,511
Lebanon	94	1,877	3,117	--	--	--
Mexico	1,228	52,366	64,620	891	41,950	53,767
Netherlands	41	3,009	3,974	5	3,021	3,630
Norway	508	21,558	22,418	471	20,479	20,561
Peru	372	12,433	17,303	459	14,101	20,419
Philippines	294	6,841	10,567	206	5,353	8,151
Spain	327	15,449	19,771	355	17,799	23,855
Sweden	1,047	33,504	42,954	924	29,521	38,298
Switzerland[6]	18	557	778	29	839	1,198
Taiwan	115	3,628	4,643	395	14,674	18,095
Thailand	4,259	117,969	177,581	3,344	98,199	149,254
Turkey	684	22,412	30,388	1,077	35,246	50,672
Venezuela	1,530	52,021	72,614	1,664	57,397	81,472
Other	20 r	5,059 r	6,216 r	262	12,805	16,606
Total[7]	24,169	939,056	1,187,718	23,242	912,802	1,179,758

[r]Revised. -- Zero.

[1]Includes portland, masonry, and other hydraulic cements. Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]China may be underrepresented; it is believed that all or some imports reported to be from Japan may be from China.

[5]Less than 1/2 unit.

[6]The country origin of these imports is thought to be misreported.

[7]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 19

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Anchorage, AK:						
Canada	8	449	850	10	596	1,149
China	18	779	1,089	--	--	--
Korea, Republic of	66	1,900	2,810	132	3,947	5,854
Total[4]	93	3,128	4,748	142	4,543	7,004
Baltimore, MD:						
Belgium	(5)	4	6	--	--	--
Greece	250	9,648	12,826	--	--	--
Netherlands	1	613	672	1	988	1,129
Total[4]	251	10,266	13,504	1	988	1,129
Boston, MA:						
Netherlands	(5)	133	164	(5)	88	106
Venezuela	210	7,593	10,061	176	6,148	8,230
Total[4]	210	7,725	10,225	176	6,237	8,336
Buffalo, NY:						
Canada	639	39,470	41,700	704	41,222	43,558
Denmark	(5)	5	5	--	--	--
France	--	--	--	(5)	35	36
United Kingdom	4	742	792	7	1,387	1,574
Total[4]	643	40,217	42,498	711	42,644	45,168
Charleston, SC:						
China	--	--	--	8	761	1,011
Colombia	593	20,692	29,225	506	17,839	24,721
Egypt	--	--	--	39	1,523	2,120
Greece	429	13,514	17,595	272	8,586	12,103
Indonesia	158	2,550	4,950	--	--	--
Netherlands	--	--	--	(5)	32	40
Sri Lanka	--	--	--	7	223	524
Spain	44	275	660	8	273	274
Thailand	70	1,153	2,299	--	--	--
United Kingdom	2	815	946	3	1,144	1,287
Total[4]	1,296	38,999	55,674	843	30,381	42,081
Chicago, IL:						
Canada	31	1,737	1,934	35	1,872	1,962
Japan	(5)	69	75	(5)	43	49
Netherlands	1	391	495	1	343	423
United Kingdom	(5)	3	4	--	--	--
Total[4]	32	2,199	2,508	37	2,258	2,434
Cleveland, OH:						
Canada	744	40,333	41,147	697	36,531	37,923
United Kingdom	--	--	--	1	248	319
Total[4]	744	40,333	41,147	698	36,779	38,242
Columbia-Snake, ID-OR-WA:						
Canada	104	5,479	5,780	56	2,712	2,854
China	412	13,379	18,081	481	15,305	21,222
Total[4]	516	18,859	23,861	538	18,017	24,075
Detroit, MI:						
Brazil	99	4,236	4,276	50	2,132	2,165
Canada	1,244	82,524	84,182	1,553	91,252	99,513
Denmark	(5)	36	41	--	--	--
France	--	--	--	(5)	3	3
Netherlands	--	--	--	(5)	19	24
Norway	--	--	--	23	910	920
Sweden	--	--	--	(5)	5	9
Total[4]	1,344	86,795	88,499	1,626	94,321	102,634
Duluth, MN, Canada	221	11,966	15,251	189	8,865	10,093
El Paso, TX, Mexico	406	15,250	19,284	189	10,245	11,913

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Great Falls, MT:						
Canada	9	403	531	14	585	741
France	--	--	--	(5)	5	5
Total[4]	9	403	531	14	590	746
Honolulu, HI:						
China	126	3,339	4,762	32	835	1,206
Philippines	153	3,728	5,282	206	5,353	8,151
Thailand	39	937	1,328	77	2,097	3,498
Total[4]	318	8,005	11,373	314	8,285	12,856
Houston-Galveston, TX:						
Belgium	--	--	--	(5)	9	12
Brazil	--	--	--	3	369	394
Chile	2	483	558	--	--	--
Colombia	116	4,887	7,301	140	6,844	9,289
Denmark	5	187	340	--	--	--
Egypt	9	837	1,030	19	1,447	2,053
France	(5)	209	252	(5)	121	149
Germany	(5)	13	15	(5)	146	182
Japan	(5)	22	30	--	--	--
Korea, Republic of	1,394	34,606	52,180	1,393	37,139	54,894
Peru	284	9,346	13,068	312	10,843	15,293
Philippines	82	1,739	2,784	--	--	--
Thailand	167	10,302	11,850	79	3,154	4,114
Turkey	14	1,207	1,625	--	--	--
United Arab Emirates	--	--	--	6	396	406
United Kingdom	(5)	133	153	(5)	198	247
Venezuela	65	2,043	2,649	73	2,557	3,570
Total[4]	2,137	66,015	93,835	2,026	63,223	90,602
Laredo, TX:						
China	(5)	27	34	--	--	--
Mexico	146	16,344	17,179	124	13,840	14,580
Total[4]	147	16,371 r	17,213 r	124	13,840	14,580
Los Angeles, CA:						
Australia	(5)	17	19	--	--	--
China[6]	1,219	35,732	47,462	709	22,708	30,636
Colombia	1	254	317	2	208	301
Egypt	--	--	--	(5)	3	4
Germany	(5)	6	7	--	--	--
Italy	--	--	--	(5)	25	26
Japan[6]	--	--	--	223	7,059	9,759
Netherlands	(5)	9	12	--	--	--
Taiwan	115	3,628	4,643	395	14,674	18,095
Thailand	607	15,586	23,032	646	19,304	29,278
United Kingdom	(5)	69	79	(5)	58	73
Total[4]	1,943	55,302	75,571	1,976	64,039	88,172
Miami, FL:						
Belgium	2	379	402	2	315	334
Colombia	23	1,138	1,490	32	1,673	2,245
Denmark	--	--	--	17	539	706
Germany	(5)	11	14	(5)	11	14
Greece	351	11,716	14,847	318	9,599	12,567
Ireland	--	--	--	(5)	10	14
Jamaica	--	--	--	(5)	3	3
Spain	283	15,164	19,099	326	16,878	22,370
Sweden	809	25,688	32,620	913	28,133	36,632
Thailand	--	--	--	--	--	--
Turkey	217	6,088	8,041	388	11,123	15,043

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Miami, FL--Continued:						
United Kingdom	(5)	104	132	1	125	162
Venezuela	57	1,725	2,264	71	2,557	3,742
Total[4]	1,743	62,012	78,908	2,067	70,967	93,833
Milwaukee, WI:						
Canada	143	8,049	8,569	270	14,605	14,988
Cyprus	75	1,845	1,849	--	--	--
Total[4]	218	9,894	10,417	270	14,605	14,988
Minneapolis, MN, Germany	(5)	7	11	--	--	--
Mobile, AL:						
Colombia	--	--	--	53	1,681	2,180
Lebanon	94	1,877	3,117	--	--	--
Thailand	399	8,492	14,772	287	6,846	11,182
United Kingdom	1	174	199	(5)	25	43
Venezuela	7	221	276	27	800	1,126
Total[4]	501	10,765	18,364	368	9,352	14,530
New Orleans, LA:						
Bulgaria	121	4,698	6,373	--	--	--
China	11	1,072	1,263	16	1,374	1,672
Colombia	28	967	1,255	22	773	1,055
Croatia	21	4,181	5,106	35	6,551	7,955
Greece	206	6,833	8,865	104	3,114	4,474
India	(5)	10	10	--	--	--
Israel	(5)	13	19	--	--	--
Korea, Republic of	165	3,805	6,802	220	5,377	8,762
Netherlands	(5)	44	53	(5)	23	27
Peru	56	2,062	2,883	116	2,312	3,746
Thailand	1,171	30,522	45,944	768	21,401	36,558
Turkey	71	2,945	3,510	242	11,771	16,336
United Kingdom	--	--	--	(5)	46	61
Total[4]	1,850	57,151	82,082	1,523	52,742	80,646
New York City, NY:						
Brazil	--	--	--	(5)	17	20
Colombia	--	--	--	(5)	30	51
Croatia	1	326	363	(5)	149	167
Denmark	8	684	684	--	--	--
France	--	--	--	(5)	2	2
Germany	(5)	8	9	(5)	10	12
Greece	131	4,255	5,826	274	8,414	11,853
Italy	(5)	3	3	(5)	5	5
Netherlands	3	1,177	1,452	1	774	945
Norway	508	21,558	22,418	448	19,568	19,641
Poland	--	--	--	3	65	69
Sweden	238	7,815	10,334	1	1,052	1,239
Switzerland	18	557	778	(5)	6	6
Turkey	179	4,993	7,330	190	4,765	8,214
United Kingdom	5	1,521	1,994	1	729	819
Venezuela	101	4,002	5,497	20	715	1,052
Total[4]	1,192	46,898	56,685	941	36,301	44,094
Nogales, AZ:						
Australia	--	--	--	(5)	6	8
Germany	(5)	25	29	(5)	6	6
Mexico	668	19,938	27,234	571	17,081	26,343
Netherlands	--	--	--	(5)	9	14
Total[4]	668	19,963	27,263	572	17,102	26,371

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Norfolk, VA:						
Bulgaria	235	9,770	12,529	151	6,318	7,770
Canada	48	1,546	1,793	78	2,536	2,909
Colombia	--	--	--	131	4,264	5,288
France	85	15,335	16,509	90	9,369	10,508
Germany	(5)	7	10	(5)	11	13
Greece	211	6,999	9,911	--	--	--
Indonesia	114	3,018	4,748	--	--	--
Netherlands	1	291	359	1	437	542
United Kingdom	1	181	256	(5)	18	23
Venezuela	--	--	--	69	2,771	3,590
Total[4]	694	37,147	46,114	520	25,723	30,643
Ogdensburg, NY:						
Canada	306	16,424	16,881	361	20,276	20,840
Germany	(5)	2	2	--	--	--
Netherlands	--	--	--	(5)	12	12
United Kingdom	(5)	15	15	--	--	--
Total[4]	306	16,440	16,898	361	20,288	20,853
Pembina, ND, Canada	217	9,287	9,694	239	9,823	18,480
Philadelphia, PA:						
Belgium	(5)	12	12	(5)	3	3
Colombia	22	750	814	--	--	--
Germany	42	300	714	3	787	1,953
Netherlands	36	272	645	(5)	267	331
Sweden	--	--	--	(5)	88	115
Thailand	39	876	950	235	5,411	6,276
Total[4]	139	2,210	3,135	239	6,556	8,678
Portland, ME, Canada	83	7,814	8,157	92	8,796	8,805
Providence, RI:						
Philippines	59	1,374	2,501	--	--	--
Turkey	118	3,616	5,402	115	3,352	4,959
Venezuela	536	18,944	27,372	486	17,271	24,696
Total[4]	713	23,934	35,275	601	20,623	29,654
San Diego, CA:						
China	4	430	433	--	--	--
Thailand	500	16,728	22,480	465	17,785	23,343
Total[4]	503	17,158	22,913	466	17,785	23,343
San Francisco, CA:						
China	260	7,797	10,082	478	14,695	20,642
Thailand	505	15,062	23,109	554	15,911	25,118
Total[4]	765	22,859	33,191	1,033	30,607	45,760
San Juan, PR:						
Belgium	3	211	392	4	247	477
China	114	3,649	5,678	99	2,637	4,362
Colombia	29	1,029	1,268	20	757	1,030
Costa Rica	--	--	--	(5)	5	7
Denmark	215	7,858	12,623	277	8,955	14,141
Mexico	7	834	923	7	784	931
Panama	(5)	5	6	1	15	17
Spain	(5)	10	12	(5)	6	7
Venezuela	--	--	--	12	376	514
Total[4]	369	13,596	20,902	419	13,782	21,486
Savannah, GA:						
Brazil	--	--	--	(5)	26	55
Colombia	--	--	--	1	166	224
Egypt	(5)	76	85	--	--	--
Italy	(5)	110	119	--	--	--
Netherlands	(5)	80	122	(5)	29	36

See footnotes at end of table.

TABLE 19--Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Savannah, GA--Continued:						
Thailand	144	3,445	6,902	--	--	--
Turkey	3	213	213	--	--	--
United Kingdom	(5)	16	21	(5)	75	116
Venezuela	--	--	--	29	860	1,130
Total[4]	147	3,939	7,463	32	1,157	1,562
Seattle, WA:						
Canada	1,187	60,879	67,795	1,187	50,949	59,728
Japan	(5)	50	83	1	176	277
Thailand	173	4,153	6,682	147	3,968	6,189
Total[4]	1,360	65,082	74,560	1,335	55,093	66,194
St. Albans, VT:						
Canada	199	16,571	17,681	115	9,134	9,534
United Kingdom	(5)	12	13	(5)	13	15
Total[4]	199	16,583	17,695	115	9,146	9,549
St. Louis, MO, Croatia	2	545	745	--	--	--
Tampa, FL:						
Brazil	--	--	--	213	6,383	9,043
Canada	--	--	--	3	85	113
Colombia	766	27,441	33,806	803	29,077	36,594
Denmark	105	8,242	11,209	139	10,087	14,650
Greece	207	5,671	8,160	220	6,888	9,554
Peru	33	1,025	1,352	31	946	1,381
Spain	--	--	--	19	578	793
Sweden	--	--	--	9	242	304
Switzerland	--	--	--	29	833	1,192
Thailand	424	10,191	17,081	86	2,322	3,698
Turkey	82	3,350	4,269	142	4,236	6,120
Venezuela	494	15,186	21,186	651	21,370	30,938
Total[4]	2,111	71,108	97,063	2,344	83,049	114,379
U.S. Virgin Islands:						
Bangladesh	--	--	--	1	62	87
Barbados	--	--	--	1	48	67
Spain	--	--	--	2	114	160
Trinidad and Tobago	--	--	--	(5)	4	4
Venezuela	53	2,071	2,965	44	1,682	2,478
Total[4]	53	2,071	2,965	48	1,909	2,796
Washington, DC, Venezuela	2	64	95	--	--	--
Wilmington, NC:						
Colombia	--	--	--	56	1,854	2,640
Thailand	24	523	1,152	--	--	--
Venezuela	5	173	249	7	290	407
Total[4]	29	696	1,401	63	2,143	3,047
Grand total[4]	24,169	939,056	1,187,718	23,242	912,802	1,179,758

[r]Revised. -- Zero.

[1]Includes all varieties of hydraulic cement and clicker.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Data may not add to totals shown because of independent rounding.

[5]Less than 1/2 unit.

[6]China may be underrepresented; it is believed that all or some imports reported to be from Japan may be from China.

Source: U.S. Census Bureau.

TABLE 20

U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Brazil	--	--	--	213	6,413	9,078
Bulgaria	356	14,467	18,902	151	6,318	7,770
Canada	4,108	223,559	240,196	4,320	217,568	242,875
China[4]	2,150	64,614	87,072	1,800	56,720	78,643
Colombia	1,456	52,284	69,271	1,660	60,531	78,882
Egypt	--	--	--	283	8,323	13,604
Denmark	216	7,416	12,347	39	1,523	2,120
Germany	42	340	764	(5)	6	6
Greece	1,523	51,016	67,171	992	30,453	42,148
Indonesia	272	5,568	9,698	--	--	--
Korea, Republic of	1,625	40,312	61,792	1,745	46,463	69,511
Mexico	1,017	29,426	39,980	694	20,534	30,844
Netherlands	36	263	637	(5)	9	14
Norway	488	19,957	20,698	422	17,334	17,380
Peru	340	11,408	15,951	312	10,843	15,293
Philippines	294	6,841	10,567	205	5,353	8,151
Spain	210	5,493	7,256	217	6,487	9,025
Sweden	1,047	33,504	42,954	922	28,381	36,945
Taiwan	115	3,628	4,643	395	14,674	18,095
Thailand	3,919	107,949	162,793	3,162	91,450	139,885
Turkey	658	20,325	27,984	1,042	32,999	46,880
Venezuela	1,452	48,746	68,718	1,557	53,565	76,531
Other[4]	1	538 r	615	237	7,453	10,166
Total[6]	21,325	747,654	970,009	20,368	723,400	953,846

[r]Revised. -- Zero.

[1]Includes imports into Puerto Rico.

[2]The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]China may be underrepresented; it is believed that all or some imports reported to be from Japan (here included with "Other") may be from China.

[5]Less than 1/2 unit.

[6]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21

U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3, 4]	Quantity	Customs[2]	C.i.f.[3, 4]
Belgium	5	595	799	5	562	811
Brazil	--	--	--	3	395	449
Canada	219	27,314	28,542	243	29,850	30,982
China	4	433	438	--	--	--
Colombia	13	1,518	1,934	20	2,012	2,588
Denmark	117	9,596	12,556	149	11,258	15,894
Egypt	9	837	1,030	19	1,450	2,057
Greece	6	497	641	--	--	--
Mexico	175	20,139	21,466	150	17,477	18,516

See footnotes at end of table.

TABLE 21--Continued

U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3, 4]	Quantity	Customs[2]	C.i.f.[3, 4]
Norway	21	1,601	1,719	26	2,235	2,261
Spain	118	9,956	12,515	138	11,312	14,830
Thailand	120	6,394	7,364	34	3,512	3,777
Turkey	26	2,087	2,404	36	2,248	3,791
United Arab Emirates	--	--	--	6	396	406
Venezuela	35	1,299	1,398	17	655	955
Other	1	518	555	(5)	552	592
Total[6]	867	82,784	93,361	848	83,914	97,909

-- Zero.

[1]Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other chages incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of data for gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[5]Less than 1/2 unit.

[6]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22

U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2002			2003		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Brazil	99	4,236	4,276	49	2,120	2,150
Canada	704	39,530	39,953	965	45,383	51,972
China	11	1,099	1,297	16	744	969
Colombia	109	3,355	4,270	86	2,624	4,148
Cyprus	75	1,845	1,849	--	--	--
France	84	14,229	15,305	89	8,216	9,235
Greece	173	4,496	6,554	196	6,149	8,401
Lebanon	94	1,877	3,117	--	--	--
Peru	33	1,025	1,352	147	3,257	5,127
Thailand	221	3,625	7,423	148	3,238	5,592
Venezuela	--	--	--	90	3,173	3,982
Other	(4) r	8 r	9 r	52	1,743	2,113
Total[5]	1,603	75,325	85,405	1,838	76,647	93,689

[r]Revised. -- Zero.

[1]For all types of hydraulic cement. Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than 1/2 unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 23
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	1999	2000	2001	2002	2003[e]
Afghanistan[e]	116	50	50	60	70
Albania[e]	106	110	39	50	50
Algeria[e]	7,500	8,300	8,300	9,000	9,000
Angola	207 [r]	201 [r]	200 [r, e]	250 [r, e]	250
Argentina	7,187	6,114	5,545	3,910	3,900
Armenia	287	219	300	400	500
Australia[e]	7,450	7,500	7,500	7,550	8,000
Austria	3,817	3,776	3,863	3,800 [e]	3,800
Azerbaijan	177	200 [e]	500	800	1,000
Bahrain	156	89	89	67	70
Bangladesh[3]	2,085	3,580	5,005	5,000 [e]	5,000
Barbados	253 [r]	268	250	298	300
Belarus	2,100	1,847	1,803	2,171 [r]	2,472 [4]
Belgium	7,277	7,150	7,500 [e]	8,000 [e]	8,000
Benin[e]	200	250	250	250	250
Bhutan[e]	150	150	160	160	160
Bolivia	1,201	1,072	983 [r]	1,010 [r]	1,000
Bosnia and Herzegovina[e]	300	300	300	300	300
Brazil	40,270	39,208	38,927	38,027 [r]	37,980 [4]
Brunei	208	232	227	241 [r]	235 [4]
Bulgaria	2,060	2,209	2,088 [r]	2,137 [r]	2,100 [4]
Burkina Faso[e]	180 [r]	100 [r]	50	30 [r]	30
Burma	338	393	378	400 [r, e]	600
Cambodia[e]	--	--	-- [r]	-- [r]	--
Cameroon	850	890	930 [e]	950 [e]	900
Canada	12,634	12,612	12,986	13,200	14,063 [4]
Chile	3,036	3,491	3,513 [r]	3,522 [r]	3,550
China	573,000	597,000	661,040	725,000 [r]	813,190 [p]
Colombia[e]	9,200	9,750	6,830 [r]	6,604 [r, 4]	6,800
Congo (Brazzaville)	--	20 [e]	--	-- [e]	--
Congo (Kinshasa)	159	161	192	190 [e]	190
Costa Rica[e]	1,100	1,150	1,100	1,100	1,130
Cote d'Ivoire[e]	650	650	650	650	650
Croatia	2,712	2,852	3,246	3,378	3,654 [4]
Cuba	1,785	1,633	1,324	1,327 [r]	1,300
Cyprus	1,157	1,398	1,369	1,600 [e]	1,600
Czech Republic	4,241	4,093	3,550	3,500 [e]	3,500
Denmark	1,926	2,009	2,010 [e]	2,010 [e]	2,020 [4]
Dominican Republic	2,283 [r]	2,505 [r]	2,746 [r]	3,050 [r]	2,907 [p]
Ecuador	2,300	2,800 [e]	2,920 [r]	3,000 [r]	3,100
Egypt	23,313	24,143	24,500 [e]	28,000 [r, e]	29,100
El Salvador	1,031	1,064	1,174	1,318	1,391
Eritrea[e]	45	45	45	45	45
Estonia	358	329	405	466 [r]	470 [4]
Ethiopia	638	880	900 [r]	900 [r]	1,200
Fiji[e]	95	95	95	95	100
Finland	1,310	1,422	1,325	1,350	1,360 [4]
France	20,219	20,137	19,839	20,000 [e]	20,000
French Guiana[e]	88	88	58 [4]	62	62
Gabon	180	210	304 [r]	350 [r, e]	350
Georgia	341 [r]	348	335 [r]	347 [r]	300 [4]
Germany	35,912	34,727	30,989	30,000 [e]	30,000
Ghana	1,870	1,950	1,900 [e]	1,900 [e]	1,900
Greece	13,908	14,530	15,000	15,500	16,000 [4]
Guadeloupe[e]	230	230	230	230	230
Guatemala	1,600	1,600	1,600 [e]	1,600 [e]	1,650
Guinea	297	300	315 [r]	360 [r]	360
Haiti	--	--	204	290	200
Honduras	980	1,100	1,100 [e]	1,100 [e]	1,000
Hong Kong	1,387	1,284	1,279 [r]	1,206 [r]	1,250

See footnotes at end of table.

TABLE 23--Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	1999	2000	2001	2002	2003[e]
Hungary	2,979	3,326	3,452	3,510 [r]	3,500 [4]
Iceland	131	144	125	130 [e]	135 [4]
India[e]	90,000	95,000	100,000	102,000 [r]	110,000
Indonesia	23,925	27,789	31,300	34,640 [r]	35,000
Iran	22,080	23,880	26,640 [r]	28,600 [r]	30,000
Iraq[e]	5,000 [r]	6,000 [r]	6,000 [r]	6,834 [r, 4]	1,000
Ireland[e]	2,466 [4]	2,620 [4]	2,600	2,500	2,500
Israel[e]	6,354 [4]	5,703 [r, 4]	4,700 [r]	5,150 [r]	5,150
Italy	37,299	38,925	39,804	40,000 [e]	38,000
Jamaica	504	521	596	614	620
Japan	80,120	81,097	76,550	71,828 [r]	71,000
Jordan	2,687	2,640	3,173	3,558 [r]	3,515 [4]
Kazakhstan	838	1,175	2,029	2,129	2,570 [4]
Kenya	1,440 [r, e]	1,367 [r]	1,319 [r]	1,463 [r]	1,537 [4]
Korea, North[e]	4,000	4,600 [r]	5,160	5,320	5,500
Korea, Republic of	48,157	51,255	52,046	55,514	59,199 [4]
Kuwait	1,435	1,540	1,600 [e]	1,600 [e]	1,600
Kyrgyzstan	386	500	469	533	770
Laos[e]	80	92	92	240	250
Latvia	W	W	W	W	W [4]
Lebanon	2,714	2,808	2,890	2,852	2,950
Liberia[e]	15	71 [r]	63 [r, 4]	54 [r, 4]	30
Libya[e]	3,000	3,000	3,000	3,300 [r]	3,300
Lithuania	666	570	529	605	600
Luxembourg	742	749	750 [e]	750 [e]	750
Macedonia	520	585	450	450 [e]	450
Madagascar	46	51	52	33 [r, e]	33
Malawi	187	156	181	174	190
Malaysia	10,104	11,445	13,820	14,336	17,243 [4]
Martinique[e]	220	220	220	220	220
Mauritania[e]	100	110	110	110	110
Mexico	29,413	31,677	29,966	31,069	32,000
Moldova	50	222	200	300	300
Mongolia	104	92	68	148	150
Morocco	7,530	8,100	10,000 [e]	10,200 [e]	10,400
Mozambique	216	270	265	285 [r]	362 [4]
Namibia[e]	(5)	--	--	--	--
Nepal[e, 3]	290	300	285	290	295
Netherlands	3,480	3,450	3,450 [e]	3,400 [e]	3,400
New Caledonia	-- [e]	100 [e]	93	100	100
New Zealand	1,030 [r]	1,070 [r]	1,080 [r]	1,090 [r, e]	1,100
Nicaragua	350	360 [e]	514 [r]	513 [r]	513
Niger[e]	30	40	40	55	55
Nigeria[e]	2,500	2,500	2,400 [r]	2,100 [r]	2,100
Norway	1,827	1,851	1,870 [e]	1,850 [e]	1,860 [4]
Oman	1,217	1,238	1,370	1,400 [e]	1,400
Pakistan[e]	9,600	9,900	9,900	9,900	10,000
Panama[e]	760 [4]	760	760	760	770
Paraguay	730	650	650	650 [e]	650
Peru	3,799	3,906	3,950	5,654 [r]	5,998 [4]
Philippines	12,556	11,959	8,653	12,614 [r]	10,000
Poland	15,555	15,046	11,918	11,700 [r, e]	12,000 [4]
Portugal	10,147	10,343	10,300 [e]	10,000 [e]	10,000
Qatar[e]	1,025 [4]	1,210 [r]	1,300 [r]	1,350 [r]	1,400
Réunion[e]	380 [4]	380 [r]	380 [r]	380 [r]	380
Romania	6,252	6,058	5,668	5,680	5,700 [4]
Russia	28,400	32,400	35,300	37,700	41,000
Rwanda	66	71	91 [r]	101 [r]	115
Saudi Arabia	16,313	18,107	20,608	22,000 [r]	23,000
Senegal[e]	1,000	1,000	1,000	2,150 [r]	2,150

See footnotes at end of table.

TABLE 23--Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	1999	2000	2001	2002	2003[e]
Serbia and Montenegro	1,575	2,117	2,418	2,396	200 [4]
Sierra Leone	45 [r]	73 [r]	113 [r]	144 [r]	170 [4]
Singapore	1,660	1,150	600 [e]	200 [e]	150 [4]
Slovakia	4,718	3,045	3,123	3,100 [e]	3,100
Slovenia[e]	1,224 [4]	1,300	1,300	1,250	1,250
South Africa, sales[6]	8,068	7,971	8,036	8,525	8,883 [4]
Spain, including Canary Islands	35,782	38,115	40,512	42,500 [e]	42,000
Sri Lanka	976	1,008	1,108	1,018	1,000 [4]
Sudan	231	146	190	220 [r, e]	320
Suriname[e]	60	60	65 [4]	65	65
Sweden	2,298	2,651	2,600	2,700 [e]	2,650 [4]
Switzerland	3,548	3,771	3,950	4,000 [e]	3,800 [4]
Syria	5,134 [r]	4,631 [r]	5,428 [r]	5,450 [r, e]	5,450
Taiwan	18,283	17,572	18,128	19,363	18,474 [4]
Tajikistan	30	50	70	100	120
Tanzania	833	833	900	1,026 [r]	1,186 [4]
Thailand	25,354	25,499	27,913	36,842 [r]	32,530 [4]
Togo[e]	600	700	800	800	800
Trinidad and Tobago	688	743	708	744 [r]	750
Tunisia	4,864	5,657	5,721	6,022	6,038 [4]
Turkmenistan[e]	450	450	450	450	450
Turkey	34,258	35,825	30,125	32,577	33,000
Uganda	347	369 [r]	434 [r]	502 [r]	505
Ukraine	5,828	5,311	5,800	7,142	9,000
United Arab Emirates[e]	7,069 [4]	6,100	6,100	6,500	6,600
United Kingdom	12,697	12,452	11,854	12,000 [e]	12,000
United States, including Puerto Rico[7]	87,777	89,510	90,450 [8]	91,266	94,329 [4]
Uruguay	789	700 [e]	1,015	1,000 [e]	1,050
Uzbekistan[e]	4,471 [4]	3,521 [4]	4,000	4,000	4,000
Venezuela[e]	8,500	8,600	8,700	7,000	7,000
Vietnam	10,489	13,298	15,374	19,481	22,600
Yemen[e]	1,454 [4]	1,400	1,400	1,400	1,400
Zambia[e]	300	380	215 [r, 4]	230 [r, 4]	480
Zimbabwe[e]	1,000	1,000	800	600	400
Total	1,600,000	1,660,000 [r]	1,730,000	1,840,000 [r]	1,950,000

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are believed to be accurate to no more than three significant digits.

[2]Table includes data available through August 17, 2004. Data may include clinker exports for some countries.

[3]Data for year ending June 30 of that stated.

[4]Reported figure.

[5]Less than 1/2 unit.

[6]Data are revised to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted, in metric tons, to: 1999--939,907; 2000--1,020,113; 2001--1,129,356; 2002--1,099,044; and 2003--1,280,000.

[7]Portland and masonry cements only.

[8]

CEMENT

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Armand Marquardt, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

With the exception of some trade data, the cements covered in this report are limited to those hydraulic varieties classified as portland and/or masonry cement. These cements are the binding agents in concrete and most mortars. Varieties included as portland cement are listed in table 15 and include blended cements.[1] Masonry cements include true masonry cements, portland-lime cements, and plastic cements. Certain other hydraulic cements (most notably aluminous cement) are included within the world hydraulic cement production data given in table 22 and the trade data in tables 16–18 and 21 (clinker). Excluded from the U.S. data and, to the degree possible, from international data are pure (unblended) supplementary cementitious materials (SCM), such as fly ash, other pozzolans, and ground granulated blast furnace slag (GGBFS). Although not finished cements in their own right, SCM are in common use as components of blended portland cements or as partial substitutes for portland cement in concrete. Indications of percentage or other changes expressed in this report compare activity in 2004 with that of 2003 unless specified otherwise. Except where otherwise indicated, activity levels in this report exclude those in Puerto Rico. Detailed background information on cement and its manufacture is available in van Oss (2005§[2]).

Production of portland and masonry cements in the United States in 2004 rose by almost 5% to a new record high of 97.4 million metric tons (Mt) (table 1). Output of clinker—the intermediate product in cement manufacturing—increased by almost 6% to a new record high of 86.7 Mt. The United States continued to rank third in the world in hydraulic cement production; world output in 2004 was about 2.1 billion metric tons (Gt). Sales of cement to domestic customers increased by 6.9% to a new record high of about 120 Mt; the previous record was in 2001. Imports of cement increased by almost 21% to 25.4 Mt but were still reported to be below demand in States heavily dependent on imports. During the year, spot shortages of cement (domestic and imported) in many States, but particularly Arizona, California, Florida, and Texas, were informally reported to the U.S. Geological Survey (USGS). Tight cement supplies and rising fuel costs led to significant, although regionally variable, price increases (tables 11–12). Overall, the value of cement sales to domestic final customers increased by 14.4% to about $9.5 billion (tables 1, 11–12). Based on typical portland cement mixing ratios in concrete, the delivered value of concrete (excluding mortar) in the United States in 2004 was estimated to be at least $47 billion.

The bulk of this report is based on data compiled from USGS annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are independent of U.S. cement manufacturers. For 2004, forms were received for 148 of 151 facilities canvassed, a response rate of 98%. The responding facilities included all but two production sites and accounted for almost 99% of total cement production and sales. For 2003, forms were received for 144 of 151 facilities canvassed, a response rate of 95%. The responding facilities accounted for 99% of the U.S. cement production in 2003. For missing or incomplete forms, telephone inquiries were made to obtain data and 100% reporting of both cement and clinker production was obtained for both years. Background information on the USGS cement canvasses is given in van Oss (2005§).

Legislation and Government Programs

Government economic policies and programs that affect the cement industry are those affecting cement trade, interest rates, and public sector construction spending. The major trade issue in 2004 continued to be that of antidumping tariffs against Japan and Mexico. For Mexico, the tariff rate in 2004 was based on the 54.97% dumping margin determined by the U.S. Department of Commerce (DOC) for the 13th review period (August 2002 through July 2003) for gray portland cement and clinker. In light of reported cement shortages, there were calls during the year for the DOC to lift, if only temporarily, the tariffs to encourage the importation of more cement from Mexico.

The major Government construction funding program in 2004 remained the Transportation Equity Act for the 21st Century (TEA–21), which authorized $216.3 billion in funding for the 6-year period from 1998 to 2003 to upgrade the country's transportation infrastructure. The TEA–21 expired on September 30, 2003, but the U.S. Congress authorized continuation of its funding at 2003 levels throughout 2004, pending reconciliation of conflicting congressional funding level proposals for its full-scale reauthorization.

The major environmental issues relating to cement stem from the production of clinker (van Oss and Padovani, 2003). The most significant emissions from clinker manufacture are of carbon dioxide (CO_2), amounting to nearly 1 metric ton (t) of CO_2 per ton of clinker, about one-half of which is derived from the calcination of calcium carbonate raw materials, and the rest from the combustion of fuels. Overall, generation of CO_2 by the U.S. cement industry in 2004 amounted to about 83 Mt; this excluded emissions associated with the utility companies that generated the electricity used by the cement industry. The cement industry was working on ways to reduce the unit emissions of CO_2, such as by encouraging the use of blended cements and of SCM in concrete.

Production

Portland cement in 2004 was produced in 37 States and Puerto Rico at a total of 115 plants. Of these plants, 73 also produced

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[1]Sales data for blended cements (also called composite cements) listed separately from portland cement are available within the monthly cement reports of the USGS Minerals Industry Surveys series, starting with January 1998.

[2]A reference that includes a section mark (§) is found in the Internet Reference Cited section.

masonry cement (tables 3–4). Cement producers in the United States ranged widely in size and in the number of plants operated. Ranking companies in terms of output or capacity is made difficult by the existence of some common parent companies and joint ventures. If companies with common parents are combined under the larger subsidiary's name, with joint ventures apportioned, then the leading 10 companies at yearend 2004, in descending order of cement production, were Holcim (US) Inc.; CEMEX, Inc.; Lafarge North America, Inc.; Buzzi Unicem USA, Inc. (including Alamo Cement Co.); Lehigh Cement Co.; Ash Grove Cement Co.; Essroc Cement Corp.; Texas Industries Inc. (TXI); California Portland Cement Co., and Eagle Materials, Inc. The leading 5 of these had about 57% of total U.S. portland cement production, and the leading 10 together accounted for about 81% of total U.S. production. Of these companies, all except Ash Grove, Eagle Materials, and TXI were foreign-owned as of yearend.

Production of portland cement in 2004 increased by about 5% to a new record of 92.4 Mt (table 3). As in 2003, the five leading producing States for portland cement in 2004, in descending order, were California, Texas, Pennsylvania, Michigan, and Missouri. Significant production increases were seen in almost all States, but that for Florida was especially large owing to the reaching of full capacity output by a new plant that started in 2003 and by the startup of a new kiln at another plant. Finish (cement) grinding capacity showed some regional changes and increased slightly for the country overall; capacity utilization also increased. Although yearend portland cement stockpiles were up slightly for the country overall, most coastal States showed declines in yearend stocks; this was in accord with widespread reports during the year of tight cement supplies and/or shortages, especially of imported material.

Data are not collected on the production of specific varieties of portland cement, but production levels would approximate the ratios among sales, by type, of portland cement (table 15). On this basis, production of Types I and II (or hybrids thereof) accounted for about 79% of total portland cement output in 2004, down from about 83% in 2003. The relative decline reflects the growing market for sulfate-resistant cements (Types II and V, and II/V hybrids reported as Type V); Type V cements accounted for about 14% of total output, up from about 10% in 2003. Ideally, these ratios should be adjusted for cement imports, which are dominantly of Types I, II, and V.

Masonry cement production in 2004 increased by 5.5% to 5.0 Mt (table 4). As in past years, however, this reported figure understates true output, primarily because a large, but unknown, tonnage of masonry cement (especially portland-lime cement) is directly blended at job sites using purchased portland cement and lime. As in recent years, about 95% of the (reported) masonry cement output continued to be reported as having been made directly from clinker rather than from finished portland cement.

Data related to clinker production are listed in table 5. Overall production rose by 5.8% to a record 86.7 Mt, with increases seen in all but two districts. As with cement production, the largest increase was in Florida. Daily output capacity (a reported statistic) was substantially unchanged in most districts. Florida's daily capacity showed a large increase owing to the addition of a large new dry kiln (and the continued inclusion of its wet kilns) at one plant. The daily capacity for the Maine-New York district also rose substantially, owing to the midyear conversion of a wet kiln to a dry kiln at the plant in Maine. The daily capacity for South Carolina showed a large decrease owing to the exclusion of two wet kilns that were dismantled in 2003, and a decrease in the capacity for Idaho-Montana-Nevada-Montana is because of the 2003 closure of one small plant in Nevada. Apparent annual capacities (a calculated statistic) showed significant variations among district but are dependent on the reporting of downtimes for scheduled maintenance; overall capacity rose by 3% to 103 million metric tons per year (Mt/yr). Capacity utilization also rose overall but is also dependent on the reported downtimes for scheduled maintenance. Given that total downtimes commonly exceed the downtimes for routine maintenance, a capacity utilization of about 85% or higher indicates that the plants were operating at full practicable capacity; this was the case for virtually all districts. The utilization declines seen in the Maine-New York district and in Florida reflect additional downtimes or production interruptions related to the plant upgrades mentioned above. Based on the data in table 5, the average plant clinker capacity in 2004 rose by about 3% to 0.96 Mt/yr, and average kiln capacity rose by about 2% to 0.55 Mt/yr. Yearend clinker stockpiles[3] showed a decline of about 0.7 Mt (16%). The increase in clinker production was itself more than adequate to support the increase in cement production noted earlier, even in light of an apparent decline in clinker imports, as detailed in table 21, without recourse to a net, long-term, drawdown of stocks. Consequently, the yearend stockpile decline may reflect the high level of cement consumption in December, which may have prevented or postponed the routine buildup of clinker stockpiles ahead of planned kiln shutdowns in early 2005 for routine maintenance.

Nonfuel raw materials consumed to make clinker and cement are listed in table 6. Materials used to make clinker are of environmental interest because they are burned in the kiln and are thus associated with various chemical changes and emissions. Materials added in the finish mill are just ground. Overall the ratios among raw materials consumed in 2004 did not change significantly from those in 2003. By comparison to the sales levels for blended cements listed in table 15, the proportion of granulated blast furnace slag in cement appears to have fallen to about 35% (component) from about 45% in 2003. This decline could be real or it could represent a change in the amount of slag used as a grinding aid (in straight portland cement) or an increase in the incorporation of slag into masonry cement. In contrast, the apparent component of fly ash in blended cements, at about 22%, was significantly higher than the 16% in 2003. The total fly ash consumption in 2004 (2.97 Mt) listed in table 6, and that of other ash (1.05 Mt, mainly bottom ash) is significantly higher than the 2.13 Mt of fly ash, 0.56 Mt of bottom ash, and 0.03 Mt of boiler slag reported by the American Coal Ash Association (ACAA) (2005) as having been sold in 2004 for use in clinker and/or cement manufacture; the differences could represent material already in stock at cement plants. In contrast, the ACAA's reported sales of synthetic gypsum (recovered via flue gas desulfurization) to the cement industry (0.41 Mt) are significantly higher than the 0.29 Mt reported to the USGS (this is a component of the gypsum consumption in table 6), but the USGS

[3]Yearend stockpiles of clinker are an artifact of data collection convenience rather than reflecting full-year market conditions or production capacity. Generally, if the clinker is not required for immediate cement market needs, a plant will try to build up its stocks of clinker prior to scheduled extended kiln shutdowns so as to provide continuity of clinker feed to the finish (cement) mill. These shutdowns can be at any time of the year.

canvass does not require a reporting distinction between synthetic and natural gypsum.

Fuels consumed by the cement industry are listed in table 7. The quantity ratios among fuels in 2004 appear to be similar to those in 2003. Although not listed in table 7, overall heat consumption in 2004 averaged about 4.3 million British thermal units (MBtu) per metric ton of clinker, about 2% lower than in 2003. Wet plants in 2004 averaged 5.9 MBtu per ton of clinker, down by about 11%. The decline in wet and overall heat consumptions reflects a conversion or replacement (Florida and Maine) of some wet kilns to dry technology. Dry plants in 2004 averaged 3.8 MBtu per ton, essentially unchanged.

As in past years, dry process plants had higher average electricity consumption per ton of cement product than wet process plants (table 8). This reflects the complex array of fans and blowers associated with modern dry kilns and clinker coolers. Shifts in average unit consumption of electricity from 2003 to 2004 appear to be related in the conversion of two plants from wet to dry technology (temporarily resident, in 2004, in the combination category "Both"). For the same general technology, plants operating multiple kilns almost invariably have higher electrical power (and general energy) requirements per ton of overall output capacity than do plants with the same overall capacity but that operate a single kiln.

There were no plant openings or closures during the year, but a number of company mergers and/or name changes were announced. Following the merger in 2003 of Lone Star Industries, Inc. and RC Cement Co., Inc. (both subsidiaries of Buzzi Unicem S.p.A. of Italy) under the name RC Lonestar, Inc., the name of the new company was changed in January 2004 to Buzzi Unicem USA, Inc. As of yearend, the merger did not include the Buzzi Unicem subsidiary Alamo Cement Co. of San Antonio, TX.

In January, Centex Construction Products, Inc. split off its cement (and concrete) plants to a new company, Eagle Materials, of Dallas, TX. The transfer involved all four cement plants owned wholly or partially by Centex—Illinois Cement Co. in LaSalle, IL (in which Centex had a 50% share); Mountain Cement Co. in Laramie, WY; Nevada Cement Co. in Fernley, NV; and Texas-Lehigh Cement Co. LP in Buda, TX (50% share). In November, Eagle Materials purchased the remaining 50% of Illinois Cement from Raam Cement Co.

In late September, CEMEX S.A. de C.V. of Monterrey, Mexico, announced that it had reached an agreement with RMC Group plc of the United Kingdom to purchase the worldwide assets of RMC. Apart from gaining a number of cement plants worldwide, the acquisition would position CEMEX as a leading worldwide producer of ready-mixed concrete. In the United States, RMC assets purchased included the RMC Pacific Materials, Inc. cement plant in Davenport, CA, and a number of concrete plants (Cement Americas, 2004a). The purchase was expected to be completed in early 2005. CEMEX expected that regulatory examination of the merger agreement would result in some recommended or mandated divestitures of facilities. In mid-November, CEMEX announced that it had signed a letter of intent to sell its Dixon, IL, and Charlevoix, MI, plants, together with a number of terminals servicing the Great Lakes region, to Votorantim Cementos Ltda. of Brazil (CEMEX S.A. de C.V., 2004). The sale was expected to be completed in early 2005. CEMEX had, itself, acquired the Dixon plant in September 2003. The plants would be operated under Votorantim's Canadian subsidiary St. Marys Cement, Inc., which already operated grinding plants in Detroit, MI, and Milwaukee, WI, and which was a 50% joint-venture partner in Suwannee American Cement Co. in Branford, FL.

In November, an agreement was announced for Lehigh Cement Co. to acquire 100% ownership in Glens Falls Lehigh Cement Co. by purchasing the 50% share in Glens Falls owned by Buzzi Unicem (Lehigh Cement, 2004). The purchase involved an integrated plant at Glens Falls, NY; the Cementon grinding plant near Catskill, NY; and a number of terminals, and was expected to be completed in January 2005.

Ash Grove announced plans to build a 1.5-Mt/yr integrated plant just northeast of Las Vegas, NV; construction was expected to begin in 2006 and be completed in early 2008 (Cement Americas, 2004b). The Las Vegas market is currently supplied largely with production from various plants in southern California. Two major plant upgrades came online during the year. In June, Dragon Products Co. completed the conversion of its Thomaston, ME, integrated plant's wet kiln to dry, preheater-precalciner technology; the wet kiln had been shut down for this purpose in April. The upgraded plant would have a capacity of approximately 0.7 Mt/yr—about 30% higher than that of wet plant (Dragon Products Co., 2004). In June, Titan America fired-up the new dry kiln at the Pennsuco integrated plant at Medley, FL. The new 1.8-Mt/yr kiln line replaced two wet kiln lines (total capacity of about 0.9 Mt/yr) that were shut shortly after the dry kiln became operational. The new plant was formally inaugurated in May 2005 (Cement Americas, 2005).

Consumption

Apparent consumption of portland and masonry cement increased by 6.9% to about 122 Mt in 2004 (table 1). The measure of consumption preferred by the cement industry for its market analyses, however, is that of cement shipments to final customers (that is, sales). The definition of "final customer" is left to the reporting cement producer but is generally understood to include the customer categories listed in table 14. The data for shipments are published monthly by the USGS and are summed in table 9. By this metric, total consumption of cement in 2004 increased by 6.9% to a record 120.2 Mt.

In some years, significant differences have existed between U.S. portland cement sales totals derived from annual canvasses, as listed in tables 1, 10–11, and 14–16, and the monthly-survey-based totals listed in table 9. The differences likely pertained to shipments (mainly of imported cement) by terminals that were missed by the annual survey but which were captured on the monthly surveys (the monthly data contain a lot of data submitted on a company-total rather than site-total basis). A number of terminals have been added to the annual canvass, with the result that the tonnage differences became insignificant for 2001–02 and again for 2004. A difference of 1.7 Mt exists for the total 2003 sales, however, but the reason for this is unclear. In contrast to portland cement, data for masonry cement have not shown significant discrepancies between the monthly and annual reporting because little of this material is imported.

Superficial similarities between table 9 and tables 12–13 belie key differences in their component data. Table 9 reveals the shipment destinations and so directly provides the location and amounts of consumption. In contrast, the regional data in tables 11–12 and 14 pertain to the location of the reporting entity (chiefly the production sites), not the location of consumption. It is very common for shipments to cross State lines.

Based on table 9, domestic portland cement consumption (sales or shipments to final customers) increased by 6.8% to 115.1 Mt, a new record that, based on reports to the USGS of cement shortages, would likely have been significantly higher still had additional imports of cement been available. Overall consumption increased in all months except January and October. The import component of sales was about 19% of the total in 2004 compared with about 17% in 2003. Most States showed consumption increases, with the largest increases being in Arizona, California, Florida, and Georgia. The 13% overall increase in Florida (driven by increases in all months except September) was especially noteworthy given that the State experienced several hurricanes during the year. The leading 10 consuming States in 2004 were, in descending order, California, Texas, Florida, Arizona, Georgia, Ohio, Illinois, Pennsylvania, New York, and Michigan. The leading 5 States accounted for about 39% of total U.S. consumption, and the leading 10 States accounted for about 55% of the total.

Cement being a key construction material, it may be expected that cement consumption levels will broadly reflect levels of construction spending, although significant time lags may exist between the onset or cutoff of spending and changes in the consumption of cement or concrete. Lag times are particularly noticeable in sectors involving individual projects requiring high tonnages of concrete (for example, large office buildings, shopping complexes, and major public sector projects). According to U.S. Census Bureau data quoted by the Portland Cement Association (2005), overall construction spending levels in 2004 rose by 2% to about $714 billion (constant 1996 dollars). This was almost entirely driven by a 6.8% increase in overall residential building construction, fed largely by an 11.5% increase in single-family housing ($265 billion), and which reflected continued very low mortgage and general interest rates. Virtually all other construction categories showed spending declines in 2004. Nonresidential private construction (for example, office buildings and factories) continued a multiyear trend by declining in 2004 by 1.2% to about $121 billion. Public sector construction spending fell by 3.5% to about $168 billion, led by a 4.7% fall in public building construction to about $75 billion and a 2.7% decline in the highways and street construction to about $47 billion.

It is difficult to reconcile some of the construction spending changes with the overall increases in cement consumption tonnages and with the breakout of sales by customer type (table 14). For example, overall sales to ready-mixed concrete producers (which feed many forms of concrete construction) were up by 6.1% in 2004, and increases were also seen for sales to manufacturers of brick and block (up by 2.6%) and pipe (up by 15.9%), and to building material dealers (5.8%)—these increases would be in accord with increased spending for residential construction. But sales to road paving contractors were also up (by 15.8%, but there is significant overlap between this category and ready-mixed concrete), as were sales to soil cement contractors (74.2%). Even accounting for possible reporting errors, these increases would not seem to be in accord with the declines in nonresidential and public sector construction spending. Only the 6.0% drop in sales to manufacturers of precast and prestressed concrete products would seem to reflect the nonresidential building and public sector spending declines. At least some of the poor correlation between overall construction spending and cement consumption levels could be owing to lag times or to significantly higher use of concrete relative to competing construction materials. The latter can be crudely evaluated through use of a calculated “penetration rate” for cement. This can be defined as the tonnage of cement consumed per $1 million in spending and ideally should be done for each type of construction. Changes in penetration rates can reflect cost or performance advantages of concrete over competing construction materials, the specific sizes and types of construction projects, promotional efforts by the concrete industry, shifts in spending between new construction and repairs to existing infrastructure, lag times between construction spending and concrete consumption, and underreported cement consumption because of partial substitution in concrete mixes of portland cement by other cementitious materials. Using the apparent consumption data in table 1, the overall construction spending data show a generally increasing trend in penetration rates for 2000–04; $1 million in construction spending bought, in chronological order, about 154 t of cement in 2000; 160 t in 2001; 157 t in 2002; 163 t in 2003; and 171 t in 2004.

Sales to final customers of different types of portland cement are listed in table 15. As in past years, Types I and II cement remained dominant, although consumption increased significantly for sulfate-resistant varieties of cement (Type V, Type II/V hybrids reported as Type V, and some blended cements). Sales of oil well cements rose by 20%, reflecting higher levels of exploration and development drilling associated with rapidly rising prices for crude petroleum and natural gas. Overall cement sales (including some regular portland cement) to oil well drillers increased by 51% (table 14).

Data on the mill net values for shipments to final customers by plants and import terminals (terminal nets) are listed in tables 11–13. Except to differentiate overall grey from white portland cement sales, respondents to the USGS annual canvass do not provide value data broken out by the specific varieties of portland cement sold. Both gray and white sales are included in table 11 and a color differentiation is provided only for the national average in table 13. The value data make no distinction between bulk and container (bag or package) shipments; however, container shipments would be expected to have higher unit values. The average mill net value of portland cement in 2004 was about $78.00 per metric ton, up by about $4.50 per ton. The magnitude of the increase in 2004 was smaller than expected given the widespread report of cement shortages and price increases, significantly higher unit prices for imports (table 17), and the fact that the 2003 price was actually about $1 per ton lower than in 2002. It is possible that average prices in 2004 would have been higher but for the existence of long-term supply contracts. The average mill net value for masonry cement in 2004 was $117 per ton, up by $8 (table 12), but the magnitude of the increase should be viewed with caution because the data include a significant component of estimates, and some respondents reported values apparently exclusive of bagging or packaging charges (they are supposed to be included).

The unit values in tables 11 and 12 are free on board (f.o.b.) the plant. A crude estimate of delivery costs to the customer can be made by comparison to the U.S. 20-city average delivered cement prices (for Type-I portland and masonry cements) reported monthly by the journal Engineering News-Record (ENR). For 2004, the monthly U.S. average Type-I portland cement delivered price for the year was calculated (after conversion to metric units) to be $92.82 per ton (up by $1.52 only); a comparison of this with the average gray portland mill net value of $77.50 per ton in table 13 suggests an average delivery cost of about $15 per ton, considerably lower than the $19 per ton apparent delivery charge calculated for 2003, and not in accord with higher fuel costs during the year. This suggests the possibility that some of the ENR data now incorporate some f.o.b. plant prices instead of delivered prices. The ENR price for masonry cement averaged about $175 per ton, up by about $3 per ton. The large difference between this and the average mill net value for masonry appears to incorporate a variety of handling charges for this mainly bagged commodity.

Foreign Trade

Trade data from the U.S. Census Bureau are listed in tables 16–21. Exports of hydraulic cement and clinker declined slightly in 2004 but, except for sales to Canada, remained insignificant (tables 1, 16). Almost all of the exported material was cement. Overall imports (including into Puerto Rico) of hydraulic cement and clinker in 2004 appear to have increased by 14.0% to 27.3 Mt (tables 17, 18). This was the third highest import level to date (the record was 29.4 Mt in 1999). The cement component of these imports (table 17 data minus the clinker data in table 21) increased by an apparent 16.2% to 25.7 Mt, a new record, and the apparent clinker component decreased by 12.7% to 1.6 Mt (table 21). The use of the "apparent" qualifier is deliberate because the trade data for 2003–04 and for an unknown number of recent previous years are incomplete with regards to overland imports from Canada, as discussed below. The clinker data for 2002–04 have been manually corrected to remove "clinker" coming into the Honolulu, HI, district; the material was actually gray portland cement incorrectly registered with the tariff code for clinker. The Honolulu data have been transferred to table 20 (gray portland cement).

The data for clinker, and possibly also for cement, imports from Canada are incomplete. For clinker, the evidence for this is that the official trade data show insufficient clinker from Canada coming into the Detroit, MI; Milwaukee, WI; and Seattle, WA, customs districts to feed the grinding plants that are located in Michigan, Wisconsin, and Washington, respectively. These plants are essentially reliant on Canadian (and, for Detroit in 2004, Brazilian) clinker and do not purchase significant quantities of domestic clinker. The unreported Canadian clinker appears to be either material that has been given a tariff code for portland cement by mistake by the importer or is clinker coming in by truck, including material that may be transshipped after truck entry into the United States. Because the individual truckloads are worth less than $2,000 (customs value), the shipments are classified as "informal entries," and data on them are not routinely transmitted by the U.S. Customs Service to the U.S. Census Bureau for recordation into the official trade data (reproduced in tables 17–21). This recordation problem presumably does not exist for imports by rail or by barge or ship because these shipments are larger. Clinker imports from Canada have been estimated to be higher than those reported by about 0.4 Mt for 2003 and about 0.6 Mt in 2004 (tables 1, 21). Likewise, certain U.S. cement companies with plants in Canada near the U.S. border may allow some of their U.S. final customers to pick up cement at the Canadian plants. Although these sales, as listed in table 9, are being recorded correctly in the companies' monthly reporting to the USGS, an informal entry data recordation problem could exist for individual truckloads worth less than $2,000. Given the large volumes of Canadian cement that do get recorded by the U.S. Census Bureau and the fact that the USGS monthly canvass form cannot distinguish the mode of entry of imported cement, the magnitude of the underreporting of cement imports from Canada is difficult to estimate.

The busiest customs districts of entry in 2004 were, in descending order, Tampa, FL; New Orleans, LA; Los Angeles, CA; Miami, FL; and Houston-Galveston, TX (table 18). The leading country suppliers of cement and clinker in 2004 were, in descending order, Canada, Thailand, Venezuela, China, Colombia, Greece, the Republic of Korea, Mexico, Taiwan, and Sweden. Cement imports from Mexico rose by 72% in 2004, notwithstanding large antidumping tariffs on the cement.

White cement import data are listed in table 20. Although no attempt has been made to correct the data, it is evident that a few of the country entries, notably entries for the United Arab Emirates (in 2003) and for Venezuela (2003–04), have unit values that are too low to be white cement. It is likely that this relatively inexpensive material is actually gray portland cement or even gray clinker for which a white cement tariff code was recorded by the importer. Some other entries have values that seem slightly too low and these may contain a component of gray portland cement.

Owing to fuel cost increases and some shortages of ships, there were widespread reports in 2003–04 of substantially higher fuel-related shipping costs for imports as well as steep rises in the chartering rates for cement ships and other bulk carriers. The difference between the unit customs value and that on a cost, insurance, freight (c.i.f.) basis is a proxy for the shipping cost. For imported gray portland cement in 2003, this difference was $12.71 per ton (up by only 5.4% from the difference in 2002), after deducting the imports (all or mostly overland) from Canada and Mexico. But for 2004, the calculation yields a difference of $19.32 per ton, up by 52%, and thus shipping cost increases were a major part of the overall 21% increase in c.i.f. unit values for waterborne imports in 2004 (the customs values increased by only 8.4%). The relatively modest shipping cost increases in 2003 were likely owing to the existence of long-term import contracts. Many shipping contracts came due for renegotiation (upwards) in the first quarter of 2004, and it was right after that time that numerous inquiries began to come into the USGS concerning tight cement supplies and price increases.

World Review

The world hydraulic cement production data listed in table 22 were derived from data collected by USGS country specialists from a variety of sources. The data for some countries may include their exports of clinker. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may not be all-inclusive. World cement production increased by about 5% in 2004 to an estimated 2.1 Gt.

More than 150 countries produced cement during the year. In terms of country rankings in 2004, China was again by far the leading cement producer with a provisional production of about 934 Mt, or about 44% of the world total. The remaining top 15 countries were, in descending order, India; the United States; Japan; the Republic of Korea; Spain; Russia; Brazil, Italy, and Turkey (tied); Indonesia; Thailand; Mexico; Germany; and Iran. Cumulatively, the top 5 countries had about 60% of total world output; the top 10 countries, about 70%; and the top 15 countries, about 78%.

Regionally, Asia contributed about 64% of world production and included 6 of the 15 leading producing countries. Western Europe had almost 10% of total output; North America, about 7%; the Middle East (including Turkey), about 6%; Central America and South America, about 4%; Africa, about 4%; the Commonwealth of Independent States, about 3%; and Eastern Europe, 2%.

Outlook

Demand for cement in the United States was expected to remain at or near record levels owing to a continued strong housing market, itself spurred by low interest rates. Mortgage and general interest rates were expected to rise in 2005, but not likely to a point where construction levels would be significantly adversely affected. Spending for public sector transportation projects, and hence related concrete demand, was expected to increase once the U.S. Congress passed a reauthorization of the TEA–21 transportation infrastructure funding bill; passage was expected in 2005. Spot shortages of cement and concrete were expected to continue, although shipping costs and general import availability problems of imported cement were anticipated to abate somewhat. In the light of high import levels and general availability of cement from more than 30 countries in 2004, it was unclear if calls to reduce or eliminate antidumping duties on imported Mexican cement would be acted upon. Given the difficulties in getting new capacity permitted, especially entirely new plants, and given rising costs of domestic production (especially for fuels), it was expected that the United States would continue to rely heavily on imports to meet large, short–term increases in cement demand, and that imports in 2005 would be at record levels. Some of the increased demand for cement was expected to be met through increased use of SCM in concrete.

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TABLE 1

SALIENT CEMENT STATISTICS[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

	2000	2001	2002	2003	2004
United States:[2]					
Production:					
Cement[3]	87,846	88,900	89,732	92,843	97,434
Clinker	78,138	78,451	81,517	81,882	86,658
Shipments from mills and terminals:[4, 5]					
Quantity	105,557	112,510	108,500	111,000	120,000
Value [6]	8,292,625 [7]	8,600,000	8,250,000	8,340,000	9,540,000
Average value[8] dollars per metric ton	78.56	76.50	76.00	75.00	79.50
Stocks at mills and terminals, yearend	7,566	6,600	7,680	6,610	6,710
Exports of cement and clinker	738	746	834	837	818
Imports for consumption:					
Cement[9]	24,561	23,694	22,198	21,015	25,396
Clinker	3,673	1,782	1,603	1,808	1,630
Total[10]	28,234	25,474	23,801	22,823	27,026
Consumption, apparent[11]	110,470	112,810	110,020	114,090	121,910
World, production[e, 12]	1,660,000	1,750,000 [r]	1,850,000 [r]	2,020,000 [r]	2,130,000

[e]Estimated. [r]Revised.

[1]Unless otherwise indicated, data are for portland (including blended) and masonry cements only. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Excludes Puerto Rico.

[3]Includes cement produced from imported clinker.

[4]Includes imported cement and cement made from imported clinker. Includes sales by import terminals.

[5]Shipments to final domestic customers. Data are from an annual survey of plants and terminals and may differ from the totals in table 9, which are based on consolidated monthly surveys from companies.

[6]Value at mill or import terminal of cement shipments to final domestic customers.

[7]Although presented unrounded, the data contain estimates for survey nonrespondents.

[8]Total value at mill or import terminal divided by the total tonnage sold.

[9]All forms of hydraulic cement or clinker, respectively.

[10]Data may not add to totals shown because of independent rounding.

[11]Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in yearend cement stocks.

[12]Total hydraulic cement. May include clinker exports for some countries.

TABLE 2

COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Chicago, metropolitan	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3

PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

	2003					2004				
			Capacity[2]					Capacity[2]		
District[3]	Active plants	Production[4] (thousand metric tons)	Finish grinding (thousand metric tons)	Percentage utilized[5]	Stocks at yearend[6] (thousand metric tons)	Active plants	Production[4] (thousand metric tons)	Finish grinding (thousand metric tons)	Percentage utilized[5]	Stocks at yearend[6] (thousand metric tons)
Maine and New York	5	3,117	4,480 [7]	69.5 [7]	277 [7]	5	3,266	4,569	71.5	167
Pennsylvania, eastern[8]	7	4,327	5,320	81.3	321	7	4,706	5,378	87.5	209 [7]
Pennsylvania, western	3	1,393	1,660 [7]	83.8 [7]	128	3	1,522	1,704	89.3	105 [7]
Illinois	4	2,925	3,390 [7]	86.2 [7]	243	4	3,009	3,388	88.8	263
Indiana	4	2,928	3,663	79.9	177	4	3,077	3,723	82.6	253
Michigan and Wisconsin[9]	6	5,541	7,510 [7]	73.7 [7]	370 [7]	6	5,688	7,363	77.3	283
Ohio	2	1,032	1,530 [7]	67.4	36	2	1,020	1,333	76.6	49
Iowa, Nebraska, South Dakota	5	4,390	5,962	73.6	384	5	4,257	6,064	70.2	346
Kansas	4	2,270	3,024	75.1	193	4	2,687	3,042	88.3	196
Missouri	5	5,182	6,823	75.9	384	5	5,263	6,822	77.1	471
Florida[8]	7	4,190	7,390 [7]	56.7 [7]	452	7	5,232	7,370 [7]	71.0	420
Georgia, Virginia, West Virginia	4	2,803	3,820 [r, 7]	73.5 [r, 7]	200 [7]	4	2,832	3,847	73.6	168
Maryland	3	2,203	2,388	92.3	126	3	2,519	2,706	93.1	164
South Carolina	3	3,148	4,340 [7]	72.6	136	3	3,114	4,587	67.9	272
Alabama	5	4,332	5,220 [7]	83.0 [7]	218	5	4,796	5,173	92.7	299
Kentucky, Mississippi, Tennessee	4	3,151	3,490 [7]	90.3 [7]	196	4	3,232	3,587	90.1	335 [7]
Arkansas and Oklahoma	4	2,742	3,330 [7]	82.4 [7]	142	4	2,753	3,277	84.0	253
Texas, northern[8]	6	6,400	7,410 [7]	86.4 [7]	302	6	6,393	7,400 [7]	86.3	322
Texas, southern	5	4,652	5,450 [7]	85.3	241	5	4,791	5,534	86.6	214 [7]
Arizona and New Mexico	3	2,618	3,035	86.3	102	3	2,750	3,477	79.1	98
Colorado and Wyoming	3	2,470	3,310 [7]	74.6 [7]	115	3	2,706	3,281	82.5	146
Idaho, Montana, Nevada, Utah	7	2,992	4,060 [7]	73.7 [7]	304 [7]	6	2,973	3,770 [7]	78.9	180
Alaska and Hawaii	--	--	--	--	35	--	--	--	--	65
California, northern	3	2,489	2,880	86.4	185 [7]	3	2,656	2,944	90.2	153
California, southern[8]	8	9,103	10,300 [7]	88.3 [7]	315 [7]	8	9,272	10,500 [7]	88.4	331
Oregon and Washington	4	1,707	2,432	70.2	213	4	1,921	2,390	80.4	189 [7]
Independent importers, n.e.c.[9]	--	--	--	--	382 [7]	--	--	--	--	315 [7]
Total or average[10]	114	88,106	112,000 [r, 7]	78.5 [r, 7]	6,180 [7]	113	92,434	113,000 [7]	81.6	6,270 [7]
Puerto Rico	2	1,485	2,462	60.3	64	2	1,580	2,462	64.2	43
Grand total or average[10]	116	89,592	115,000 [r, 7]	78.1 [r, 7]	6,240 [7]	115	94,014	116,000 [7]	81.3	6,310 [7]

[r]Revised. -- Zero.

[1]Even when presented unrounded, data are thought to be accurate to no more than three significant digits. Includes data for white cement.

[2]Reported grinding capacity is based on fineness needed to produce a plant's normal product mix, including masonry cement, and allowing for downtime for routine maintenance.

[3]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

[4]Includes cement produced from imported clinker.

[5]Calculated relative to portland cement output.

[6]Includes imported cement. Includes mills and terminals.

[7]Data, even where they appear to be unrounded, contain estimates for nonrespondent or incompletely reporting facilities.

[8]Data, except for stockpiles, exclude one plant that reported cement (clinker) grinding capacity but reported no production of portland cement.

[9]Not elsewhere classified. Data include only those importers or terminals for which regional assignations were not possible.

[10]Data may not add to totals shown because of independent rounding.

TABLE 4
MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

	2003			2004		
District[2]	Active plants	Production[3] (thousand metric tons)	Stocks at yearend[4] (thousand metric tons)	Active plants	Production[3] (thousand metric tons)	Stocks at yearend[4] (thousand metric tons)
Maine and New York	4	117	15 [5]	4	127	20
Pennsylvania, eastern	6	246	44	6	289	37
Pennsylvania, western	3	96	9	3	W	W [5]
Indiana	4	W	W	4	W	W
Michigan	5	237	37	4	231	32
Ohio	2	75	12	2	98	18
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	W	W	2	W	W
Missouri	1	W	W	1	W	W
Florida	5	674	35	5	763	45
Georgia, Virginia, West Virginia	5	371 [5]	38 [5]	5	419	49
Maryland	2	W	W	2	W	W
South Carolina	3	425	23	3	453	7
Alabama	4	565	51	4	430	56
Kentucky, Mississippi, Tennessee	3	W	W	3	W	W
Arkansas and Oklahoma	4	149	14	4	161	15
Texas, northern	4	155	11	4	161	22
Texas, southern	3	152	7	3	158	5 [5]
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	--	W	W
Alaska and Hawaii	1	4	--	--	--	--
California, northern, Oregon, Washington[6]	3	73	8	3	81	6
California, southern	4	519	9	4	605	12
Independent importers, n.e.c.[7]	--	--	5 [5]	--	--	5 [5]
Total[8]	76	4,737 [5, 9]	434 [5]	73	5,000	441 [5]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Includes masonry, portland-lime, and plastic cements. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

[3]Includes cement produced from imported clinker.

[4]Includes imported cement.

[5]Data, even where they appear unrounded, contain estimates for nonrespondent or incompletely reporting facilities.

[6]Oregon and Washington reported zero production and stocks in 2004.

[7]Not elsewhere classified.

[8]Data may not add to totals shown because of independent rounding.

[9]Production from clinker accounted for 95% of the total. Production from finished cement accounted for the remainder.

TABLE 5

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2004, BY DISTRICT[1]

District	Active plants[2] Process used Wet	Dry	Both	Total	Number of kilns[3]	Daily capacity[4] (thousand metric tons)	Average days of routine maintenance	Apparent annual capacity[5] (thousand metric tons)	Production (thousand metric tons)	Percentage of capacity utilized	Yearend stocks[6] (thousand metric tons)
Maine and New York	2	1	1	4	6	12.8	19.9	4,390	3,055	69.5	107
Pennsylvania, eastern	2	5	--	7	14	16.5	36.6	5,440	4,486	82.5	185
Pennsylvania, western	2	1	--	3	7	5.0	29.8 [7]	1,700	1,442	85.0 [7]	45
Illinois	--	4	--	4	8	8.6	21.1	2,910	2,654	91.1	205
Indiana	1	3 [8]	--	4	8	10.6	23.3	3,650	3,163	86.7	87
Michigan	1	2	--	3	8	13.9	26.6	4,730	4,077	86.2	375
Ohio	1	1	--	2	3	3.4	18.6	1,200	1,015	84.8	31
Iowa, Nebraska, South Dakota	--	4	1	5	9	13.9	21.9	4,710	3,849	81.7	153
Kansas	1	3	--	4	9	8.9	11.6	3,150	2,608	82.7	123
Missouri	2	3	--	5	6	15.9	13.7	5,570	5,015	90.1	124
Florida	--	5	1	6	9	21.3	19.2	7,370	4,758	64.6	182 [7]
Georgia, Virginia, West Virginia	1	3	--	4	6	9.6	19.1	3,310	2,421	73.1	198
Maryland	1	2	--	3	4	8.1	13.5	2,830	2,495	88.2	85
South Carolina	1	2	--	3	6	11.0	19.8	3,680	3,145	85.4	118
Alabama	--	5	--	5	5	16.4	18.2	5,690	5,048	88.7	184
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.2	21.8	3,510	3,108	88.5	230
Arkansas and Oklahoma	2	2	--	4	10	8.3	15.6	2,900	2,536	87.4	73
Texas, northern	2	3	1	6	16	21.3	19.7	7,380	6,312	85.6	204
Texas, southern	--	4	1	5	6	13.7	20.5	4,750	4,417	93.0	232
Arizona and New Mexico	--	3	--	3	7	8.6	14.1	3,020	2,566	84.9	112
Colorado and Wyoming	--	3	--	3	4	8.7	13.7	3,050	2,486	81.6	68
Idaho, Montana, Nevada, Utah	3	3	--	6	8	8.3	21.1	2,880	2,777	96.4	72
California, northern	--	3	--	3	3	8.9	21.8	3,070	2,623	85.3	114
California, southern	--	8	--	8	17	29.5	23.4	10,190	8,970	88.1	357
Oregon and Washington	1	2	--	3	3	6.3	56.6	1,920	1,632	85.1	68
Total or average[9]	24	78	5	107	186	299.7	21.4	103,000	86,658	84.1	3,730
Puerto Rico	--	2	--	2	2	6.0	11.0	2,130	1,533	72.1	97
Grand total or average[9]	24	80	5	109	188	305.7	21.3	105,000	88,190	83.9	3,830

-- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes white cement plants. Includes all plants active for at least one day during the year.

[3]Kilns active at least one day during year. Excludes idle kilns (full year) that cannot be restarted, fully permitted, in less than 6 months.

[4]Sum of reported daily kiln capacities for each plant in district.

[5]Sum of apparent annual kiln capacities; for each kiln calculated as 365 days (366 in leap years) minus reported days as shut down for routine maintenance and then multiplied by the reported (unrounded) daily capacity.

[6]Includes imported clinker and clinker stockpiles at grinding plants.

[7]Data, even where apparently unrounded, contain estimates for nonrespondent or incompletely reporting facilities.

[8]Includes one semidry kiln.

[9]Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

Raw materials	2003 Clinker	2003 Cement[3]	2004 Clinker	2004 Cement[3]
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	109,000	1,530	125,000	1,810
Cement rock (includes marl)	12,700	44	12,700	2
Cement kiln dust (CKD)[4]	289	149	333	165
Lime[5]	22	27	24	29
Other	235	32	23	19
Aluminous:				
Clay	3,950	--	4,740	--
Shale	2,630	8	3,700	29
Other[6]	618	--	661	--
Ferrous, iron ore, pyrites, millscale, other	1,340	--	1,340	--
Siliceous:				
Sand and calcium silicate	2,860	2	3,150	--
Sandstone, quartzite soils, other	587	2	878	6
Fly ash	2,250	39	2,890	77
Other ash, including bottom ash	1,100	--	1,050	--
Granulated blast furnace slag[7]	17	333	104	345
Other blast furnace slag	214	--	189	--
Steel slag	448	--	401	--
Other slags	113	--	53	--
Natural rock pozzolans[8]	--	25	--	6
Other pozzolans[9]	129	49	114	19
Other:				
Gypsum and anhydrite	--	5,000	--	5,300
Other, n.e.c.[10]	70	68	106	98
Total[11]	139,000	7,300	157,000	7,910
Clinker, imported, raw materials equivalent[11]	--	4,240	--	7,530
Grand total[12]	139,000	11,500	157,000	15,400

-- Zero.

[1]Nonfuel raw materials. Includes Puerto Rico.

[2]Data have been rounded to three significant digits to reflect inherent reporting accuracy and the incorporation of estimates for some facilities.

[3]Includes portland, blended, and masonry cements.

[4]Data are underreported.

[5]Data are probably underreported, especially regarding incorporation within masonry cements.

[6]Includes alumina, aluminum dross, bauxite, catalysts, staurolite, and other materials.

[7]Includes both ground (GGBFS) and unground material.

[8]Includes pozzolana and burned clays and shales except where reported directly as clay or shale.

[9]Includes diatomite, silica fume, other microcrystalline silica, and other pozzolans, whether or not used as such.

[10]Not elsewhere classified.

[11]Data may not add to totals shown because of independent rounding.

[12]Converted as the weight of foreign clinker consumed times 1.7.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS[1, 2]

Kiln process	Clinker produced[3]: Active plants	Clinker produced[3]: Quantity (thousand metric tons)	Clinker produced[3]: Percentage of total	Fuel consumed: Coal[4] (thousand metric tons)	Fuel consumed: Coke[5] (thousand metric tons)	Fuel consumed: Petroleum coke (thousand metric tons)	Fuel consumed: Oil[6] (thousand liters)	Fuel consumed: Natural gas (thousand cubic meters)	Waste fuel: Tires (thousand metric tons)	Waste fuel: Solid (thousand metric tons)	Waste fuel: Liquid (thousand liters)
2003:											
Wet	26	13,259	15.9	1,830	--	528	24,300	33,400	92	234	686,000
Dry	79	65,201	78.3	6,940	3	1,420	61,200	286,000	291	52	185,000
Both[7]	4	4,855	5.8	696	--	26	--	58,100	5	31	39,000
Total[8]	109	83,315	100.0	9,460	3	1,980	85,400	377,000	387	317	910,000
2004:											
Wet	24	14,165	16.1	1,730	--	584	29,300	36,700	61	38	771,000
Dry	80	68,693	77.9	7,420	--	1,600	75,200	299,000	312	71	188,000
Both[7]	5	5,333	6.0	700	--	77	691	60,000	5	16	40,400
Total[8]	109	88,190	100.0	9,850	--	2,260	105,000	396,000	377	125	999,000

-- Zero.

[1]All fuel data have been rounded to three significant digits.

[2]Includes Puerto Rico.

[3]Clinker data were all reported; although unrounded, data are thought to be accurate to no more than three significant digits.

[4]All reported to be bituminous.

[5]Data are likely to be all or mostly misreported petroleum coke.

[6]Distillate and residual fuel oils; excludes used oils included under liquid wastes.

[7]Fuel quantities may not represent normal operating conditions owing to the inclusion of plants that were converted from wet to dry technology during the year.

[8]Data may not add to totals shown because of independent rounding.

TABLE 8

ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS[1]

Plant process	Electric energy used[2]: Generated at plant: Number of plants	Generated at plant: Quantity (million kilowatthours)	Purchased: Number of plants	Purchased: Quantity (million kilowatthours)	Total: Quantity[3] (million kilowatthours)	Total: Percentage	Finished cement produced[4] (thousand metric tons)	Average consumption (kilowatthours per metric ton of cement produced)
2003:								
Integrated plants:								
Wet	--	--	26	2,190	2,190	16.5	15,618	140
Dry	5	526	79	9,760	10,300	77.4	72,895	141
Both[5]	--	--	4	814	814	6.1	5,816	140
Total or average[3]	5	526	109	12,800	13,300	100.0	94,329	141
Grinding plants[6]	--	--	6	166	166	--	2,169	77
Exclusions[7]	--	--	2	--	--	--	139	--
2004:								
Integrated plants:								
Wet	--	--	24	2,170	2,170	15.8	15,770	137
Dry	4	456	80	10,300	10,700	78.2	75,045	143
Both[5]	--	--	5	822	822	6.0	5,642	146
Total or average[3]	4	456	109	13,300	13,700	100.0	96,457	142
Grinding plants[6]	--	--	6	198	198	--	2,392	83
Exclusions[7]	--	--	2	--	--	--	165	--

-- Zero.

[1]Includes Puerto Rico.

[2]Electricity data are rounded because they include estimates for a number of nonrespondent plants or incomplete reporting by respondent facilities.

[3]Data may not add to totals shown because of independent rounding.

[4]Includes portland and masonry cements. Data are all reported and have not been rounded.

[5]Electricity consumption may not represent normal operating conditions owing to the inclusion of plants that were converted from wet to dry technology during the year.

[6]Excludes plants that reported production only of masonry cement.

[7]Tonnage of cement produced by plants that reported production of masonry cement only.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

	Portland cement		Masonry cement	
Destination and origin	2003	2004	2003	2004
Destination:				
Alabama	1,599 r	1,643	162	172
Alaska[3]	165	175	(4)	--
Arizona	3,608	4,117	109	113
Arkansas	1,094	1,173	69	83
California, northern	4,681	5,044	111	125
California, southern	8,574	9,177	450	537
Colorado	2,290	2,440	27	30
Connecticut[3]	757	828	15	19
Delaware[3]	173 r	181	11	13
District of Columbia[3]	195	191	(4)	(4)
Florida	8,589 r	9,698	767 r	879
Georgia	3,446 r	4,109	321	354
Hawaii	340	380	5	5
Idaho	590	685	1	1
Illinois, excluding Chicago	1,756	2,068	26	27
Illinois, metropolitan Chicago[3]	2,234	1,919	62	65
Indiana	2,176	2,238	93	97
Iowa	1,717 r	1,842	7	6
Kansas	1,540	1,535	15	14
Kentucky	1,337	1,395	107	114
Louisiana[3]	1,832	1,882	62	66
Maine	219	234	5	5
Maryland	1,344 r	1,542	85	91
Massachusetts[3]	1,265 r	1,322	20	24
Michigan	3,052	3,175	142	146
Minnesota[3]	2,068	2,077	50	47
Mississippi	984 r	974	64	67
Missouri	2,664	2,623	47	49
Montana	375	407	1	1
Nebraska	1,208 r	1,308	8	9
Nevada	2,026	2,382	23	29
New Hampshire[3]	233	221	5	5
New Jersey[3]	1,886	2,036	75	89
New Mexico	813	940	9	9
New York, eastern	645	663	26	23
New York, western[3]	819	879	29	30
New York, metropolitan[3]	1,685	1,694	75	87
North Carolina[3]	2,469	2,743	305	326
North Dakota[3]	330	402	3	2
Ohio	3,830	3,999	189	191
Oklahoma	1,480 r	1,442	54	62
Oregon	1,005	1,119	1	1
Pennsylvania, eastern	1,948	2,230	61	73
Pennsylvania, western	1,165 r	1,166	68	60
Rhode Island[3]	197	178	3	4
South Carolina	1,499	1,742	138	147
South Dakota	452	512	2	2
Tennessee	1,884 r	1,875	223	256
Texas, northern	6,680	6,222	192	148
Texas, southern	6,359	6,874	191	219
Utah	1,200	1,373	(4)	(4)

See footnotes at end of table.

TABLE 9—Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2003	Portland cement 2004	Masonry cement 2003	Masonry cement 2004
Destination—Continued:				
Vermont[3]	136	144	3	3
Virginia	2,100	2,478	169	189
Washington	1,903	2,090	2	2
West Virginia	432	488	27	29
Wisconsin	2,229	2,329	30	28
Wyoming	424	463	1	(4)
Total[5]	107,701 r	115,066	4,745	5,172
Foreign countries[6]	483	492	(4)	1
Puerto Rico	1,858	1,879	--	--
Grand total[5]	110,042 r	117,435	4,745	5,172
Origin:				
United States	89,598	93,323	4,701	5,115
Puerto Rico	1,484	1,585	--	--
Foreign countries[7]	18,960	22,527	44	57
Total shipments[5]	110,042	117,435	4,745	5,172

[r]Revised. -- Zero.

[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.

[2]Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 10-12, and 14-15, which are from annual surveys of individual plants and importers. Includes any revisions to monthly data available through August 31, 2005. Although presented unrounded, data are thought to be accurate to no more than three significant digits.

[3]Has no cement plants.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Includes shipments to U.S. possessions and territories.

[7]Imported cement distributed in the United States as reported by domestic producers and other importers. Data do not match the imports calculated from tables 17 and 21.

TABLE 10

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total shipments
	In bulk	In containers[3]	In bulk	In containers[3]	In bulk	In containers[3]	to consumer[4]
2003:							
Railroad	12,200	7	1,770	--	411	19	2,200
Truck	4,380	142	56,800	2,030	46,300	745	106,000
Barge and boat	7,910	--	141	1	44	--	186
Total[4]	24,400	149	58,700	2,030	46,800	764	108,000 [5]
2004:							
Railroad	13,700	47	1,690	8	409	1	2,108
Truck	4,910	563	61,300	2,080	48,800	847	113,000
Barge and boat	8,400	10	99	--	1,290	--	1,390
Total[4]	27,000	620	63,100	2,090	50,500	848	116,000 [5]

-- Zero.

[1]Includes Puerto Rico. Includes imported cement and cement made from imported clinker.

[2]Data are rounded to no more than three significant digits because they include estimates.

[3]Includes packages, bags, and jumbo bags.

[4]Data may not add to totals shown because of independent rounding.

[5]Shipments calculated on the basis of an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidatedonthly data.

TABLE 11

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1]

	2003			2004		
		Value[2]			Value[2]	
District[3, 4]	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	2,142	$158,000 [5]	74.00 [5]	3,556	$269,944	75.91
Pennsylvania, eastern	4,336	317,000 [5]	73.00 [5]	4,830 [5]	363,000 [5]	75.00 [5]
Pennsylvania, western	1,404	106,000 [5]	75.50 [5]	1,535	120,000 [5]	78.00 [5]
Illinois	2,988	215,000 [5]	72.00 [5]	3,052	235,921	77.31
Indiana	2,830 [5]	196,379	69.39	3,013	213,484	70.85
Michigan and Wisconsin	6,600 [5]	490,000 [5]	74.00 [5]	6,611	535,000 [5]	81.00 [5]
Ohio	1,078	85,872	79.64	1,005	84,700 [5]	84.00 [5]
Iowa, Nebraska, South Dakota	4,869	378,034	77.65	4,802	394,319	82.12
Kansas	2,051	156,000 [5]	76.00 [5]	2,222	175,000 [5]	79.00 [5]
Missouri	6,291	426,931	68.87	6,058	446,008	73.63
Florida	8,289	638,000 [5]	77.00 [5]	9,430 [5]	776,000 [5]	82.50 [5]
Georgia, Virginia, West Virginia	2,730	193,000 [5]	70.50 [5]	2,951	220,030	74.55
Maryland	2,483	165,935	66.82	2,733	189,628	69.38
South Carolina	3,210	198,000 [5]	61.50 [5]	3,491	220,162	63.06
Alabama	4,275	269,000 [5]	63.00 [5]	4,621	308,181	66.69
Kentucky, Mississippi, Tennessee	3,183	218,000 [5]	68.50 [5]	3,087	227,798	73.79
Arkansas and Oklahoma	2,797	196,459	70.24	2,658	198,487	74.68
Texas, northern	6,660 [5]	449,000 [5]	67.50 [5]	7,678	559,000 [5]	73.00 [5]
Texas, southern	6,020 [5]	408,030	67.78	6,270 [5]	435,000 [5]	69.50 [5]
Arizona and New Mexico	3,676	342,180	93.08	3,969	368,314	92.80
Colorado and Wyoming	2,329	169,619	72.82	2,786	206,658	74.19
Idaho, Montana, Nevada, Utah	3,097	245,000 [5]	79.00 [5]	3,245	281,775	86.83
Alaska and Hawaii	454	58,952	129.80	499	64,680	129.53
California, northern	3,751	302,695	80.69	4,257	369,806	86.88
California, southern	9,881	740,801	74.97	10,764	881,243	81.87
Oregon and Washington	1,897	145,334	76.61	2,690 [5]	207,000 [5]	77.00 [5]
Independent importers, n.e.c.[6, 7]	7,140 [5]	555,000 [5]	78.00 [5]	6,790 [5]	598,000 [5]	88.00 [5]
Total or average[8]	106,000 [5, 9]	7,820,000 [5]	73.50 [5]	115,000 [5, 9]	8,950,000 [5]	78.00 [5]
Puerto Rico	1,848	W	W	1,868	W	W
Grand total[8]	108,000 [5, 9]	W	W	116,000 [5, 9]	W	W

W Withheld to avoid disclosing company proprietary data.

[1]Includes portland cement (gray and white) and cement produced from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Values represent mill net or ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded value data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per ton.

[3]District is the location of the reporting facility, not the location of sales.

[4]Includes shipments by independent importers where regional assignations were possible.

[5]Data are rounded (unit values to the nearest $0.50) because they include estimated data.

[6]Importers for which district assignations were not possible.

[7]Not elsewhere classified.

[8]Data may not add to totals shown because of independent rounding.

[9]Shipments calculated on the basis of an annual survey of plants and importers; may differ from data in table 9, which are based on consolidated company monthly data.

TABLE 12

MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1, 2]

District[4]	2003 Quantity (thousand metric tons)	2003 Value[3] Total (thousands)	2003 Value[3] Average (dollars per metric ton)	2004 Quantity (thousand metric tons)	2004 Value[3] Total (thousands)	2004 Value[3] Average (dollars per metric ton)
Maine and New York	112 [5]	$11,600 [5]	104.00 [5]	122	$12,100 [5]	99.50 [5]
Pennsylvania, eastern	317 [5, 6]	36,700 [5, 6]	116.00 [5, 6]	254	29,200 [5]	115.00 [5]
Pennsylvania, western	W	W	W	91	10,600 [5]	116.50 [5]
Illinois, Indiana, Ohio	494	57,040	115.43	532	62,500 [5]	117.50 [5]
Michigan	269	27,500 [5]	102.50 [5]	255	30,000 [5]	117.50 [5]
Iowa, Nebraska, South Dakota	32	5,291	165.72	35	4,627	132.92
Kansas and Missouri	146	13,804	94.76	154	18,166	118.23
Florida	675	83,093	123.04	775	99,200 [5]	128.00 [5]
Georgia, Maryland, Virginia, West Virginia	428	53,200 [5]	124.50 [5]	455	66,000 [5]	145.00 [5]
South Carolina	416	42,767	102.71	400	44,073	110.06
Alabama	488	48,100 [5]	98.50 [5]	425	48,875	114.98
Kentucky, Mississippi, Tennessee	118	13,500 [5]	114.00 [5]	125	15,000	119.73
Arkansas and Oklahoma	159	15,220	95.52	157	16,724	106.61
Texas, northern	130	17,500 [5]	134.50 [5]	163	22,800 [5]	139.50 [5]
Texas, southern	160	16,586	103.45	172	17,111	99.75
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	148	14,500 [5]	98.00 [5]	147	15,513	105.71
Alaska and Hawaii	4	724	173.05	4	914	209.44
California, northern; Oregon; Washington	76	6,487	85.08	84	9,710 [5]	115.00 [5]
California, southern	535	48,379	90.51	599	57,115	95.30
Independent importers, n.e.c.[7, 8]	28	3,600 [5]	130.00 [5]	43 [5]	4,910 [5]	114.00 [5]
Total or average[9]	4,740 [5, 10]	516,000 [5]	109.00 [5]	4,990 [5, 10]	585,000 [5]	117.00 [5]

W Withheld to avoid disclosing company proprietary data; included in "Pennsylvania, eastern."

[1]Shipments are to final customers and include imported cement and cement made from imported clinker. Data exclude Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes gray, white, and colored varieties of masonry, portland-lime, and plastic cements.

[3]Values represent ex-plant (free-on-board) valuations of total sales to final customers, including sales from distribution terminals. Even where presented unrounded, data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[4]District location is that of the reporting facilities, not necessarily the location of sales.

[5]Data are rounded (unit values to the nearest $0.50) because they include estimated data.

[6]Data include "Pennsylvania, western."

[7]Importers for which district assignations were not possible.

[8]Not elsewhere classified.

[9]Data may not add to totals shown because of independent rounding.

[9]Tonnages based on an annual survey of plants and terminals and may differ from the totals in table 9, which represent consolidated monthly surveys of companies.

TABLE 13

AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

Year	Gray portland cement	White portland cement[3]	All portland cement	Prepared masonry cement	All classes of cement
2003	72.50	159.00	73.50	109.00	75.00
2004	77.50	164.00	78.00	117.00	79.50

[1]Excludes Puerto Rico. Values are the average of sales to final customers, free on board plant or import terminal, less all discounts, allowances, and onward delivery charges to customers or distribution terminals, but inclusive of bagging

[2]Data are rounded to the nearest $0.50 because they include estimates.

[3]The unit values for white cement include a component of resales showing significant price markups.

TABLE 14

PORTLAND CEMENT SHIPMENTS IN 2004, BY DISTRICT AND TYPE OF CUSTOMER[1]

(Thousand metric tons)

District[2, 3]	Ready-mixed concrete	Concrete product manufacturers[4]	Contractors[5]	Building material dealers	Oil well, mining, waste[6]	Government and miscellaneous[7]	Total[8, 9]
Maine and New York	2,680	485	90	274	--	31	3,556
Pennsylvania, eastern	3,050	1,270	164	250	2	91	4,830
Pennsylvania, western	1,080	259	157	5	16	16	1,535
Illinois	2,280	373	113	40	139	105	3,052
Indiana	2,300	436	182	73	10	16	3,013
Michigan and Wisconsin	5,110	770	371	182	18	163	6,611
Ohio	788	132	47	29	1	9	1,005
Iowa, Nebraska, South Dakota	3,660	589	358	74	108	9	4,802
Kansas	1,650	131	322	72	45	1	2,222
Missouri	4,850	418	662	99	7	22	6,058
Florida	6,750	1,920	123	632	--	11	9,430
Georgia, Virginia, West Virginia	2,270	437	180	37	21	9	2,951
Maryland	1,950	462	167	52	5	96	2,733
South Carolina	2,250	701	312	140	1	87	3,491
Alabama	3,570	662	201	141	16	36	4,621
Kentucky, Mississippi, Tennessee	2,500	383	125	63	11	2	3,087
Arkansas and Oklahoma	1,790	132	565	105	61	8	2,658
Texas, northern	4,960	560	1,070	137	731	228	7,678
Texas, southern	4,240	611	729	204	455	32	6,270
Arizona and New Mexico	2,820	622	238	121	21	145	3,969
Colorado and Wyoming	2,170	314	179	55	65	5	2,786
Idaho, Montana, Nevada, Utah	2,590	238	116	40	228	38	3,245
Alaska and Hawaii	419	65	11	1	--	4	499
California, northern	3,560	279	114	302	--	4	4,257
California, southern	7,330	2,620	351	375	84	3	10,764
Oregon and Washington	1,960	390	178	114	41	3	2,690
Independent importers, n.e.c.[10, 11]	5,220	986	216	206	44	117	6,790
Total[9]	83,800	16,200	7,340	3,820	2,130	1,290	115,000
Puerto Rico	1,090	173	81	527	--	--	1,868
Grand total[9]	84,900	16,400	7,420	4,350	2,130	1,290	116,000

-- Zero.

[1]Includes imported cement and cement ground from imported clinker. Except for district totals, data have been rounded to three significant digits but are likely to be accurate to only two significant digits. District totals are accurate to no more than three significant digits.

[2]District location is that of the reporting facilities and may include sales by them into other districts.

[3]Includes shipments by independent importers for which district assignations were possible.

[4]Grand total shipments to concrete product manufacturers include brick and block—6,390; precast and prestressed—3,580; pipe—2,190; and other or unspecified—4,270.

[5]Grand total shipments to contractors include airport—164; road paving—4,170; soil cement—1,150; and other or unspecified—1,930.

[6]Grand total shipments include oil well drilling—1,800; mining—217; and waste stabilization—116.

[7]Includes shipments for which customer types were not specified.

[8]District totals are not rounded except in accord with the data in table 11.

[9]Data may not add to totals shown because of independent rounding.

[10]Shipments by independent importers for which district assignations were not possible.

[11]Not elsewhere classified.

TABLE 15

PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE[1, 2]

(Thousand metric tons)

Type	2003	2004
General use and moderate heat (Types I and II) (gray)[3]	89,500	91,800
High early strength (Type III)	3,750	3,820
Sulfate resisting (Type V)[3]	10,600	15,800
Block	752	609
Oil well	1,090	1,310
White[4]	985	1,130
Blended:		
Portland, natural pozzolans	142	49
Portland, granulated blast furnace slag	747	978
Portland, fly ash	240	343
Other blended cement[5]	438	486
Total[6]	1,570	1,860
Expansive and regulated fast setting	52	62
Miscellaneous[7]	88	32
Grand total[6, 8]	108,000	116,000

[1]Includes Puerto Rico. Includes imported cement.

[2]Data are rounded to no more than three significant digits; may not add to totals shown.

[3]Cements classified as Type II/V hybrids are now commonly reported as Type V.

[4]Mostly Types I and II, but may include Types III-V and block varieties.

[5]Includes blends with other pozzolans, such as cement kiln dust and silica fume.

[6]Data may not add to totals shown because of independent rounding.

[7]Includes low heat (Type IV), waterproof, and other portland cements.

[8]Data are based on an annual survey of plants and importers; may differ from data on table 9, which are based on monthly consolidated data from companies.

TABLE 16

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003		2004	
Country of destination	Quantity	Value[2]	Quantity	Value[2]
Aruba	1	228	(3)	51
Azerbaijan	(3)	6	9	425
Bahamas, The	11	1,416	21	2,613
Bolivia	1	23	--	--
Brazil	1	108	(3)	41
Canada	720	50,291	639	48,034
Cayman Islands	(3)	72	1	198
China	4	251	6	645
Dominican Republic	24	1,672	71	2,929
Egypt	1	54	(3)	9
El Salvador	1	98	(3)	8
Equatorial Guinea	--	--	2	71
Finland	2	75	(3)	5
Greece	1	190	1	179
Haiti	(3)	36	1	27
Hong Kong	1	97	2	157
Israel	1	40	(3)	24
Jamaica	(3)	59	1	42
Japan	1	109	1	74
Korea, Republic of	3	156	1	87
Mexico	35	3,817	41	4,699
Nigeria	1	30	1	24
Oman	8	401	1	81
Panama	1	97	1	85
Peru	1	45	(3)	53
Poland	--	--	1	53
Russia	1	34	(3)	12
Saudi Arabia	1	33	(3)	24
Singapore	1	23	(3)	15
Spain	1	99	(3)	8
Sweden	(3)	5	1	74
Switzerland	1	59	(3)	32
Taiwan	2	158	3	171
Thailand	1	22	(3)	22
Trinidad and Tobago	1	124	1	165
Turks and Caicos Islands	6	305	(3)	44
United Arab Emirates	1	101	1	80
Venezuela	2	338	5	275
Other	5 r	920 r	6	1,505
Total[4]	837	61,596	818	63,041

[r]Revised. -- Zero.

[1]Includes portland and masonry cements.

[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

[3]Less than ½ unit.

[4]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 17

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Country of origin	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Belgium	5	574	826	6	850	1,120
Brazil	266	8,927	11,677	442	18,206	22,359
Bulgaria	151	6,318	7,770	231	12,478	15,069
Canada	6,319 r	327,191 r	362,502 r	5,753	319,651	338,988
China[4]	1,823	58,315	80,752	2,145	73,168	115,440
Colombia	1,766	65,167	85,618	2,123	84,173	116,426
Croatia	36	6,700	8,122	25	4,668	5,671
Denmark	433	19,581	29,497	373	18,319	30,041
Egypt	58	2,972	4,177	339	17,147	26,166
France	90	9,535	10,703	79	15,163	17,710
Greece	1,188	36,602	50,550	2,011	65,398	105,253
Indonesia	--	--	--	630	22,490	41,804
Korea, Republic of	1,745	46,463	69,511	1,729	48,014	80,415
Mexico	891	41,950	53,767	1,439	63,552	82,479
Netherlands	5	3,021	3,630	7	3,338	4,111
Norway	471	20,479	20,561	365	23,388	25,642
Peru	459	14,101	20,419	644	21,335	35,871
Philippines	206	5,353	8,151	301	8,360	13,293
Spain	355	17,799	23,855	412	19,699	28,605
Sri Lanka	8	273	274	--	--	--
Sweden	924	29,521	38,298	1,058	31,483	55,336
Switzerland[5]	29	839	1,198	--	--	--
Taiwan	395	14,674	18,095	1,068	42,014	69,345
Thailand	3,344	98,199	149,254	2,808	90,620	148,475
Turkey	1,077	35,246	50,672	771	26,889	43,045
United Arab Emirates	6	396	406	2	126	204
United Kingdom	13	4,066	4,738	19	6,097	6,625
Venezuela	1,664	57,397	81,472	2,505	99,419	140,571
Other	233 r	8,495 r	12,574 r	19	3,282	5,364
Total[6]	23,959 r	940,154 r	1,209,069 r	27,305	1,139,328	1,575,428

r Revised. -- Zero.

[1]Includes portland, masonry, and other hydraulic cements. Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]China may be underrepresented and it is believed that all or some imports from Japan should be assigned to China.

[5]The country origin of these imports is thought to be misreported.

[6]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 18

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Anchorage, AK:						
Canada	10	596	1,149	11	731	1,350
Korea, Republic of	132	3,947	5,854	111	3,280	5,281
Total[4]	142	4,543	7,004	122	4,011	6,631
Baltimore, MD:						
Belgium	--	--	--	(5)	7	11
China	--	--	--	(5)	5	5
Germany	--	--	--	(5)	6	7
Netherlands	1	988	1,129	1	215	232
Total[4]	1	988	1,129	1	233	256
Boston, MA:						
Netherlands	(5)	88	106	(5)	83	102
Venezuela	176	6,148	8,230	127	4,756	6,634
Total[4]	176	6,237	8,336	128	4,839	6,737
Buffalo, NY:						
Canada	704	41,222	43,558	796	46,241	48,993
France	(5)	35	36	--	--	--
Germany	--	--	--	(5)	12	13
United Kingdom	7	1,387	1,574	12	2,696	2,797
Total[4]	711	42,644	45,168	808	48,950	51,802
Charleston, SC:						
China	8	761	1,011	6	758	1,062
Colombia	506	17,839	24,721	293	11,619	15,866
Egypt	39	1,523	2,120	--	--	--
Greece	272	8,586	12,103	451	16,273	27,461
Netherlands	(5)	32	40	(5)	18	22
Spain	7	223	524	46	391	1,048
Sri Lanka	8	273	274	--	--	--
Sweden	--	--	--	(5)	58	68
United Kingdom	3	1,144	1,287	2	1,105	1,126
Venezuela	--	--	--	7	683	1,132
Total[4]	843	30,381	42,081	806	30,905	47,785
Chicago, IL:						
Canada	35	1,872	1,962	34	1,833	1,936
Japan	(5)	43	49	(5)	72	83
Netherlands	1	343	423	1	580	726
Total[4]	37	2,258	2,434	36	2,485	2,745
Cleveland, OH:						
Canada	697	36,531	37,923	699	35,946	37,412
Mexico	--	--	--	(5)	7	11
Netherlands	--	--	--	(5)	278	319
United Kingdom	1	248	319	(5)	65	88
Total[4]	698	36,779	38,242	699	36,295	37,830
Columbia-Snake, ID-OR-WA:						
Canada	56	2,712	2,854	128	6,720	7,224
China	481	15,305	21,222	506	16,053	22,564
Korea, Republic of	--	--	--	21	715	1,056
Total[4]	538	18,017	24,075	656	23,488	30,843
Detroit, MI:						
Brazil	50	2,132	2,165	127	5,454	5,504
Canada	1,553	91,252	99,513	1,320	82,765	85,106
Denmark	--	--	--	(5)	5	5

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Detroit, MI—Continued:						
France	(5)	3	3	--	--	--
Netherlands	(5)	19	24	(5)	47	59
Norway	23	910	920	--	--	--
Sweden	(5)	5	9	--	--	--
United Kingdom	--	--	--	1	252	304
Total[4]	1,626	94,321	102,634	1,448	88,523	90,978
Duluth, MN, Canada	189	8,865	10,093	172	7,854	8,762
El Paso, TX, Mexico	189	10,245	11,913	368	17,004	20,703
Great Falls, MT:						
Canada	14	585	741	51	2,528	2,619
France	(5)	5	5	--	--	--
Japan	--	--	--	(5)	4	4
Total[4]	14	590	746	51	2,532	2,622
Honolulu, HI:						
China	32	835	1,206	55	1,757	3,257
Korea, Republic of	--	--	--	21	609	1,449
Philippines	206	5,353	8,151	301	8,360	13,293
Thailand	77	2,097	3,498	40	1,080	1,794
Total[4]	314	8,285	12,856	417	11,806	19,793
Houston-Galveston, TX:						
Belgium	(5)	9	12	--	--	--
Brazil	3	369	394	--	--	--
Chile	--	--	--	(5)	29	35
Colombia	140	6,844	9,289	119	7,511	7,944
Egypt	19	1,447	2,053	29	2,282	2,971
France	(5)	121	149	(5)	84	94
Germany	(5)	146	182	(5)	90	110
Greece	--	--	--	206	6,266	9,252
Korea, Republic of	1,393	37,139	54,894	1,138	31,751	49,999
Peru	312	10,843	15,293	31	1,141	1,576
Thailand	79	3,154	4,114	--	--	--
Turkey	--	--	--	69	2,158	3,360
United Arab Emirates	6	396	406	--	--	--
United Kingdom	(5)	198	247	(5)	158	190
Venezuela	73	2,557	3,570	375	16,464	22,446
Total[4]	2,026	63,223	90,602	1,969	67,934	97,977
Laredo, TX, Mexico	124	13,840	14,580	158	18,052	18,989
Los Angeles, CA:						
China	709	22,708	30,636	1,196	42,085	64,956
Colombia	2	208	301	2	176	257
Egypt	(5)	3	4	2	150	245
Indonesia	--	--	--	78	5,857	8,775
Italy	(5)	25	26	--	--	--
Japan	223	7,059	9,759	(5)	142	233
Peru	--	--	--	1	86	128
Taiwan	395	14,674	18,095	260	10,487	14,904
Thailand	646	19,304	29,278	974	36,655	62,244
United Arab Emirates	--	--	--	1	79	114
United Kingdom	(5)	58	73	1	172	172
Total[4]	1,976	64,039	88,172	2,513	95,889	152,028

See footnotes at end of table.

TABLE 18—Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Miami, FL:						
Belgium	2	315	334	2	596	630
Brazil	--	--	--	(5)	6	9
Colombia	32	1,673	2,245	30	1,800	2,798
Denmark	17	539	706	4	862	1,369
Egypt	--	--	--	14	546	847
Germany	(5)	11	14	(5)	25	29
Greece	318	9,599	12,567	485	14,784	21,498
Guyana	--	--	--	1	384	387
Ireland	(5)	10	14	--	--	--
Jamaica	(5)	3	3	--	--	--
Peru	--	--	--	(5)	10	15
Spain	326	16,878	22,370	346	18,593	26,575
Sweden	913	28,133	36,632	1,055	28,737	52,156
Turkey	388	11,123	15,043	248	7,546	10,905
United Kingdom	1	125	162	(5)	125	158
Venezuela	71	2,557	3,742	109	5,473	7,786
Total[4]	2,067	70,967	93,833	2,294	79,488	125,161
Milwaukee, WI, Canada	270	14,605	14,988	278	14,090	14,365
Mobile, AL:						
Colombia	53	1,681	2,180	231	7,761	13,351
Peru	--	--	--	61	1,858	3,902
Thailand	287	6,846	11,182	97	2,288	3,763
Turkey	--	--	--	12	351	626
United Kingdom	(5)	25	43	(5)	45	62
Venezuela	27	800	1,126	128	5,512	7,602
Total[4]	368	9,352	14,530	529	17,815	29,307
New Orleans, LA:						
China	16	1,374	1,672	5	542	760
Colombia	22	773	1,055	213	6,865	9,068
Croatia	35	6,551	7,955	25	4,663	5,666
Egypt	--	--	--	268	13,102	20,069
Greece	104	3,114	4,474	370	11,530	19,002
Korea, Republic of	220	5,377	8,762	437	11,659	22,630
Netherlands	(5)	23	27	(5)	58	72
Norway	--	--	--	29	2,875	5,129
Peru	116	2,312	3,746	550	18,240	30,249
Thailand	768	21,401	36,558	464	12,887	25,976
Turkey	242	11,771	16,336	137	7,526	13,006
United Kingdom	(5)	46	61	(5)	6	7
Venezuela	--	--	--	52	2,303	3,387
Total[4]	1,523	52,742	80,646	2,551	92,255	155,023
New York City, NY:						
Brazil	(5)	17	20	--	--	--
Colombia	(5)	30	51	1	90	155
Croatia	(5)	149	167	(5)	5	5
France	(5)	2	2	--	--	--
Germany	(5)	10	12	11	1,040	1,232
Greece	274	8,414	11,853	255	7,910	14,699
Italy	(5)	5	5	--	--	--
Netherlands	1	774	945	(5)	102	123

See footnotes at end of table.

TABLE 18—Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
New York City, NY—Continued:						
Norway	448	19,568	19,641	336	20,513	20,513
Poland	3	65	69	(5)	85	90
Sweden	1	1,052	1,239	3	2,273	2,652
Switzerland	(5)	6	6	--	--	--
Thailand	--	--	--	10	230	250
Turkey	190	4,765	8,214	31	1,054	2,018
United Kingdom	1	729	819	2	952	1,055
Venezuela	20	715	1,052	190	7,317	10,642
Total[4]	941	36,301	44,094	839	41,571	53,435
Nogales, AZ:						
Australia	(5)	6	8	--	--	--
Germany	(5)	6	6	--	--	--
Mexico	571	17,081	26,343	847	25,276	39,130
Netherlands	(5)	9	14	--	--	--
Total[4]	572	17,102	26,371	847	25,276	39,130
Norfolk, VA:						
Bulgaria	151	6,318	7,770	231	12,478	15,069
Canada	78	2,536	2,909	10	322	538
Colombia	131	4,264	5,288	163	5,549	7,948
France	90	9,369	10,508	79	15,080	17,616
Germany	(5)	11	13	(5)	32	37
Netherlands	1	437	542	(5)	166	212
Sweden	--	--	--	1	415	460
United Kingdom	(5)	18	23	(5)	191	216
Venezuela	69	2,771	3,590	26	915	1,370
Total[4]	520	25,723	30,643	511	35,149	43,467
Ogdensburg, NY:						
Canada	361	20,276	20,840	384	26,212	26,654
Germany	--	--	--	(5)	4	4
Netherlands	(5)	12	12	--	--	--
United Kingdom	--	--	--	(5)	2	2
Total[4]	361	20,288	20,853	384	26,219	26,661
Pembina, ND, Canada	239	9,823	18,480	181	8,799	9,570
Philadelphia, PA:						
Belgium	(5)	3	3	(5)	21	24
China	--	--	--	(5)	13	17
Germany	3	787	1,953	3	694	2,195
Netherlands	(5)	267	331	3	1,355	1,719
Sweden	(5)	88	115	--	--	--
Thailand	235	5,411	6,276	404	9,673	10,826
Total[4]	239	6,556	8,678	410	11,755	14,780
Portland, ME:						
Canada	92	8,796	8,805	98	9,624	9,653
Venezuela	--	--	--	31	1,667	1,677
Total[4]	92	8,796	8,805	129	11,291	11,330
Providence, RI:						
Turkey	115	3,352	4,959	--	--	--
Venezuela	486	17,271	24,696	648	22,773	33,043
Total[4]	601	20,623	29,654	648	22,773	33,043

See footnotes at end of table.

TABLE 18—Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

Customs district and country	2003 Quantity	2003 Value Customs[2]	2003 Value C.i.f.[3]	2004 Quantity	2004 Value Customs[2]	2004 Value C.i.f.[3]
San Diego, CA:						
Mexico	--	--	--	58	2,181	2,234
Taiwan	--	--	--	545	22,464	31,726
Thailand	466 r	17,785	23,343	76	2,955	3,932
Total[4]	466	17,785	23,343	679	27,600	37,892
San Francisco, CA:						
China	478	14,695	20,642	351	11,424	21,572
Denmark	--	--	--	(5)	13	14
Indonesia	--	--	--	553	16,634	33,029
Taiwan	--	--	--	263	9,063	22,716
Thailand	554	15,911	25,118	561	19,696	31,386
United Arab Emirates	--	--	--	1	47	89
United Kingdom	--	--	--	(5)	78	92
Total[4]	1,033	30,607	45,760	1,729	56,955	108,898
San Juan, PR:						
Belgium	4	247	477	3	226	456
China	99	2,637	4,362	25	523	1,231
Colombia	20	757	1,030	3	238	319
Costa Rica	(5)	5	7	(5)	38	41
Denmark	277	8,955	14,141	217	6,638	13,255
Dominican Republic	--	--	--	(5)	11	11
Mexico	7	784	931	10	1,032	1,412
Panama	1	15	17	(5)	15	17
Spain	(5)	6	7	4	222	226
Turkey	--	--	--	16	288	308
Venezuela	12	376	514	--	--	--
Total[4]	419	13,782	21,486	279	9,230	17,274
Savannah, GA:						
Brazil	(5)	26	55	--	--	--
Colombia	1	166	224	3	263	385
Germany	--	--	--	(5)	127	152
Netherlands	(5)	29	36	(5)	143	168
Romania	--	--	--	(5)	3	3
United Kingdom	(5)	75	116	1	248	357
Venezuela	29	860	1,130	--	--	--
Total[4]	32	1,157	1,562	4	783	1,065
Seattle, WA:						
Canada	1,905 r	78,301 r	89,039 r	1,469	64,454	73,179
Japan	1	176	277	1	374	548
Netherlands	--	--	--	(5)	11	12
Thailand	147	3,968	6,189	184	5,157	8,304
Total[4]	2,053 r	82,445 r	95,505 r	1,654	69,996	82,043
St. Albans, VT:						
Canada	115	9,134	9,534	123	11,532	11,628
United Kingdom	(5)	13	15	--	--	--
Total[4]	115	9,146	9,549	123	11,532	11,628
St. Louis, MO:						
China	--	--	--	(5)	6	10
Netherlands	--	--	--	(5)	284	344
Total[4]	--	--	--	1	290	353

See footnotes at end of table.

TABLE 18—Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Tampa, FL:						
Brazil	213	6,383	9,043	315	12,745	16,846
Canada	3	85	113	--	--	--
China	--	--	--	(5)	2	6
Colombia	803	29,077	36,594	932	37,284	51,443
Denmark	139	10,087	14,650	152	10,801	15,398
Egypt	--	--	--	27	1,066	2,034
Greece	220	6,888	9,554	244	8,635	13,340
Peru	31	946	1,381	--	--	--
Spain	19	578	793	16	493	756
Sweden	9	242	304	--	--	--
Switzerland	29	833	1,192	--	--	--
Thailand	86	2,322	3,698	--	--	--
Turkey	142	4,236	6,120	258	7,967	12,821
Venezuela	651	21,370	30,938	652	25,004	35,194
Total[4]	2,344	83,049	114,379	2,595	103,997	147,839
U.S. Virgin Islands:						
Bangladesh	1	62	87	2	95	134
Barbados	1	48	67	--	--	--
Spain	2	114	160	--	--	--
Trinidad And Tobago	(5)	4	4	--	--	--
Venezuela	44	1,682	2,478	79	3,063	4,274
Total[4]	48	1,909	2,796	81	3,158	4,408
Wilmington, NC:						
Colombia	56	1,854	2,640	134	5,017	6,891
Venezuela	7	290	407	83	3,490	5,384
Total[4]	63	2,143	3,047	217	8,506	12,275
Grand total[4]	23,959 r	940,154 r	1,209,069 r	27,305	1,139,328	1,575,428

[r]Revised. -- Zero.

[1]Includes all varieties of hydraulic cement and clicker.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Data may not add to totals shown because of independent rounding.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 19

U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Brazil	213	6,413	9,078	315	12,745	16,846
Bulgaria	151	6,318	7,770	231	12,478	15,069
Canada	5,038 r	244,919 r	272,187 r	4,744	247,821	264,773
China[4]	1,768 r	55,255 r	76,734 r	2,077	70,001	111,033
Colombia	1,660	60,531	78,882	1,874	71,964	100,591
Denmark	283	8,323	13,604	218	5,717	12,539
Egypt	39	1,523	2,120	291	13,359	20,841
Greece	992	30,453	42,148	2,007	64,313	104,168
Indonesia	--	--	--	630	22,490	41,804
Korea, Republic of	1,745	46,463	69,511	1,729	48,014	80,415
Mexico	694	20,534	30,844	1,193	35,662	52,577
Norway	422	17,334	17,380	304	17,006	17,006
Peru	312	10,843	15,293	543	19,040	31,578
Philippines	90 r	2,350 r	4,039 r	263	7,331	11,860
Spain	217	6,487	9,025	257	6,836	10,449
Sweden	922	28,381	36,945	1,055	28,737	52,156
Taiwan	395	14,674	18,095	1,068	42,014	69,345
Thailand	3,162	91,450	139,885	2,726	86,160	140,787
Turkey	1,042	32,999	46,880	687	21,349	33,635
Venezuela	1,557	53,565	76,531	1,953	74,662	106,281
Other	236 r	7,469 r	10,187 r	13	1,210	1,418
Total[5]	20,939 r	746,283 r	977,137 r	24,180	908,910	1,295,172

r Revised. -- Zero.

[1] Includes imports into Puerto Rico.

[2] The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3] Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4] China may be underrepresented and it is thought that all or some imports from Japan should be assigned to China.

[5] Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 20

U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3, 4]	Quantity	Customs[2]	C.i.f.[3, 4]
Belgium	5	562	811	6	829	1,097
Brazil	3	395	449	(5)	6	9
Canada	243	29,850	30,982	308	35,247	36,802
Chile	--	--	--	(5)	29	35
Colombia	20	2,012	2,588	30	2,972	3,852
Costa Rica	(5)	5	7	--	--	--
Denmark	149	11,258	15,894	155	12,589	17,489
Egypt	19	1,450	2,057	48	3,788	5,325
Germany	--	--	--	(5)	23	27
Greece	--	--	--	3	1,085	1,085
Italy	(5)	25	26	--	--	--
Jamaica	(5)	3	3	--	--	--
Mexico	150	17,477	18,516	196	23,449	24,981
Netherlands	(5)	504	534	1	173	181
Norway	26	2,235	2,261	61	6,382	8,636
Peru	--	--	--	1	96	143
Spain	138	11,312	14,830	155	12,863	18,157
Switzerland	(5)	6	6	--	--	--
Thailand	34	3,512	3,777	23	2,939	4,354
Turkey	36	2,248	3,791	84	5,532	9,401
United Arab Emirates	6	396	406	2	126	204
United Kingdom	(5)	13	15	--	--	--
Venezuela	17	655	955	125	5,774	8,914
Total[6]	848	83,914	97,909	1,197	113,904	140,691

-- Zero.

[1]Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of data for gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[5]Less than ½ unit.

[6]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21

U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2003			2004		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
Brazil	49	2,120	2,150	127	5,454	5,504
Canada	965	45,383	51,972	639	30,869	31,283
China	47 r	2,209 r	2,878 r	11	1,244	1,751
Colombia	86	2,624	4,148	220	9,237	11,982
France	89	8,216	9,235	77	13,614	15,953
Greece	196	6,149	8,401	--	--	--
Norway	23	910	920	--	--	--
Peru	147	3,257	5,127	100	2,199	4,150
Switzerland	29	833	1,192	--	--	--
Thailand	148	3,238	5,592	59	1,521	3,334
Venezuela	90	3,173	3,982	398	17,419	22,962
Total[4]	1,869 r	78,112 r	95,597 r	1,631	81,557	96,919

[r]Revised. -- Zero.

[1]For all types of hydraulic cement. Includes imports into Puerto Rico.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2000	2001	2002	2003[e]	2004[e]
Afghanistan[e]	50	50	60	70	70
Albania	180 [r]	-- [r]	-- [r]	578 [r, 3]	573 [3]
Algeria[e]	8,300	8,300	9,000	9,000	9,000
Angola[e]	201 [3]	200	250	250	250
Argentina	6,121 [r]	5,545	3,910	5,218 [r, 3]	6,254 [3]
Armenia	219	300	355 [r]	384 [r, 3]	400
Australia[e]	7,500	7,500	7,550	8,000	8,000
Austria	3,776	3,863	3,800 [e]	3,800	3,800
Azerbaijan	200 [e]	500	848 [r]	1,013 [r, 3]	1,400
Bahrain	89	89	67	70	75
Bangladesh[4]	3,580	5,005	5,000 [e]	5,000	5,000
Barbados	268	250	298	330 [r]	330
Belarus	1,847	1,803	2,171	2,472 [3]	2,500
Belgium[e]	7,150 [3]	7,500	8,152 [r, 3]	8,000	8,000
Benin[e]	250	250	250	250	250
Bhutan[e]	150	160	160	160	170
Bolivia	1,072	983	1,010	1,138 [r, 3]	1,276 [3]
Bosnia and Herzegovina	628 [r]	704 [r]	913 [r]	891 [r, 3]	1,045 [3]
Brazil	39,208	38,927	38,027	34,010 [r, 3]	38,000
Brunei	232	227	241	235 [3]	240 [3]
Bulgaria	2,209	2,088	2,137	2,100 [3]	2,100
Burkina Faso[e]	100	50	30	30	30
Burma	393	378	450 [r, e]	572 [r, 3]	600
Cameroon[e]	890 [3]	930	950	930 [r]	930
Canada	12,612	12,986	13,710 [r]	13,424 [r, 3]	14,017 [3]
Chile	3,377 [r]	3,513 [r]	3,462 [r]	3,622 [r, 3]	3,798 [3]
China	597,000	661,040	725,000	862,080 [r, 3]	933,690 [p]
Colombia[e]	9,750	6,830	6,604 [3]	7,300 [r]	8,000
Congo (Brazzaville)[e]	20	-- [3]	--	--	--
Congo (Kinshasa)	169 [r]	201 [r]	265 [r]	331 [r]	400
Costa Rica	1,050 [r]	1,200 [r]	1,200 [r, e]	1,320 [r]	1,300
Côte d'Ivoire[e]	650	650	650	650	650
Croatia	2,852	3,246	3,378	3,654 [3]	3,811 [3]
Cuba	1,633	1,324	1,327	1,700 [r]	1,700
Cyprus	1,398	1,369	1,438 [r]	1,637 [r, 3]	1,689 [3]
Czech Republic	4,093	3,550	3,217 [r]	3,465 [r, 3]	3,709 [3]
Denmark	2,009	2,047 [r]	2,010 [e]	2,020 [3]	2,050
Dominican Republic	2,505	2,746	3,050	2,907 [3]	2,636 [p]
Ecuador[e]	2,800	2,920 [3]	3,000	3,100	3,100
Egypt	24,143	24,700 [r]	28,155 [r]	26,639 [r]	28,000
El Salvador	1,064	1,174	1,318	1,390 [r]	1,400
Eritrea[e]	45	45	45	45	45
Estonia	329	405	466	506 [3]	615 [3]
Ethiopia	880	900	900	1,200	1,300
Fiji[e]	95	95	95	100	100
Finland	1,422	1,325	1,198 [r]	1,360 [3]	1,400
France	20,137	19,839	19,450 [r]	19,660 [r, 3]	20,960 [3]
French Guiana[e]	88	58 [3]	62	62	62
Gabon	210	304	350 [e]	350	350
Georgia	348	335	347	300 [3]	300
Germany	35,414 [r]	32,118 [r]	31,009 [r]	32,349 [r, 3]	31,954 [3]
Ghana[e]	1,950 [3]	1,900	1,900	1,900	2,000
Greece	15,463 [r]	15,500 [r, e]	15,000 [r]	15,300 [r]	15,000
Guadeloupe	265 [r]	265 [r]	230	230 [3]	230

See footnotes at end of table.

TABLE 22—Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2000	2001	2002	2003[e]	2004[e]
Guatemala	1,960 [r]	2,000 [r]	1,800 [r]	1,900 [r]	1,900
Guinea	300	315	360	360	360
Haiti	--	204	290	300 [r]	300
Honduras	1,284 [r]	1,321 [r]	1,360 [r, e]	1,400 [r]	1,400
Hong Kong	1,284	1,279	1,206	1,250	1,250
Hungary	3,326	3,452	3,510	3,573 [r, 3]	3,580 [3]
Iceland	144	125	130 [e]	135 [3]	140
India[e]	95,000	105,000 [r]	115,000 [r]	123,000 [r, 3]	125,000
Indonesia	27,789	31,300	34,640	35,000	36,000
Iran	23,880	26,640	28,600	30,000	30,000
Iraq[e]	6,000	6,000	6,834 [3]	1,000	3,000
Ireland[e]	2,620 [3]	2,600	2,500	2,500	2,500
Israel	5,703	4,700 [e]	4,584 [r]	4,632 [r, 3]	4,494 [3]
Italy	38,925	39,804	40,000 [e]	38,000	38,000
Jamaica	521	596	614	608 [r, 3]	610
Japan	81,097	76,550	71,828	68,766 [r, 3]	67,369 [3]
Jordan	2,640	3,173	3,558	3,515 [3]	3,908 [3]
Kazakhstan	1,175	2,029	2,129	2,570 [3]	3,000
Kenya	1,367	1,319	1,463	1,658 [r, 3]	1,789 [3]
Korea, North[e]	4,600	5,160	5,320	5,540 [r]	5,500
Korea, Republic of	51,255	52,046	55,514	59,194 [r, 3]	53,900 [3]
Kuwait	1,187 [r]	921 [r]	1,584 [r]	1,600	1,660 [3]
Kyrgyzstan	500	469	533	757 [r, 3]	800
Laos[e]	92	92	240	250	250
Latvia	W	W	260 [r]	295 [r]	284 [3]
Lebanon	2,808	2,890	2,852	2,900 [r]	2,900
Liberia	71 [e]	63	54	30	30
Libya[e]	3,000	3,000	3,300	3,500 [r, 3]	3,600
Lithuania	570	529	606 [r]	597 [r, 3]	753 [3]
Luxembourg[e]	749 [3]	750	750	750	750
Macedonia	585	630 [r]	600 [r, e]	768 [r, 3]	820 [3]
Madagascar	51	52	33 [e]	70 [r]	110
Malawi	156	181	174	190	190
Malaysia	11,445	13,820	14,336	17,243 [3]	18,000
Martinique	255 [r]	255 [r]	221 [r]	225 [r]	225
Mauritania[e]	120 [r]	200 [r]	200 [r]	200 [r]	200
Mexico	33,228 [r]	32,110 [r]	33,372 [r]	33,593 [r, 3]	34,992 [3]
Moldova	222	200	300	300	300
Mongolia	92	68	148	162 [r]	170
Morocco[e]	8,100 [3]	10,000	10,200	10,400	10,400
Mozambique	270	265	285	362 [3]	350
Nepal[e, 4]	300	285	290	295	285
Netherlands[e]	3,450 [3]	3,450	3,400	3,400	3,400
New Caledonia	100 [e]	93	100	100	100
New Zealand	1,070	1,080	1,090 [e]	1,100	1,110 [3]
Nicaragua	530 [r]	514	549 [r]	590 [r]	590
Niger[e]	40	40	40 [r]	40 [r]	40
Nigeria[e]	2,500	2,400	2,100	2,300 [r]	2,300
Norway	1,851	1,870 [e]	1,850 [e]	1,860 [3]	1,900
Oman	1,238	1,370	1,700 [r, e]	2,100 [r]	2,500
Pakistan[e]	9,900	11,000 [r]	11,000 [r]	13,000 [r]	16,000
Panama[e]	950 [r]	820 [r]	770 [r]	770	770
Paraguay	650	650	650 [e]	660 [r]	660
Peru	3,906	3,950	3,980 [r]	4,000 [r, 3]	4,590 [3]

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2000	2001	2002	2003[e]	2004[e]
Philippines	11,959	8,653	12,614	10,000	11,000
Poland	15,046	11,918	10,948 r	11,653 r, 3	12,837 3
Portugal[e]	10,343 3	10,300	10,000	10,000	10,000
Qatar[e]	1,210	1,240 r	1,340 r	1,400	1,400
Réunion[e]	380	380	380	380	380
Romania	6,058	5,668	5,680	5,992 r, 3	6,210 3
Russia	32,400	35,300	37,700	41,000	43,000
Rwanda	71	91	101	105 r, 3	104 3
Saudi Arabia	18,107	20,608	22,000	23,000	23,200 3
Senegal	1,341 r	1,539 r	2,150 e	2,150	2,150
Serbia and Montenegro	2,117	2,418	2,396	2,075 r, 3	2,240 3
Sierra Leone	73	113	144	170 3	170
Singapore[e]	1,150 3	600	200	150 3	150
Slovakia	3,045	3,123	3,141 r	3,147 r, 3	3,158 3
Slovenia[e]	1,300	1,300	1,250	1,300 r, 3	1,300 3
South Africa, sales[5]	7,971	8,036	8,525	8,973 r, 3	12,348 3
Spain, including Canary Islands	38,154 r	40,512	42,417 r	45,000 r	46,790 3
Sri Lanka	1,008	1,108	1,018	1,164 r, 3	1,400
Sudan	146	190	205 r	272 r, 3	280
Suriname[e]	60	65 3	65	65	65
Sweden	2,651	2,600	2,700 e	2,650 3	2,700 3
Switzerland	3,771	3,920 r	3,771 r	3,800 3	3,898 3
Syria	4,631	5,428	5,450 e	5,250 r	4,800 3
Taiwan	17,572	18,128	19,363	18,474 3	19,050 3
Tajikistan	50	70	100	120	150 3
Tanzania	833	900	1,026	1,186 3	1,287 3
Thailand	25,499	27,913	31,679 r	32,530 3	35,626 3
Togo[e]	700	800	800	800	800
Trinidad and Tobago	743	697 r	744	766 r, 3	765
Tunisia	5,657	5,721	6,022	6,038 3	6,358 3
Turkmenistan[e]	450	450	450	450	450
Turkey	35,825	30,125	32,577	35,077 r, 3	38,019 3
Uganda	367 r	431 r	506 r	507 r, 3	520 3
Ukraine	5,311	5,800	7,142	8,900 r	10,600
United Arab Emirates[e]	6,100	6,100	7,000 r	8,000 r	8,000
United Kingdom	12,702 r	11,854	11,089 r	11,215 r, 3	11,250 3
United States, including Puerto Rico[6]	89,510	90,450 7	91,266	94,329 3	99,015 3
Uruguay[e]	700	1,015 3	1,000	1,050	1,050
Uzbekistan[e]	3,521 3	4,000	4,000	4,000	4,000
Venezuela[e]	8,600	8,700	7,000	7,700 r	9,000
Vietnam	13,298	16,073 r	21,121 r	23,282 r, 3	25,320 3
Yemen[e]	1,400	1,400	1,400	1,400	1,546 3
Zambia[e]	380	215 3	230 3	480	480
Zimbabwe[e]	1,000	800	600	400	400
Total	1,660,000	1,750,000 r	1,850,000 r	2,020,000 r	2,130,000

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are believed to be accurate to no more than three significant digits.

[2]Table includes data available through August 17, 2005. Data may include clinker exports for some countries.

[3]Reported figure.

[4]Data for year ending June 30 of that stated.

[5]Data are revised to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted to: 2000—1,020; 2001—1,129; 2002—1,099; 2003—1,190 (revised); and 2004—1,436.

[6]Portland and masonry cements only.

[7]Data are rounded to four significant digits.

2005 Minerals Yearbook

CEMENT

U.S. Department of the Interior
U.S. Geological Survey

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Cement

By Hendrik G. van Oss

Domestic survey data and tables were prepared by D. Armand Marquardt, statistical assistant, and the world production table was prepared by Regina R. Coleman, international data coordinator.

Production, imports, and sales volumes and prices of cement all reached record high levels in 2005. Output of portland and masonry cements in the United States in 2005 rose by 1.9% to 99.3 million metric tons (Mt) (table 1). Production of clinker—the intermediate product in cement manufacturing—increased slightly to 87.4 Mt, also a record. The United States continued to rank third in the world in hydraulic cement production; world output in 2005 was about 2.3 billion metric tons (Gt). Notwithstanding disruptions caused by major hurricanes, sales of cement to domestic customers increased by 5.8% to about 127 Mt. Imports of cement increased by almost 20% to 30.4 Mt. Despite the higher domestic production and import levels, spot shortages of cement continued to be informally reported to the U.S. Geological Survey (USGS), although to a somewhat lower degree than in 2004. The continuing tight cement supplies and rising fuel costs led to large, although regionally variable, price increases (tables 11–12). Overall, the value of cement sales to domestic final customers increased almost 22% to about $11.6 billion (tables 1, 11–12). Based on typical portland cement mixing ratios in concrete, the delivered value of concrete (excluding mortar) in the United States in 2005 was estimated to be at least $51 billion.

Indications of percentage or other changes expressed in this report compare activity in 2005 with that of 2004 unless specified otherwise. Except where otherwise indicated, activity levels in this report exclude those in Puerto Rico. And except for some trade data, the cements covered in this report are limited to those hydraulic varieties broadly classified as portland and/or masonry cement. These cements are the binding agents in concrete and most mortars. Varieties included as portland cement are listed in table 15 and include blended cements[1]. Masonry cements include true masonry cements, portland-lime cements, and plastic cements; currently, the category does not include natural cement for mortar, minor production of which resumed in 2004 after a hiatus of 34 years. Certain other hydraulic cements (most notably aluminous cement) are included in the trade data in tables 16-18 and 21 (clinker) and within the world hydraulic cement production data given in table 22. Excluded from the U.S. data and, to the degree possible, from international data, are pure (unblended) supplementary cementitious materials (SCM) such as fly ash, other pozzolans, and ground granulated blast furnace slag (GGBFS). Although not finished cements in their own right, SCM are in common use as components of blended portland cements or as partial substitutes for portland cement in concrete. Detailed background information on cement and its manufacture is given in van Oss (2005§[2]).

The bulk of this report is based on data compiled from USGS annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are independent of U.S. cement manufacturers. For 2005, forms were received from 146 of 150 facilities canvassed, a response rate of 97%. The responding facilities included all but three production sites and accounted for almost 98% of total cement sales. For 2004, forms were received from 148 of 150 facilities canvassed, a response rate of 99%. For missing or incomplete forms, telephone inquiries were made to obtain data, and 100% reporting of cement and clinker production tonnages was obtained for both years. Background information on the USGS cement canvasses is given in van Oss (2005§).

Legislation and Government Programs

Government economic policies and programs that affect the cement industry are those relating to cement and clinker trade, interest rates, and public sector construction spending. The major trade issue in 2005 continued to be that of antidumping tariffs against Japan and Mexico. For Mexico, the tariff rate in 2005 continued to be based on the 54.9% dumping margin determined by the U.S. Department of Commerce (DOC) for the 13th review period (August 2002 through July 2003) for gray portland cement and clinker. A preliminary determination announced August 31, 2005, for the 14th review period (August 2003 through July 2004) was for a lower, 40.54%, dumping margin, but the determination had not been finalized as of yearend. In any case, owing to widespread reports of cement shortages in 2004 and 2005, and notwithstanding the fact that imports of cement from Mexico in 2005 were already 52% higher than in 2004 and 145% higher than in 2003, there were calls from industry groups and some State Governments (Cement Americas, 2005a) to end or suspend the tariffs to encourage the importation of more cement from Mexico. Negotiations were underway towards this end between the DOC and the Mexican Government, and a resolution to this longstanding trade dispute was expected to be agreed to early in 2006.

The main Federal funding program in recent years relating to construction has been the $216.3 billion Transportation Equity Act for the 21st Century (TEA–21) and temporary funding continuations following its formal expiration in September 2003. Negotiations to reauthorize TEA–21 culminated with the August 10, 2005, signing into law of its replacement, the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA–LU). This Act authorized Federal funding of surface transportation projects for the period 2005–09 at a total guaranteed minimum funding level of $244.1 billion for the period.

The major environmental issues relating to cement are associated with the production of clinker. The most significant

[1]Sales data for blended cements (also called composite cements) listed separately from portland cement are available within the monthly cement reports of the USGS Mineral Industry Surveys series, starting with January 1998.

[2]References that include a section mark (§) are found in the Internet References Cited section.

emissions from clinker manufacture are of carbon dioxide (CO_2), slightly more than one-half of which is derived from the calcination of calcium carbonate raw materials, and the rest from the combustion of fuels. Overall, generation of CO_2 by the U.S. cement industry in 2005 amounted to about 84 Mt, or about 0.96 ton CO_2 per ton of clinker; this excluded emissions associated with the utility companies that generated the electricity used by the cement industry. The methodology for this calculation may be found in van Oss and Padovani (2003, p. 123-126). The cement industry was working on ways to reduce the unit emissions of CO_2, such as by encouraging the use of blended cements and of SCM in concrete. Also, the ASTM standard for portland cement was amended in 2004 to allow the incorporation of up to 5% ground limestone in the finished portland cement; this is reflected in the 2005 edition of the standard (ASTM C-150-05). As with adding SCM, this limestone addition potentially allows a commensurate increase to a plant's cement capacity without increasing the unit emissions of CO_2, provided that the limestone available to the plant does not adversely affect the cement quality. Widespread adoption of limestone addition was not expected unless the States' departments of transportation incorporate the practice into the otherwise similar American Association of State Highway and Transportation Officials (AASHTO) standard M85-89.

Production

In 2005, portland cement was produced in 37 States and Puerto Rico by 115 plants (table 3). Of these plants, 73 also produced masonry cement (table 4). Cement producers in the United States ranged widely in size and in the number of plants operated. Ranking companies in terms of output or capacity is difficult because of the existence of some common parent companies and joint ventures. With common parents combined under the larger subsidiary's name and with joint ventures apportioned, the 10 leading companies at yearend 2005 were, in descending order of cement production, Holcim (US) Inc.; Lafarge North America, Inc.; CEMEX, Inc.; Buzzi Unicem USA, Inc. (including Alamo Cement Co.); Lehigh Cement Co.; Ash Grove Cement Co.; Essroc Cement Corp.; Texas Industries Inc. (TXI); California Portland Cement Co.; and St. Marys Cement, Inc. The leading 5 of these had about 56% of total U.S. portland cement production, and the leading 10 together accounted for about 80% of total U.S. production. Of these named companies, all except Ash Grove and TXI were foreign owned as of yearend.

In 2005, output of portland cement increased by 1.6% to a new record of 93.9 Mt (table 3). The reported U.S. overall grinding (or cement) capacity and the capacity utilization percentage increased slightly, but the changes may not be statistically significant owing to issues of capacity data quality. The five leading producing States for portland cement in 2005 were, in descending order of tonnage produced, California, Texas, Pennsylvania, Florida, and Michigan. A majority of districts showed increased production levels. The increase in production in Florida was especially large, reflecting a full year of full capacity output by a plant that had completed a major upgrade in 2004. The large increase in Alabama appears related to a full year's output from a new finish mill installed in 2004 at one plant, and perhaps also the installation of a new clinker cooler at another. The large increase in output in Texas appears to be largely market driven. Elsewhere, the larger increases appear related to a combination of strong markets and technical upgrades at plants. District-level capacity utilization percentages did not change dramatically for most districts. The decline in output and in capacity utilization in the Georgia, Virginia, and West Virginia district appears to be mainly because of greatly reduced output by one plant, owing to the company servicing its customers from more modern plants elsewhere. The large decline in California overall is distributed among many of the plants and appears to be related to a combination of rising fuel costs and an increased availability of imported cement. Yearend stockpiles were up significantly, and this rise appears to reflect a combination of an increased availability of imported cement and disruptions to consumption related to hurricanes Katrina (end of August) and Rita (late September). However, the yearend sample is not indicative of the stockpile fluctuation throughout the year.

Data are not collected on the production of specific varieties of portland cement, but production levels would approximate the ratios among sales, by type, of portland cement (table 15). On this basis, production of Types I and II (or hybrids thereof) accounted for about 77% of total portland cement output in 2005, down from about 78% (revised) in 2004. This apparent relative decline, although small, reflects the growing market for sulfate-resistant cements (Types II and V; and II/V hybrids reported as Type V, and blended cements). Again by analogy to sales, Type V cements accounted for almost 15% of total output, compared with about 14% in 2004, and overall blended cement output was about 2.6% of the total portland cement production in 2005, compared with 1.6% in 2004. Ideally, these ratios should be adjusted for cement imports, which are dominantly of Types I, II, and V.

In 2005, masonry cement production increased by 8.3% to a record 5.4 Mt (table 4), reflecting the continued strong housing market. As in past years, however, this reported figure understates true output, primarily because a large, but unknown, tonnage of masonry cement (especially portland-lime cement) is directly blended at job sites using purchased portland cement and lime. Although not revealed in the tables, about 84% of the 2005 masonry cement production was reported as having been made directly from clinker rather than from finished portland cement. This was a significant decline from the 95% (from clinker) reported in 2004 and recent previous years, and the reason for this change (if not owing to assignation errors by respondents) is unclear.

Clinker production data are listed in table 5. Overall production during the year was a record 87.4 Mt; this, however, was an increase of only 0.9%. Although not apparent from table 5 (shows a single-year only), most districts showed only small changes in clinker output in 2005. Florida showed a significant increase, owing to a major upgrade at one plant the preceding year. A comparable upgrade in South Carolina in 2004 did not result in a large increase in clinker output in 2005 for the State because it was partly offset by production disruptions related to the upgrade of another plant in the State in 2005. A significant decline in production in the Georgia, Virginia, and West Virginia district was in-line with the 2004 closure of the kiln at one Georgia plant (it continued, however, to grind clinker brought in from another State). Other changes to the kiln counts were related to wet-to-dry technology changes (Florida, Maine, and

South Carolina in 2004, and South Carolina in 2005). Because table 5 shows all kilns active for at least 1 day during the year, kiln closures during the current year will not show up until the next year. The closure at yearend of four kilns at one plant in eastern Pennsylvania is thus not visible on the current table.

As with the kiln count, changes to apparent annual capacity and capacity utilization are also affected by plant upgrades. Large apparent capacity declines, but increases in capacity utilization, in Florida and in the Maine and New York district in 2005 merely reflect the replacement of two wet kilns by a dry kiln in Florida in 2004, and the 2004 kiln conversion, and hence replacement of wet kiln capacity by dry capacity, at the plant in Maine. In contrast, the approximately 1.2-million-metric-ton-per-year (Mt/yr) increase in capacity, but very low capacity utilization, in 2005 in South Carolina reflects the replacement of four wet kilns with one dry kiln at one plant during the year; the State's capacity will decline in 2006 accordingly, and the capacity utilization would be expected to increase significantly.

Except for States having new plants, plant shutdowns, or plant upgrades during the current or preceding year, annual variations in district-level apparent annual capacities (a calculated statistic) and capacity utilization rates are difficult to analyze because the statistics are dependent on the reported daily kiln capacities and the correct reporting of kiln downtimes for scheduled maintenance relative to total downtimes. For example, southern California showed a significant (0.2 Mt) decline in clinker output in 2005 and about a 0.3-Mt decline in apparent annual capacity, yet there were no plant closures or significant upgrades during the year, and the overall daily clinker capacity and average days for routine maintenance are essentially identical to those of 2004. The apparent annual capacity decline is because of more days of routine maintenance at a couple of the larger facilities; however, the longer maintenance is invisible on the table because of offsets by shorter maintenance periods at other plants in the district. The apparent annual capacity for the country overall declined by 1 Mt/yr to 102 Mt; this mostly reflects the removal of "artificial" capacity related to kiln conversions. The average capacity utilization increased 2% to 86.0%, but the increase may not be statistically significant. Given that total downtimes commonly exceed the downtimes for routine maintenance, a capacity utilization of about 85% or higher indicates that the plants were operating at full practicable capacity; this was the case in all districts (as noted above, South Carolina's low utilization rate is artificial). Based on the data in table 5, the average plant clinker capacity in 2005 was significantly unchanged at about 0.96 Mt/yr, and average kiln capacity rose slightly to 0.56 Mt/yr.

Yearend clinker stockpiles were about 3.5 Mt, down about 0.2 Mt, but it is unclear if this represents an actual net "operational" drawdown of stocks[3] and hence a proportional increase in availability of clinker for cement manufacture. Including the significant increase in clinker imports in 2005 (table 21), this apparent stockpile drawdown would appear to be in excess of that needed to account for the increase in portland and masonry cement production during the year and, therefore, caution should be used in interpreting yearend stockpile changes.

Nonfuel raw materials consumed to make clinker and cement are listed in table 6. Materials used to make clinker are burned in the kiln and are thus of potential environmental interest. In contrast, materials added in the finish mill are just ground and are associated with only minor, if any, emissions. The total raw materials to make clinker did not change in 2005, and the ratios among raw materials (as contributors of major oxides) appear to be broadly similar to those in 2004. Some classes of raw materials—notably the aluminous, ferrous, and secondary material (for example, ashes and slags) siliceous feeds—appear to have increased in percentage terms much more than the total clinker production increased, but while it is tempting to treat these changes in terms of a single, closed, system (X went up because Y went down), in fact the changes in some of the materials reflect changes at just a few plants. The increases seen in the consumption of SCM (fly ash, GGBFS, natural pozzolans, and other pozzolans) for finished cement are in accord with increases in sales of blended cements (table 15) and increased production of masonry cement (table 4). This may also be true for cement kiln dust (CKD) for cement, although the increase could merely reflect more complete reporting. The increase in ground limestone used to make cement would appear largely to reflect the higher output of masonry cement in 2005 rather than the change to the ASTM C-150 portland cement standard noted earlier.

The tonnages of other blast furnace slag and steel slag consumed to make clinker are in broad accord with sales (to make clinker) collected on the USGS canvass of ferrous slag processors (air-cooled blast furnace slag sales of 0.15 Mt in 2004 and 0.37 Mt in 2005; steel slag sales of 0.50 Mt in 2004 and 0.60 Mt in 2005). A comparison cannot be made for GGBFS, because most of the material sold by slag processors went directly to the concrete industry rather than to cement plants. By comparison to the sales levels for blended cements listed in table 15, the proportion of GGBFS in cement appears to have fallen to about 28% (component) from about 35% in 2004. This decline could be real, or it could represent a change in the amount of slag used as a grinding aid (in straight portland cement) or an increase in the incorporation of slag into masonry cement.

Likewise, relative to sales, the apparent component of fly ash in blended cements was about 42% in 2005, compared with about 22% in 2004. This shift appears to be real. The total fly ash consumption listed in table 6 (3.10 Mt), and that of other ash (1.21 Mt), are significantly higher than the 2.57 Mt of fly ash, 0.85 Mt of bottom ash, and 0.04 Mt of boiler slag reported by the American Coal Ash Association (ACAA) as having been sold in 2005 for cement and/or raw feed for clinker (American Coal Ash Association, 2006); the same held true for 2004. Although the higher tonnages in table 6 could represent material already resident in cement plant raw material stockpiles (i.e., purchased prior to 2004-05), it may be that the ACAA survey contains some distribution problems between material sold to the cement industry itself and material sold to concrete companies, especially where the concrete companies are subsidiaries of cement companies. Within the gypsum consumption tonnages listed in table 6 are 0.29 Mt of synthetic gypsum (also known as flue gas desulfurization or FGD gypsum) consumed in 2004 and 0.530

[3]Yearend stockpiles of clinker are an artifact of data collection convenience rather than a reflection of full-year market conditions or production capacity. Generally, if the clinker is not required for immediate cement market needs, a plant will try to build up its stocks of clinker prior to scheduled extended kiln shutdowns so as to provide continuity of clinker feed to the finish (cement) mill. These shutdowns can be at any time of the year.

Mt in 2005; however, because the USGS canvass does not require a differentiation between natural and synthetic gypsum, these synthetic gypsum tonnages are likely understated. In contrast, the ACAA survey shows sales to the cement industry of 0.41 Mt of FGD gypsum in 2004 and 0.36 Mt in 2005. The higher tonnage within table 6 for 2005 may reflect material already in stock at cement plants, or it may reflect an increase in the number of cement plants having sulfur oxide scrubbing systems.

Fuels consumed by the cement industry are listed in table 7. The quantity ratios among fuels and of fuels to clinker produced in 2005 appear to be broadly similar to those in 2004; specific shifts may be owing to changes at just a few plants. Some of the changes in fuels relative to kiln technology reflect the conversion of certain wet kiln facilities to dry kiln technology (plants undergoing this conversion are considered to be combination plants for the conversion year [denoted as “Both” in table 7] and will be listed with the dry plants the subsequent year). For the industry overall, the only significant fuel change appears to be apparent offset of the large decline in fuel oil consumption by a large increase in the consumption of liquid waste fuels. This reflects the continuing high cost of petroleum, but may in part also reflect changes in categorization of “off-spec” fuel oil (a fairly common fuel).

Although not listed in table 7, overall heat consumption in 2005 was about 4.4 billion joules (GJ)[4] per metric ton of clinker, about 2% lower than in 2004. Wet plants in 2005 averaged about 6.3 GJ per ton of clinker, about 2% higher than in 2004. Dry kiln plants averaged about 4.1 GJ per ton of clinker, about 2% lower than in 2004, and combination plants averaged 4.9 GJ per ton, up by about 5%. The changes primarily reflect conversions of wet to dry kiln technology.

Dry process plants have higher average electricity consumption per ton of cement product than wet process plants (table 8). This reflects the complex array of fans and blowers associated with modern dry kilns and clinker coolers. Declines were seen in average unit electricity consumption for wet and dry plants in 2005, but the consumption average rose significantly for combination plants. These changes reflected the reassignment of two plants (in Florida and Maine), listed within “Both” for 2004, to the dry category for 2005, and the assignment of a South Carolina plant undergoing conversion to the “Both” category for 2005; it had been a wet plant in 2004. Abnormally high unit electricity consumption is common during such conversions. For the same general technology, plants operating multiple kilns almost invariably have higher electrical power (and general energy) requirements per ton of overall output capacity than do plants with the same overall capacity but that operate a single kiln.

There were no plant openings or closures during the year, although Essroc Cement Corp. permanently shut down the kilns at its Nazareth III plant in eastern Pennsylvania at yearend; the facility will continue to operate its finish mill (will be a grinding plant). The company’s nearby integrated (clinker and cement) Nazareth I and II facilities remain fully operational.

Although not mentioned in the previous edition of this report nor incorporated in the current report’s tables, it is of historical interest to note that there has been limited production of natural cement in the United States since 2004, when production was resumed from raw material quarried at Rosendale, NY. Natural cement was the first cement type to be produced in the United States (1817) and was for many decades in common production, but over the years it was superseded for concrete applications by portland and related cements. Many natural cement plants converted to portland cement production in the early 20th century, and the remaining natural cement production and sales data were included within the masonry cement category. Natural cement was produced at Rosendale during the period 1825-1970, at which time the company there, Century Cement Co., closed; Century had been the last producer in the country. The manufacture of natural cement differs from that of portland cement primarily in two ways. First, natural cement is made by burning only argillaceous limestones (“cement rock”) and does not have the artificial mixing of raw materials in the kiln feed (limestone plus clay or shale, etc.) that is almost ubiquitous for portland cement. Second, the processing temperatures in the kiln are lower for natural cement (at least that made in the United States), such that sintering or clinkering does not occur and thus alite or tricalcium silicate (essentially the defining mineral in portland cement) is not formed. In natural cement, the hydraulic reactivity is mainly from a lower-temperature phase called belite or dicalcium silicate (this is also present in portland cement), and possibly heat-activated clay pozzolans. The resumption of natural cement production in 2004 was by Edison Coatings, Inc., which processes Rosendale, NY, cement rock at a small kiln in Plainville, CT. The natural cement is used, primarily, for the restoration of historical buildings originally constructed with natural cement concrete and/or mortar. For this restoration work, the hydration properties of natural cement mortars are considered to be more compatible than mortars incorporating portland-cement-base masonry cements or hydraulic lime (Edison Coatings Inc., 2006§). Although current output of natural cement by Edison is currently only a small fraction of the plant’s kiln capacity of about 10,000 tons per year, demand for the product is anticipated to increase. To this end, the company was attempting to reinstate the ASTM C-10 standard for natural cement. This standard was initially adopted in 1904 but was withdrawn in 1974 owing to lack of product availability (Edison, 2006).

On March 1, CEMEX S.A. de C.V. of Monterrey, Mexico, announced that it had completed the purchase of the worldwide assets of RMC Group plc of the United Kingdom (CEMEX S.A. de C.V., 2005a). This purchase included the RMC Pacific Materials, Inc. cement plant in Davenport, CA, and a number of concrete plants, but had the main impact of making CEMEX one of the largest world producers of ready-mixed concrete. Peripherally related to the RMC acquisition, CEMEX announced in November an agreement to sell its Dixon, IL, and Charlevoix, MI, plants, together with a number of terminals servicing the Great Lakes region, to Votorantim Participacões S.A. of Brazil (The sale was completed in March 2005 (CEMEX S.A. de C.V., 2005b). The plants were to be operated under Votorantim’s Canadian subsidiary St. Marys Cement, Inc., which already operated grinding plants in Detroit, MI, and Milwaukee, WI, and which was a 50% joint-venture partner in Suwannee American Cement Co. in Branford, FL.

[4]The USGS canvass solicits information on heat consumption in terms of millions of British thermal units (MBtu), where 1 MBtu=1.055056 GJ, and data are based on high or gross heat values of fuels rather than low or net heats.

In January, Lehigh Cement Co. announced the completion of its purchase from Buzzi Unicem of the remaining 50% of Glens Falls Lehigh Cement Co. that Lehigh did not already own (Lehigh Cement Co., 2005). The purchase involved an integrated plant at Glens Falls, NY, and the Cementon grinding plant near Catskill, NY.

In May, Titan America formally inaugurated its new 1.8-Mt/yr dry kiln line at the Pennsuco integrated plant at Medley, FL. The new kiln had been first fired up in mid-2004 and replaced the plant's two wet kiln lines, which were shut later that year (Cement Americas, 2005b).

Following an April denial of a final permit related to waterborne shipping, St. Lawrence Cement Co. (the Canadian subsidiary of Holcim Group of Switzerland) announced that it had abandoned plans to build a 2-Mt/yr greenfields cement plant at Greenport, NY, on a site where the company already operated a large crushed stone quarry. The proposal to build a state-of-the art precalciner kiln plant at the Greenport plant had met with extended local environmental opposition, notwithstanding that it would have replaced the company's very old existing 0.7-Mt/yr wet kiln plant at Catskill, NY (Cement Americas, 2005c).

In March, Eagle Materials Inc. announced plans to upgrade its LaSalle, IL, cement plant through the installation of a precalciner onto its existing preheater kiln. The upgrade will raise the plant's clinker capacity by about 65% to 1.1 Mt/yr. The upgrade was expected to be completed at yearend 2006 (KHD Humboldt Wedag, Inc., 2005).

Giant Cement commissioned its new 1.1-Mt/yr precalciner kiln at Harleyville, SC, at the end of May. The new kiln replaced four wet kilns, totaling about 0.7 Mt/yr, which were permanently shut down during the year (World Cement, 2005).

Buzzi Unicem USA announced in December that it would upgrade its Selma, MO, plant by building a 2.3-Mt/yr precalciner kiln to replace the plant's existing long dry kilns (total capacity 1.3 Mt/yr). It was anticipated that the increased capacity would allow the company to reduce its imports of cement to supply customers along the Mississippi River (Buzzi Unicem SpA, 2005).

Monarch Cement Co. was nearing the completion of its project to install a precalciner on an existing kiln at its Humboldt, KS, plant, which will make that kiln identical in capacity to the company's other kiln, which was similarly upgraded in 2001. The upgrade was expected to be completed in March 2006, and would raise the plant's total capacity to about 1.1 Mt/yr (International Cement Review, 2005).

Texas Industries Inc. announced in April that it would modernize and expand its Oro Grande, CA, plant. The upgrade would replace the plant's existing 7 long dry kilns (total capacity about 1.2 Mt/yr of clinker) with a single precalciner dry kiln of about 2.1 Mt/yr capacity (Texas Industries, Inc., 2005). Currently, the Oro Grande plant produces an excess of clinker, which it then grinds at the company's Crestmore, CA, plant.

Consumption

Apparent consumption of portland and masonry cement rose 5.2% to about 128.3 Mt in 2005 (table 1). Because the data are available monthly from the USGS and show breakouts by State, the measure of consumption preferred by the cement industry for market analysis is that of cement shipments to final domestic customers (that is, sales). The full year summations of the monthly data are provided in table 9. The definition of "final customer" is left to the reporting cement producer but is generally understood to include the customer categories listed in table 14. Consumption measured as sales to final domestic customers increased in 2005 by 5.6% to a record 126.9 Mt.

In some years, significant differences have existed between the U.S. total portland cement sales amounts derived from annual canvasses, as listed in tables 1, 10-11, and 14-16, and the monthly-survey-based totals listed in table 9. The differences likely pertain to shipments (mainly of imported cement) by terminals that were missed by the annual survey but which were captured on the monthly surveys; the monthly surveys contain a lot of data submitted on a company-total rather than site-total basis. Owing to more complete annual canvassing, the tonnage differences for the past 5 years have became insignificant except for 2003 (1.7 Mt). In contrast to portland cement, data for masonry cement have not shown significant discrepancies between the monthly and annual reporting because little of this material is imported.

Superficial similarities between the national totals in table 9 and tables 12-13 hide important differences in their component data. Table 9 reveals the sales destinations and so directly provides the location and amounts of consumption. In contrast, the regional data in tables 11, 12, and 14 pertain to the location of the reporting entity (chiefly the production sites), not the location of consumption. It is very common for shipments to cross State lines.

Based on table 9, domestic portland cement consumption increased by 5.5% to a record 121.4 Mt in 2005 and would likely have been significantly higher had there not been severe disruptions to construction work caused by hurricanes Dennis (July), Katrina (August), Rita (September), and Wilma (October); Katrina also caused severe damage to ship unloading and general transportation infrastructure. Notwithstanding the hurricanes, the only individual months that showed declines in 2005 relative to 2004 were April (minor decline) and July (almost always a weak month). The import component of sales was about 23% of the total in 2005 compared with about 19% in 2004. Only about 11 States had significant declines in consumption in 2005 and almost all major consuming States showed large increases, including those impacted by the hurricanes. The leading 10 consuming States in 2005 were, in descending order, California, Texas, Florida, Arizona, Georgia, Illinois, Ohio, Pennsylvania, New York, and Michigan. The leading 5 States accounted for about 41% of total U.S. consumption, and the leading 10 States accounted for about 56% of the total.

Cement is a key construction material, and although cement consumption levels within a given category of construction will broadly reflect levels of construction spending, significant time lags may exist between the onset or cutoff of spending and changes in the consumption of cement or concrete. Lag times are particularly noticeable in sectors involving individual projects requiring high tonnages of concrete (for example, large office buildings, shopping complexes, and major public sector projects). According to U.S. Census Bureau data quoted by the Portland Cement Association (2006), overall construction spending levels in 2005 rose by 4.2% to about $755 billion (constant 1996 dollars). As in 2004, this increase was dominated by an increase in overall residential building construction ($424 billion, up by 7.2%), which in turn continued to dominated largely by an increase in single-family housing ($286 billion, up by 8.2%). This spending reflected continued very low mortgage and general interest rates. Nonresidential private construction spending overall reversed a multiyear declining trend by increasing 2.9% to $131 billion; this was led by industrial buildings (up by 23% to $20.4 billion) and office buildings (up by 3.2% to $29.3 billion). Educational and religious buildings were among the few declines during the year, but both are categories of construction that might be expected to show a significant time lag behind housing construction. Public sector construction was about the same as in 2004, $163 billion, and was dominated by buildings ($72.4 billion, down by 1.9%), and roads ($43.4 billion, up by 2.8%); these categories had shown significant spending declines in 2004.

Some of the spending shifts do not accord well with the breakout of portland cement sales by customer type listed in table 14. Sales tonnages to ready-mixed concrete companies (which engage in many types of concrete construction) were up 7.8% in 2005 and sales overall to contractors (a category that tends to overlap ready-mixed concrete) were slightly up (0.5%). Within a 3.7% overall increase in sales to makers of concrete products were declines in sales for brick and block manufacture (down 1.1%) and pipe manufacture (down by 7.3%); at least the brick and block decline would be in contrast to the single-family residential spending increase noted earlier. On the other hand, sales to precast-prestressed product manufacturers were up 5.9%, which would be in accord with the increased spending for private sector nonresidential buildings. However, the miscellaneous and/or unspecified component of concrete product sales went up by 12.6%, and this could indicate less precise reporting in 2005. Among sales to contractors, airport construction tonnages went up by almost 21% in 2005. Sales to road paving companies declined 8.4%, a surprise given the spending level increases noted above, but the tonnage decline could be at least partly because of overlap with the ready-mixed concrete category (which increased). An almost 53% increase in sales tonnages to “Government and miscellaneous” customers may reflect increases in security and military spending. High prices for many metals and for crude petroleum and natural gas during the year spurred increased drilling and mining activity, which were reflected in the 2.8% increase in sales tonnages for “oil well” drilling and the almost 26% increase in sales to the mining industry.

At least some of the poor correlation between overall construction spending and cement consumption levels could be owing to lag times or to changes in use of concrete relative to competing construction materials. For example, increases in the number and average size of new homes being built would be expected to result in more concrete for house foundations, but might not translate to commensurate increases in brick and block consumption if the houses are being constructed of wallboard and plywood, and have vinyl siding, or if it is clay brick being used instead of concrete brick. Single-family construction use of brick and blocks might be especially sensitive to large cement price increases, such as in 2005 (tables 11-13). Overall, the effect of competing materials can be crudely evaluated through use of a calculated “penetration rate” for cement. This can be defined as the tonnage of cement consumed per $1 million in spending and ideally should be done for each type of construction. Changes in penetration rates can reflect cost or performance advantages of concrete over competing construction materials, the specific sizes and types of construction projects, promotional efforts by the concrete industry, shifts in spending between new construction and repairs to existing infrastructure, lag times between construction spending and concrete consumption, and total cement consumption underreported because of partial substitution in concrete mixes of portland cement by other cementitious materials. Using the apparent consumption data in table 1, the overall construction spending data (revised for 2001-04) show a generally increasing trend in penetration rates for 2001–05; $1 million in construction spending bought, in chronological order, about 158 t of cement in 2001; 156 t in 2002; 162 t in 2003; 169 t in 2004; and 170 t in 2005.

Sales to final customers of different types of portland cement are listed in table 15. As in past years, Types I and II cement were dominant, but their relative dominance was declining somewhat in favor of sulfate-resistant varieties of cement (Type V, Type II/V hybrids reported as Type V, and some blended cements). Sales of oil well cements rose by almost 10%, although understate the market somewhat because shallow wells can sometimes be handled with less specialized cements. Blended cement sales were up strongly (almost 70%), especially those varieties containing fly ash; indeed, 2005 was the first year in which blended cement sales exceeded 3 Mt (the USGS monthly data for blended cements suggest that sales were actually about 2.96 Mt, however). The higher sales of blended cement would appear to reflect success in promotional efforts by the cement industry and environmental agencies to gain acceptance for these cements, especially for public sector construction projects, both in environmental terms and in terms of overall concrete strength and durability.

Portland cement shipments by method of transportation are listed in table 10. These data are prone to more reporting errors by survey respondents than most other forms of data, and thus small changes year-to-year may not be real. It is clear from this table that the U.S. market is a bulk cement market. As in past years, truck transportation was by far the dominant form of cement shipping to customers in 2005. The significant drop in overall initial shipments from plant to terminal in 2005 (column 1 of table 10) probably reflects an increased availability of imported cement to the terminals. The reduction in shipments by rail and by barge in this column may also reflect hurricane damage to ship unloading and transfer facilities (particularly in the New Orleans customs district), and to rail infrastructure.

Consumption of masonry cement rose 6.1% to a record 5.5 Mt; this is in accord with the strong housing construction market (table 9). However, given the decline in sales of block cement or sales of portland cement to brick and block makers noted above, the strong masonry cement sales would suggest that clay brick was capturing most of the masonry market related to housing.

Data on the mill net values for shipments to final customers by plants and import terminals (terminal nets) are listed in tables 11-13. Except to differentiate overall gray from white portland cement sales, respondents to the USGS annual canvass do not provide value data broken out by the specific varieties of portland cement sold. Both gray and white sales are included in table

11 and only table 13 provides a white cement value breakout (for the national average). The value data make no distinction between bulk and container (bag or package) shipments; however, container shipments would be expected to have higher unit values. The average mill net value of portland cement in 2005 was about $89.00 per metric ton, up by about $11.00 per ton. The magnitude of the increase in 2005 reflects a combination of cement shortages in 2004-05 and the smaller than expected price increase in 2004 owing to the existence of yearlong contracts. Many of these contracts appear to have been renegotiated in 2005, with the result that many of the reported valuations in 2005 incorporate, in effect, 2 years of price increases. The average mill net for masonry cement rose $9.50 per ton (table 12 and 13), but the amount of the increase should be viewed with caution because the data include a significant component of estimates, and some respondents reported values apparently exclusive of bagging or packaging charges (they are supposed to be included).

The unit values in tables 11 and 12 are free on board (f.o.b.) the plant. A crude estimate of delivery costs to the customer can be made by comparison to the U.S. 20-city average delivered cement prices (for Type-I portland and masonry cements) reported monthly by the journal Engineering News-Record (ENR). For 2005, the average ENR price for Type I portland cement, converted to metric units, was $96.72 per ton, up by only $3.90 per ton. By comparison, the average mill net for gray portland cement was $88.50 per ton, up by $11.50 per ton (table 13). Not only was the ENR price increase surprisingly modest, it suggests a delivery charge component of only $8.22 per ton in 2005, compared with an apparent delivery charge component of $15 per ton in 2004. In the face of very high fuel costs in 2005, it is highly unlikely that delivery charges actually decreased. The ENR price for concrete averaged $84.00 per cubic yard, up by about $6.50 per cubic yard. The ENR price for masonry cement calculates to about $182 per ton, up by about $7 per ton. The large difference between this and the average mill net value (table 13) for masonry appears to incorporate a variety of handling charges for this mainly bagged commodity.

Foreign Trade

Trade data from the U.S. Census Bureau are listed in tables 16-21. Exports of hydraulic cement and clinker increased slightly in 2005 but, except for sales to Canada, remained insignificant (tables 1, 16). Almost all of the exported material was cement. Overall imports of hydraulic cement and clinker in 2005 increased dramatically to a record 33.3 Mt, up 23.1% (table 17) and 13.3% higher than the previous record of 29.4 Mt in 1999. The cement component of these imports (table 17 data minus the clinker data in table 21) increased by an apparent 19.7% to 30.4 Mt, also a new record, and the apparent clinker component of imports increased by 75.3% to 2.9 Mt (table 21). The use of the “apparent” qualifier is deliberate because the trade data for 2003-05 and for an unknown number of recent previous years are incomplete with regards to overland imports from Canada, as discussed below. The clinker data for 2002 and later years have been manually corrected to remove any “clinker” coming into the Honolulu, HI, district; the material was actually gray portland cement incorrectly registered with the tariff code for clinker. The Honolulu data have been transferred to table 20 (gray portland cement).

The data for clinker, and possibly also for cement, imports from Canada are incomplete. For clinker, the official trade data show insufficient clinker from Canada coming into the Detroit, MI; Milwaukee, WI; and Seattle, WA, customs districts to feed the grinding plants that are located in Michigan, Wisconsin, and Washington, respectively. These plants are essentially reliant on Canadian (and, for the Detroit district in 2004-05, Brazilian) clinker and do not purchase significant quantities of domestic clinker. The unreported Canadian clinker appears to be either material that has been given a tariff code for portland cement by mistake by the importer or is clinker coming in by truck, including material that may be transshipped after truck entry into the United States. Because the individual truckloads are worth less than $2,000 (customs value), the shipments are classified as “informal entries,” and data on them are not routinely transmitted by the U.S. Customs Service to the U.S. Census Bureau for recordation into the official trade data (reproduced in tables 17-21). This recordation problem presumably does not exist for imports by rail or by barge or ship because these shipments are larger. Clinker imports from Canada have been estimated to be higher than those reported by about 0.6 Mt in 2004 and about 0.5 Mt in 2005 (tables 1, 21). Likewise, certain U.S. cement companies with plants in Canada near the U.S. border may allow some of their U.S. final customers to pick up cement at the Canadian plants. Although these sales, as listed in table 9, are being recorded correctly in the companies’ monthly reporting to the USGS, an informal entry data recordation problem could exist for individual truckloads worth less than $2,000; this, however, is unlikely to have been an issue in 2005 because of the much higher cement prices. Given the large volumes of Canadian cement that do get recorded by the U.S. Census Bureau and the fact that the USGS monthly canvass form cannot distinguish the mode of entry of imported cement, the magnitude of the underreporting of cement imports in past years from Canada is difficult to estimate.

The 10 busiest customs districts of entry in 2005 were, in descending order, New Orleans, LA; Tampa, FL; Los Angeles, CA; Houston-Galveston, TX; San Francisco, CA; Miami, FL; Seattle, WA; Detroit, MI; New York, NY; and Charleston, SC (table 18). The 10 leading country suppliers of cement and clinker in 2005 were, in descending order, Canada, China, Thailand, Greece, the Republic of Korea, Venezuela, Mexico, Colombia, Taiwan, and Sweden. The largest increase in imports was from China, up by 2.6 Mt or 123%, but very large tonnage (and percentage) increases were also seen for Greece, Mexico, the Republic of Korea, Peru, and Taiwan. The imports from Asian countries were of especial interest because whereas they once were mainly into Pacific coast ports, they now are heavily present on the Gulf and Atlantic coasts as well. Imports from Mexico were up by 52% from those of 2004, which in turn were up 60% from those of 2003, and the increases were despite ongoing antidumping tariffs.

White cement import data are listed in table 20. Although no attempt has been made to correct the data, it is evident that a few of the country entries, notably entries for Brazil, the Dominican Republic, Greece (2005 only), Switzerland, and Venezuela, have unit values that are too low to be white cement. It is likely that this relatively inexpensive material is actually gray portland cement or even gray clinker for which a white cement tariff code was recorded by the importer. Some other entries have values that seem slightly low, and these may contain a component of gray portland cement.

Owing to fuel cost increases and some shortages of ships, there were widespread reports in 2004 of substantially higher fuel-related shipping costs for imports as well as steep rises in the chartering rates for cement ships and other bulk carriers. Chartering rates were said to have been mixed in 2005, but ship availability much improved. The difference between the unit customs value and that on a cost, insurance, freight (c.i.f.) basis is a proxy for the shipping cost. For imported gray portland cement in 2004, this difference was $19.66 per ton (up by more than 50% from that in 2003), after deducting the imports (all or mostly overland) from Canada and Mexico. For 2005, the calculation yields a difference of $24.00 per ton, up by 22%. The average c.i.f. price for waterborne imports in 2005 was $67.51 per ton, up 17.7% and the average Customs value was $43.51, up 15.4%. Shipping costs as a percentage of the c.i.f. price averaged 35.6% for waterborne imports in 2005, against 34.3% in 2004.

World Review

World hydraulic cement production data are listed in table 22. Although the data are supposed to include all forms of hydraulic cement, the data for the United States are for portland plus masonry cement only, and the data for some other countries also may be incomplete. The data for some countries may include their exports of clinker.

World cement production increased by about 5% in 2005 to an estimated 2.3 Gt. More than 150 countries produced cement during the year; production was very unevenly distributed. China was once again the overwhelmingly largest producer, with an output for the first time exceeding 1 Gt; this was almost 45% of world output. The large increase in its exports to the United States was only part of a significant rise in total Chinese cement exports; China has become the world's leading cement exporter. The remaining top 15 producing countries were, in descending order, India, the United States, Japan, the Republic of Korea, Spain, Russia, Italy, Turkey, Thailand, Indonesia, Brazil, Mexico, Iran, and Germany. Cumulatively, the top 5 countries had about 61% of total world output; the top 10 countries, about 70%; and the top 15 countries, about 78%.

Regionally, Asia contributed about 65% of world production and included 6 of the 15 leading producing countries. Western Europe had about 9% of total output; North America, about 7%; the Middle East (including Turkey), about 6%; Central America and South America, about 4%; Africa, about 4%; the Commonwealth of Independent States, about 3%; and Eastern Europe, 2%.

Outlook

Interest (including mortgage) rates were expected to rise in 2006, and this was expected to have a significant negative impact on private sector construction, particularly for single-family housing. Because of the work disruptions and damage caused by the hurricanes (especially Katrina) in 2005, repair and catch up construction activity in at least the first quarter of 2006 was expected to be very high, and thus offset some of the housing construction decline in terms of cement consumption. Public sector construction spending, including that for transportation infrastructure, was expected to increase, but the degree was uncertain, including the ultimate degree of repair and restoration activity in the hurricane damaged regions. Overall, cement consumption in 2006 was expected to be 1% to 3% higher than that in 2005, absent unusually severe weather conditions. Although a number of companies had announced capacity expansion plans, this activity was not expected to contribute to clinker production in 2006 by very much, and so import levels were expected to increase to meet any excess demand. Ultimately, increased production capacity was expected to reduce the need for imports in the medium- to long-term. It appeared likely that import duties on imported Mexican cement would be significantly reduced in 2006, but it was unclear to what extent this would result in higher short-term imports (largely brought in by rail) from Mexico, given the already strong increases in imports from Mexico in 2004-05 and the U.S. rail infrastructure having little extra capacity. In any case, it was unlikely that increased Mexican imports would penetrate very far into the United States and so would not significantly alleviate cement shortages in most States.

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TABLE 1
SALIENT CEMENT STATISTICS[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

		2001	2002	2003	2004	2005
United States:[2]						
Production:						
Cement[3]		88,900	89,732	92,843	97,434	99,319
Clinker		78,451	81,517	81,882	86,658	87,405
Shipments from mills and terminals:[4, 5]						
Quantity		112,510	108,500	111,000	120,000	127,000
Value [6]		8,600,000	8,250,000	8,340,000	9,520,000 r	11,600,000
Average value[7]	dollars per metric ton	76.50	76.00	75.00	79.50	91.00
Stocks at mills and terminals, yearend		6,600	7,680	6,610	6,710	7,390
Exports of cement and clinker		746	834	837	749 r	766
Imports for consumption:						
Cement[8]		23,694	22,198	21,015	25,396	30,403
Clinker		1,782	1,603	1,808	1,630	2,858
Total[9]		25,474	23,801	22,823	27,026	33,261
Consumption, apparent[10]		112,810	110,020	114,090	121,980 r	128,280
World, production[e, 11]		1,740,000 r	1,850,000	2,030,000 r	2,190,000 r	2,310,000

[e]Estimated. [r]Revised.
[1]Unless otherwise indicated, data are for portland (including blended) and masonry cements only. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.
[2]Excludes Puerto Rico.
[3]Includes cement produced from imported clinker.
[4]Includes imported cement and cement made from imported clinker. Includes sales by import terminals.
[5]Shipments to final domestic customers. Data are from an annual survey of plants and terminals and may differ from the totals in table 9, which are based on consolidated monthly surveys from companies.
[6]Value at mill or import terminal of cement shipments to final domestic customers.
[7]Total value at mill or import terminal divided by the total tonnage sold.
[8]All forms of hydraulic cement or clinker, respectively.
[9]Data may not add to totals shown because of independent rounding.
[10]Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in yearend cement stocks.
[11]Total hydraulic cement. May include clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Chicago, metropolitan	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3

PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

	2004					2005				
			Capacity[2]					Capacity[2]		
District[5]	Active plants	Production[3] (thousand metric tons)	Finish grinding (thousand metric tons)	Percentage utilized[6]	Stocks at yearend[4] (thousand metric tons)	Active plants	Production[3] (thousand metric tons)	Finish grinding (thousand metric tons)	Percentage utilized[6]	Stocks at yearend[4] (thousand metric tons)
Maine and New York	5	3,266	4,569	71.5	167	5	3,241	4,569	70.9	220
Pennsylvania, eastern[7]	7	4,706	5,378	87.5	209 [8]	7	4,715	5,410	87.2	270
Pennsylvania, western	3	1,522	1,704	89.3	105 [8]	3	1,573	1,719	91.5	126 [8]
Illinois	4	3,009	3,388	88.8	263	4	3,237	3,410 [8]	95.0	199 [8]
Indiana	4	3,077	3,723	82.6	253	4	3,058	3,723	82.2	223
Michigan and Wisconsin[9]	6	5,688	7,363	77.3	283	6	5,599	7,330 [8]	76.4	323 [8]
Ohio	2	1,020	1,333	76.6	49	2	986	1,333	74.0	57
Iowa, Nebraska, South Dakota	5	4,257	6,064	70.2	346	5	4,502	6,062	74.3	392
Kansas	4	2,687	3,042	88.3	196	4	2,887	3,110 [8]	92.8	146
Missouri	5	5,263	6,822	77.1	471	5	5,332	7,017	76.0	444
Florida[7]	7	5,232	7,370 [8]	71.0	420	7	5,726	7,301	78.4	537 [8]
Georgia, Virginia, West Virginia	4	2,832	3,847	73.6	168	4	2,370	3,440 [8]	68.9	268
Maryland	3	2,519	2,706	93.1	164	3	2,552	2,706	94.3	146
South Carolina	3	3,114	4,587	67.9	272	3	3,267	5,018	65.1	185
Alabama	5	4,796	5,173	92.7	299	5	5,123	5,948	86.1	270
Kentucky, Mississippi, Tennessee	4	3,232	3,587	90.1	335 [8]	4	3,311	3,679	90.0	304
Arkansas and Oklahoma	4	2,753	3,277	84.0	253	4	2,810	3,280 [8]	85.6	128
Texas, northern[7]	6	6,393	7,400 [8]	86.3	322	6	6,639	7,560 [8]	87.8	803
Texas, southern	5	4,791	5,534	86.6	214 [8]	5	4,916	5,620 [8]	87.5	211
Arizona and New Mexico	3	2,750	3,477	79.1	98	3	2,788	3,480 [8]	80.2	106
Colorado and Wyoming	3	2,706	3,281	82.5	146	3	2,648	3,025	87.5	185
Idaho, Montana, Nevada, Utah	6	2,973	3,770 [8]	78.9	180	6	3,085	3,740 [8]	82.6	203
Alaska and Hawaii	--	--	--	--	65	--	--	--	--	71
California, northern	3	2,656	2,944	90.2	153	3	2,696	2,944	91.6	127 [8]
California, southern[7]	8	9,272	10,500 [8]	88.4	331	8	8,868	10,200 [8]	86.6	217 [8]
Oregon and Washington	4	1,921	2,390	80.4	189 [8]	4	1,974	2,448	80.6	163
Independent importers, n.e.c.[9]	--	--	--	--	315 [8]	--	--	--	--	528 [8]
Total or average[10]	113	92,434	113,000 [8]	81.6	6,270 [8]	113	93,904	114,000 [8]	82.3	6,850 [8]
Puerto Rico	2	1,580	2,462	64.2	43	2	1,584	2,462	64.3	45
Grand total or average[10]	115	94,014	116,000 [8]	81.3	6,310 [8]	115	95,488	117,000 [8]	81.9	6,900 [8]

-- Zero.

[1]Even when presented unrounded, data are thought to be accurate to no more than three significant digits. Includes data for white cement.

[2]Reported grinding capacity is based on fineness needed to produce a plant's normal product mix, including masonry cement, and allowing for downtime for routine maintenance.

[3]Includes cement produced from imported clinker.

[4]Includes imported cement. Includes mills and terminals.

[5]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

[6]Calculated relative to portland cement output.

[7]Data, except for stockpiles, exclude one plant that reported cement (clinker) grinding capacity but reported no production of portland cement.

[8]Data contain estimates for nonrespondent or incompletely reporting facilities.

[9]Not elsewhere classified. Data include only those importers or terminals for which regional assignations were not possible.

[10]Data may not add to totals shown because of independent rounding.

TABLE 4

MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

District[4]	2004 Active plants	2004 Production[2] (thousand metric tons)	2004 Stocks at yearend[3] (thousand metric tons)	2005 Active plants	2005 Production[2] (thousand metric tons)	2005 Stocks at yearend[3] (thousand metric tons)
Maine and New York	4	127	20	4	119	18
Pennsylvania, eastern	6	289	37	6	399 [5]	60 [5, 6]
Pennsylvania, western	3	W	W	3	W [5]	W [5]
Indiana	4	W	W	4	555 [7]	72 [7]
Michigan	4	231	32	4	228	46 [5, 6]
Ohio	2	98	18	2	W [7]	W [7]
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	W	W	2	W	W
Missouri	1	W	W	2	W	W
Florida	5	763	45	5	902	35
Georgia, Virginia, West Virginia	5	419	49	5	543 [8]	51 [8]
Maryland	2	W	W	2	W [8]	W [8]
South Carolina	3	453	7	3	498	26
Alabama	4	430	56	4	475	77
Kentucky, Mississippi, Tennessee	3	W	W	3	W	W
Arkansas and Oklahoma	4	161	15	4	188	18
Texas, northern	4	161	22	5	213	21
Texas, southern	3	158	5 [6]	3	182	13
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	--	W	W	1	W	W
Alaska and Hawaii	--	--	--	--	--	--
California, northern	3	81	6	3	67	11
California, southern	4	605	12	4	627	12
Independent importers, n.e.c.[9]	--	--	5 [6]	--	--	4 [6]
Total[10]	73	5,000	441 [6]	76	5,415	532 [6]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Includes masonry, portland-lime, and plastic cements. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes cement produced from imported clinker.

[3]Includes imported cement.

[4]District assignation is the location of the reporting facilities. Includes independent importers for which regional assignations were possible.

[5]For 2005, western Pennsylvania tonnages are included with eastern Pennsylvania.

[6]Data contain estimates for nonrespondent or incompletely reporting facilities.

[7]For 2005, Ohio tonnages are included with Indiana.

[8]For 2005, Maryland tonnages are included with Georgia, Virginia, and West Virginia.

[9]Not elsewhere classified.

[10]Data may not add to totals shown because of independent rounding.

TABLE 5

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2005, BY DISTRICT[1]

District	Active plants[2] Process used Wet	Dry	Both	Total	Number of kilns[6]	Daily capacity[3] (thousand metric tons)	Average days of routine maintenance	Apparent annual capacity[4] (thousand metric tons)	Production (thousand metric tons)	Percentage of capacity utilized	Yearend stocks[5] (thousand metric tons)
Maine and New York	2	2	--	4	5	10.9 [7]	26.6	3,670 [7]	3,072	83.6 [7]	85
Pennsylvania, eastern	2	5	--	7	14	16.3 [7]	24.1	5,430 [7]	4,501	82.9 [7]	177
Pennsylvania, western	2	1	--	3	7	5.2	19.6 [7]	1,800 [7]	1,553	86.1 [7]	48
Illinois	--	4	--	4	8	8.6	14.5	2,980	2,721	91.4	148
Indiana[8]	1	3	--	4	8	10.6	21.1	3,640	3,161	86.8	115
Michigan	1	2	--	3	8	14.2	26.6	4,810	4,111	85.5	443 [7]
Ohio	1	1	--	2	3	3.4	18.3	1,190	1,010	84.7	71
Iowa, Nebraska, South Dakota	--	4	1	5	9	14.0	20.8	4,790	4,093	85.5	173
Kansas	1	3	--	4	9	9.0	20.0	3,130	2,792	89.1	97
Missouri	2	3	--	5	6	15.9	21.1	5,400	4,871	90.3	137
Florida	--	6	--	6	7	18.0	21.7	6,150	5,285	85.9	199
Georgia, Virginia, West Virginia	1	2	--	3	5	8.4	18.6 [7]	2,870 [7]	2,245	78.4 [7]	131
Maryland	1	2	--	3	4	8.1	18.3	2,760	2,458	89.1	79
South Carolina	--	2	1	3	7	14.3	18.4	4,880	3,147	64.5	163
Alabama	--	5	--	5	5	16.6	23.4	5,630	4,884	86.7	82
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.3 [7]	16.8	3,580 [7]	3,133	87.4 [7]	175
Arkansas and Oklahoma	2	2	--	4	10	8.3	15.7	2,890	2,628	90.9	62
Texas, northern	2	3	1	6	16	20.9	16.5	7,250	6,363	87.8	262
Texas, southern	--	4	1	5	6	13.9	17.4	4,830	4,385	90.8	199
Arizona and New Mexico	--	3	--	3	7	8.6	21.3	2,990	2,604	87.0	91
Colorado and Wyoming	--	3	--	3	4	8.9	19.3	3,030	2,409	79.5	56
Idaho, Montana, Nevada, Utah	3	3	--	6	8	8.4	15.2	2,930	2,797	95.5	24
California, northern	--	3	--	3	3	8.8	18.6	3,060	2,593	84.7	114
California, southern	--	8	--	8	17	29.4	23.2	9,860	8,873	90.0	352
Oregon and Washington	1	2	--	3	3	6.3	36.3	2,060	1,715	83.3	33
Total or average[9]	23	79	4	106	183	297.2 [7]	21.7 [7]	102,000 [7]	87,405	86.0 [7]	3,520 [7]
Puerto Rico	--	2	--	2	2	5.9	21.0 [7]	2,020 [7]	1,378	68.4 [7]	64
Grand total or average[9]	23	81	4	108	185	303.1 [7]	21.7 [7]	104,000 [7]	88,783	85.7 [7]	3,580 [7]

-- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes white cement plants. Includes all plants active for at least one day during the year.

[3]Sum of reported daily kiln capacities for each plant in district.

[4]Sum of apparent annual kiln capacities; for each kiln calculated as 365 days (366 in leap years) minus days reported as shut down for routine maintenance and then multiplied by the reported (unrounded) daily capacity.

[5]Includes imported clinker and clinker stockpiles at grinding plants.

[6]Kilns active at least one day during year. Excludes idle kilns (full year) that cannot be restarted, fully permitted, in less than 6 months.

[7]Data contain estimates for nonrespondent or incompletely reporting facilities.

[8]Includes one semidry kiln.

[9]Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

Raw materials	2004 Clinker	2004 Cement[3]	2005 Clinker	2005 Cement[3]
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	113,000 r	1,810	114,000	2,230
Cement rock (includes marl)	12,700	2	11,300	2
Cement kiln dust (CKD)[4]	333	165	334	414
Lime[5]	24	29	9	30
Other	23	19	26	21
Aluminous:				
Clay	4,630 r	--	4,790	--
Shale	3,700	29	3,780	30
Other[6]	661	--	721	--
Ferrous, iron ore, pyrites, millscale, other	1,330 r	--	1,553	--
Siliceous:			--	--
Sand and calcium silicate	3,150	--	3,010	--
Sandstone, quartzite, soils, other	878	6	950	--
Fly ash	2,890	77	2,950	153
Other ash, including bottom ash	1,050	--	1,210	--
Granulated blast furnace slag[7]	104	345	144	521
Other blast furnace slag	189	--	255	--
Steel slag	401	--	525	--
Other slags	53	--	58	2
Natural rock pozzolans[8]	--	6	--	8
Other pozzolans[9]	114	19	222	62
Other:				
Gypsum and anhydrite	--	5,200 r	--	5,370
Other, n.e.c.[10]	106	98	84	108
Total[11]	146,000 r	7,810 r	146,000	8,940
Clinker, imported, raw materials equivalent[11]	--	4,400 r	--	4,750
Grand total[12]	146,000 r	12,200 r	146,000	13,700

[r]Revised. -- Zero.

[1]Nonfuel raw materials. Excludes Puerto Rico.

[2]Data have been rounded to three significant digits to reflect inherent reporting accuracy and the incorporation of estimates for some facilities.

[3]Includes portland, blended, and masonry cements.

[4]Data are underreported.

[5]Data are probably underreported, especially regarding incorporation within masonry cements.

[6]Includes alumina, aluminum dross, bauxite, catalysts, staurolite, and other materials.

[7]Includes both ground (GGBFS) and unground material.

[8]Includes pozzolana and burned clays and shales except where reported directly as clay or shale.

[9]Includes diatomite, silica fume, other microcrystalline silica, and other pozzolans, whether or not used as such

[10]Not elsewhere classified.

[11]Converted as the weight of foreign clinker consumed times 1.7.

[12]Data may not add to totals shown because of independent rounding.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS[1]

	Clinker produced[2]			Fuel consumed					Waste fuel	
Kiln process	Active plants	Quantity (thousand metric tons)	Percentage of total	Coal[3] (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil[4] (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
2004:										
Wet	24	14,165	16.3	1,730	584	29,300	36,700	61	38	771,000
Dry	78 [5]	67,160 [5]	77.5 [5]	7,230 [5]	1,600	74,600 [5]	299,000	312	71	186,000 [5]
Both[6]	5	5,333	6.2	700	77	691	60,000	5	16	40,400
Total[7]	107 [5]	86,658 [5]	100.0 [5]	9,660 [5]	2,260	105,000 [5]	396,000	377	125	997,000 [5]
2005:										
Wet	23	11,807	13.5	1,480	586	29,300	22,800	85	9	479,000
Dry	79	70,809	81.0	7,340	1,740	58,000	310,000	315	110	894,000
Both[6]	4	4,790	5.5	679	21	--	62,000	5	10	93,300
Total[7]	106	87,405	100.0	9,490	2,350	87,300	395,000	405	130	1,470,000

-- Zero.

[1]All fuel data have been rounded to three significant digits.

[2]Clinker data were all reported; although unrounded, data are thought to be accurate to no more than three significant digits.

[3]All reported to be bituminous.

[4]Distillate and residual fuel oils; excludes used oils included under liquid wastes.

[5]Revised to exclude Puerto Rico.

[6]Fuel quantities may not represent normal operating conditions owing to the inclusion of plants that were converted from wet to dry technology during the year.

[7]Data may not add to totals shown because of independent rounding.

TABLE 8

ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS

	Electric energy used[1]							
	Generated at plant		Purchased		Total			
Plant process	Number of plants	Quantity (million kilowatthours)	Number of plants	Quantity (million kilowatthours)	Quantity[2] (million kilowatthours)	Percentage	Finished cement produced[3] (thousand metric tons)	Average consumption (kilowatthours per metric ton of cement produced)
2004:								
Integrated plants:								
Wet	--	--	24	2,170	2,170	16.1 [4]	15,770	137
Dry	4	456	78 [4]	10,000 [4]	10,500 [4]	77.8 [4]	73,465 [4]	142 [4]
Both[5]	--	--	5	822	822	6.1 [4]	5,642	146
Total or average[2]	4	456	107 [4]	13,000 [4]	13,500 [4]	100.0	94,877 [4]	142
Grinding plants[6]	--	--	6	198	198	--	2,392	83
Exclusions[7]	--	--	2	NA	NA	--	165	NA
2005:								
Integrated plants:								
Wet	--	--	23	1,770	1,770	13.1	13,075	135
Dry	5	486	79	10,400	10,900	80.7	78,423	139
Both[5]	--	--	4	770	770	5.7	5,029	153
Total or average[2]	5	486	106	13,000	13,500	100.0	96,527	139
Grinding plants[6]	--	--	7	214	214	--	2,562	84
Exclusions[7]	--	--	2	NA	NA	--	229	NA

NA Not available. -- Zero.

[1]Electricity data are rounded because they include estimates for a number of nonrespondent plants or incomplete reporting by respondent facilities.

[2]Data may not add to totals shown because of independent rounding.

[3]Includes portland and masonry cements. Data are all reported and have not been rounded.

[4]Revised to exclude Puerto Rico.

[5]Electricity consumption may not represent normal operating conditions owing to the inclusion of plants that were converted from wet to dry technology during the year.

[6]Excludes plants that reported production only of masonry cement.

[7]Tonnage of cement produced by plants that reported production of masonry cement only.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2004	Portland cement 2005	Masonry cement 2004	Masonry cement 2005
Destination:				
Alabama	1,643	1,738	172	183
Alaska[3]	175	173	--	--
Arizona	4,117	4,671	113	102
Arkansas	1,173	1,205	83	97
California, northern	5,044	5,377	125	148
California, southern	9,177	9,945	537	540
Colorado	2,440	2,521	30	33
Connecticut[3]	828	799	19	19
Delaware[3]	181	208	13	13
District of Columbia[3]	191	205	(4)	(4)
Florida	9,698	11,233	879	1,052
Georgia	4,109	4,395	354	357
Hawaii	380	431	5	7
Idaho	685	704	1	1
Illinois, excluding Chicago	2,068	2,437	27	28
Illinois, metropolitan Chicago[3]	1,919	1,669	65	70
Indiana	2,238	2,182	97	92
Iowa	1,842	1,933	6	6
Kansas	1,535	1,537	14	11
Kentucky	1,395	1,486	114	117
Louisiana[3]	1,882	1,935	66	65
Maine	234	234	5	5
Maryland	1,542	1,568	91	92
Massachusetts[3]	1,322	1,242	24	22
Michigan	3,175	2,924	146	135
Minnesota[3]	2,077	2,016	47	39
Mississippi	974	1,067	67	69
Missouri	2,623	2,816	49	52
Montana	407	380	1	1
Nebraska	1,308	1,356	9	6
Nevada	2,382	2,602	29	27
New Hampshire[3]	221	229	5	5
New Jersey[3]	2,036	1,964	89	94
New Mexico	940	901	9	8
New York, eastern	663	653	23	19
New York, western[3]	879	817	30	27
New York, metropolitan[3]	1,694	1,681	87	92
North Carolina[3]	2,743	2,900	326	352
North Dakota[3]	402	359	2	2
Ohio	3,999	3,893	191	171
Oklahoma	1,442	1,603	62	71
Oregon	1,119	1,237	1	1
Pennsylvania, eastern	2,230	2,214	73	71
Pennsylvania, western	1,166	1,096	60	56
Rhode Island[3]	178	188	4	3
South Carolina	1,742	1,778	147	166
South Dakota	512	483	2	2
Tennessee	1,875	2,111	256	278
Texas, northern	6,222	6,793	148	164
Texas, southern	6,874	7,680	219	257
Utah	1,373	1,526	(4)	(4)

See footnotes at end of table.

TABLE 9—Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2004	Portland cement 2005	Masonry cement 2004	Masonry cement 2005
Destination—Continued:				
Vermont[3]	144	129	3	3
Virginia	2,478	2,666	189	203
Washington	2,090	2,238	2	2
West Virginia	488	512	29	27
Wisconsin	2,329	2,348	28	25
Wyoming	463	466	(4)	1
Total[5]	115,066	121,448	5,172	5,489
Foreign countries[6]	492	424	1	(4)
Puerto Rico	1,879	1,857	--	--
Grand total[5]	117,435	123,730	5,172	5,489
Origin:				
United States	93,323	94,004	5,115	5,429
Puerto Rico	1,585	1,584	--	--
Foreign countries[7]	22,527	28,142	57	60
Total shipments[5]	117,435	123,730	5,172	5,489

-- Zero.

[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.

[2]Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 10-12, and 14-15, which are from annual surveys of individual plants and importers. Includes any revisions to monthly data available through August 31, 2005. Although presented unrounded, data are thought to be accurate to no more than three significant digits.

[3]Has no cement plants.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Includes shipments to U.S. possessions and territories.

[7]Imported cement distributed in the United States as reported by domestic producers and other importers. Data do not match the imports calculated from tables 17 and 21.

TABLE 10

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total shipments
	In bulk	In containers[3]	In bulk	In containers[3]	In bulk	In containers[3]	to consumer[4]
2004:							
Railroad	13,700	47	1,690	8	456 [r]	1	2,160 [r]
Truck	4,210 [r]	563	60,200 [5]	1,520 [5]	49,800 [5]	790 [5]	112,000 [5]
Barge and boat	9,100 [r]	10	99	--	--	--	99 [r]
Total[4]	27,000	620	62,000 [5]	1,530 [5]	50,300 [5]	791 [5]	115,000 [5, 6]
2005:							
Railroad	12,000	13	1,570	18	488	--	2,080
Truck	3,920	200	62,700	1,940	54,800	723	120,000
Barge and boat	8,970	--	80	--	--	--	80
Total[4]	24,900	214	64,400	1,960	55,200	723	122,000 [6]

[r]Revised. -- Zero.

[1]Includes imported cement and cement made from imported clinker.

[2]Data are rounded to no more than three significant digits because they include estimates.

[3]Includes packages, bags, and jumbo bags.

[4]Data may not add to totals shown because of independent rounding.

[5]Revised to exclude Puerto Rico.

[6]Shipments calculated on the basis of an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 11

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1]

	2004			2005		
		Value[2]			Value[2]	
District[3, 4]	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	3,556	$269,944	75.91	3,434	$305,647	89.00
Pennsylvania, eastern	4,830 [5]	363,000 [5]	75.00 [5]	4,686	411,000 [5]	87.50 [5]
Pennsylvania, western	1,535	120,000 [5]	78.00 [5]	1,563	139,204	89.06
Illinois	3,052	235,921	77.31	3,280 [5]	291,000 [5]	88.50 [5]
Indiana	3,013	213,484	70.85	3,141	249,419	79.40
Michigan and Wisconsin	6,611	535,000 [5]	81.00 [5]	6,170 [5]	574,000 [5]	93.00 [5]
Ohio	1,005	81,000 [r, 5]	80.50 [r, 5]	984	89,069	90.48
Iowa, Nebraska, South Dakota	4,802	394,319	82.12	5,151	474,693	92.16
Kansas	2,222	175,000 [5]	79.00 [5]	2,376	200,526	84.41
Missouri	6,058	446,008	73.63	6,281	546,361	86.99
Florida	9,430 [5]	776,000 [5]	82.50 [5]	10,841	982,819	90.65
Georgia, Virginia, West Virginia	2,951	220,030	74.55	3,001	256,000 [5]	85.50 [5]
Maryland	2,733	189,628	69.38	2,842	234,227	82.41
South Carolina	3,491	220,162	63.06	3,827	289,278	75.59
Alabama	4,621	308,181	66.69	5,459	448,929	82.24
Kentucky, Mississippi, Tennessee	3,087	227,798	73.79	3,281	284,667	86.77
Arkansas and Oklahoma	2,658	198,487	74.68	2,998	250,345	83.51
Texas, northern	7,678	559,000 [5]	73.00 [5]	8,096	681,000 [5]	84.00 [5]
Texas, southern	6,270 [5]	435,000 [5]	69.50 [5]	6,674	534,932	80.15
Arizona and New Mexico	3,969	368,314	92.80	4,600 [5]	465,000 [5]	101.00 [5]
Colorado and Wyoming	2,786	206,658	74.19	2,704	237,000 [5]	87.50 [5]
Idaho, Montana, Nevada, Utah	3,245	268,775 [r]	82.82 [r]	3,473	323,457	93.13
Alaska and Hawaii	499	64,680	129.53	560	78,247	139.72
California, northern	4,257	369,806	86.88	4,518	443,260	98.11
California, southern	10,764	881,243	81.87	11,575	1,125,323	97.22
Oregon and Washington	2,690 [5]	207,000 [5]	77.00 [5]	3,040 [5]	268,000 [5]	88.00 [5]
Independent importers, n.e.c.[6, 7]	6,790 [5]	598,000 [5]	88.00 [5]	7,740 [5]	745,000 [5]	96.50 [5]
Total or average[8]	115,000 [5, 9]	8,930,000 [r, 5]	78.00 [5]	122,000 [5, 9]	10,900,000 [5]	89.00 [5]
Puerto Rico	1,868	W	W	1,867	W	W
Grand total[8]	116,000 [5, 9]	W	W	124,000 [5, 9]	W	W

[r]Revised. W Withheld to avoid disclosing company proprietary data.

[1]Includes portland cement (gray and white) and cement produced from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Values represent mill net or ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded value data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[3]District is the location of the reporting facility, not the location of sales.

[4]Includes shipments by independent importers where regional assignations were possible.

[5]Data are rounded (unit values to the nearest $0.50) because they include estimated data.

[6]Importers for which district assignations were not possible.

[7]Not elsewhere classified.

[8]Data may not add to totals shown because of independent rounding.

[9]Shipments calculated on the basis of an annual survey of plants and importers; may differ from data in table 9, which are based on consolidated company monthly data.

TABLE 12

MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1, 2]

District[4]	2004 Quantity (thousand metric tons)	2004 Value[3] Total (thousands)	2004 Value[3] Average (dollars per metric ton)	2005 Quantity (thousand metric tons)	2005 Value[3] Total (thousands)	2005 Value[3] Average (dollars per metric ton)
Maine and New York	122	$12,100 [5]	99.50 [5]	118	$12,751	108.06
Pennsylvania	345	39,767 [5]	115.50 [5]	342 [5]	42,600 [5]	124.50 [5]
Illinois, Indiana, Ohio	532	62,500 [5]	117.50 [5]	536	68,340	127.50
Michigan	255	30,000 [5]	117.50 [5]	232 [5]	28,000 [5]	120.50 [5]
Iowa, Nebraska, South Dakota	35	4,627	132.92	40	3,728	93.20
Kansas and Missouri	154	18,166	118.23	169	21,279	125.91
Florida	775	99,200 [5]	128.00 [5]	945	134,930	142.78
Georgia, Maryland, Virginia, West Virginia	455	66,000 [5]	145.00 [5]	476	75,800 [5]	159.50 [5]
South Carolina	400	44,073	110.06	473	51,539	108.96
Alabama	425	48,875	114.98	500	57,727	115.45
Kentucky, Mississippi, Tennessee	125	15,000	119.73	127	16,364	128.85
Arkansas and Oklahoma	157	16,724	106.61	190	20,508	107.94
Texas, northern	163	22,800 [5]	139.50 [5]	188	26,200 [5]	139.00 [5]
Texas, southern	172	17,111	99.75	186	19,814	106.53
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	147	15,513	105.71	156	18,706	119.91
Alaska and Hawaii	4	914	209.44	5	1,234	246.80
California, northern; Oregon; Washington	84	9,710 [5]	115.00 [5]	71	9,060 [5]	127.50 [5]
California, southern	599	57,115	95.30	628	72,178	114.93
Independent importers, n.e.c.[6, 7]	43 [5]	4,910 [5]	114.00 [5]	24 [5]	3,480 [5]	145.00 [5]
Total or average[8]	4,990 [5, 9]	585,000 [5]	117.00 [5]	5,410 [5, 9]	684,000	126.50

[1]Shipments are to final customers and include imported cement and cement made from imported clinker. Data exclude Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes gray, white, and colored varieties of masonry, portland-lime, and plastic cements.

[3]Values represent ex-plant (free on board) valuations of total sales to final customers, including sales from distribution terminals. Even where presented unrounded, data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[4]District location is that of the reporting facilities, not necessarily the location of sales.

[5]Data are rounded (unit values to the nearest $0.50) because they include estimated data.

[6]Importers for which district assignations were not possible.

[7]Not elsewhere classified.

[8]Data may not add to totals shown because of independent rounding.

[9]Tonnages based on an annual survey of plants and terminals and may differ from the totals in table 9, which represent consolidated monthly surveys of companies.

TABLE 13

AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

Year	Gray portland cement	White portland cement[3]	All portland cement	Prepared masonry cement	All classes of cement
2004	77.00 [r]	164.00	78.00	117.00	79.50
2005	88.50	176.00	89.00	126.50	91.00

[r]Revised.

[1]Excludes Puerto Rico. Values are the average of sales to final customers, free on board plant or import terminal, less all discounts, allowances, and onward delivery charges to customers or distribution terminals, but inclusive of bagging charges.

[2]Data are rounded to the nearest $0.50 because they include estimates.

[3]The unit values for white cement include a component of resales showing significant price markups.

TABLE 14

PORTLAND CEMENT SHIPMENTS IN 2005, BY DISTRICT AND TYPE OF CUSTOMER[1]

(Thousand metric tons)

District[2, 3]	Ready-mixed concrete	Concrete product manufacturers[4]	Contractors[5]	Building material dealers	Oil well, mining, waste[6]	Government and miscellaneous[7]	Total[8, 9]
Maine and New York	2,710	355	67	254	--	49	3,434
Pennsylvania, eastern	2,880	1,300	145	265	--	98	4,686
Pennsylvania, western	1,100	265	159	1	18	18	1,563
Illinois	2,540	249	147	51	177	119	3,280
Indiana	2,420	457	162	75	11	17	3,141
Michigan and Wisconsin	4,840	744	175	179	44	186	6,170
Ohio	793	151	10	15	1	15	984
Iowa, Nebraska, South Dakota	3,620	605	562	99	95	172	5,151
Kansas	1,860	158	221	85	53	1	2,376
Missouri	5,150	376	621	96	5	38	6,281
Florida	8,010	2,000	176	626	1	27	10,841
Georgia, Virginia, West Virginia	2,140	634	162	38	11	13	3,001
Maryland	2,250	318	141	55	2	79	2,842
South Carolina	2,730	706	256	94	2	40	3,827
Alabama	4,150	686	241	163	16	201	5,459
Kentucky, Mississippi, Tennessee	2,530	514	168	30	17	20	3,281
Arkansas and Oklahoma	2,140	144	461	130	75	44	2,998
Texas, northern	5,160	566	1,120	150	673	428	8,096
Texas, southern	4,530	719	767	152	480	31	6,674
Arizona and New Mexico	3,430	596	259	130	161	144	4,600
Colorado and Wyoming	2,060	299	146	68	111	19	2,704
Idaho, Montana, Nevada, Utah	2,730	243	182	41	230	46	3,473
Alaska and Hawaii	460	66	23	--	6	4	560
California, northern	3,670	462	309	69	3	5	4,518
California, southern	8,150	2,710	266	388	64	2	11,575
Oregon and Washington	2,110	537	180	151	56	9	3,040
Independent importers, n.e.c.[10, 11]	6,190	910	248	223	27	144	7,740
Total[9]	90,300	16,800	7,380	3,630	2,340	1,970	122,000
Puerto Rico	1,100	191	52	525	--	--	1,867
Grand total[9]	91,400	17,000	7,430	4,160	2,340	1,970	124,000

-- Zero.

[1]Includes imported cement and cement ground from imported clinker. Except for district totals, data have been rounded to three significant digits but are likely to be accurate to only two significant digits. District totals are accurate to no more than three significant digits.

[2]District location is that of the reporting facilities and may include sales by them into other districts.

[3]Includes shipments by independent importers for which district assignations were possible.

[4]Grand total shipments to concrete product manufacturers include brick and block—6,320; precast and prestressed—3,790; pipe—2,030; and other or unspecified—4,810.

[5]Grand total shipments to contractors include airport—198; road paving—3,820; soil cement—1,410; and other or unspecified—2,000.

[6]Grand total shipments include oil well drilling—1,850; mining—273; and waste stabilization—121.

[7]Includes shipments for which customer types were not specified.

[8]District totals are not rounded except in accord with the data in table 11.

[9]Data may not add to totals shown because of independent rounding.

[10]Shipments by independent importers for which district assignations were not possible.

[11]Not elsewhere classified.

TABLE 15
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE[1, 2]

(Thousand metric tons)

Type	2004	2005
General use and moderate heat (Types I and II) (gray)[3]	90,000 r	93,900
High early strength (Type III)	3,820	3,960
Sulfate resisting (Type V)[3]	15,800	18,100
Block	609	555
Oil well	1,310	1,440
White[4]	1,130	1,190
Blended:		
Portland, natural pozzolans	49	40
Portland, granulated blast furnace slag	978	1,880
Portland, fly ash	343	362
Other blended cement[5]	486	883
Total[6]	1,860	3,160
Expansive and regulated fast setting	62	6
Miscellaneous[7]	32	2
Grand total[6, 8]	115,000 r	122,000

[r]Revised.
[1]Includes imported cement.
[2]Data are rounded to no more than three significant digits; may not add to totals shown.
[3]Cements classified as Type II/V hybrids are now commonly reported as Type V.
[4]Mostly Types I and II, but may include Types III-V and block varieties.
[5]Includes blends with other pozzolans, such as cement kiln dust and silica fume.
[6]Data may not add to totals shown because of independent rounding.
[7]Includes low heat (Type IV), waterproof, and other portland cements.
[8]Data are based on an annual survey of plants and importers; may differ from data on table 9, which are based on monthly consolidated data from companies.

TABLE 16

U.S. AND PUERTO RICO EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004		2005	
	Quantity	Value[2]	Quantity	Value[2]
United States:				
Argentina	(3)	53	1	123
Australia	(3)	48	3	288
Azerbaijan	9	425	3	160
Bahamas	21	2,613	31	3,733
Brazil	(3)	41	1	124
Canada	639	48,034	650	52,313
Cayman Islands	1	198	1	162
China	6	645	4	461
Dominican Republic	2 [4]	188 [4]	4	216
Equatorial Guinea	2	71	--	--
France	(3)	117	1	102
Greece	1	179	2	202
Guatemala	(3)	102	1	164
Hong Kong	2	157	3	185
Indonesia	--	--	1	33
Israel	(3)	24	1	35
Jamaica	1	42	(3)	48
Japan	1	74	1	66
Korea, Republic of	1	87	2	140
Mexico	41	4,699	28	4,787
Netherlands	(3)	3	1	30
Netherlands Antilles	(3)	51	1	127
Panama	1	85	1	129
Peru	(3)	53	3	189
Saudi Arabia	(3)	24	9	907
Spain	(3)	8	1	26
Sweden	1	74	1	60
Taiwan	3	171	4	179
Trinidad and Tobago	1	165	1	129
Turks and Caicos Islands	(3)	44	(3)	33
United Arab Emirates	1	80	1	211
United Kingdom	(3)	6	1	32
Venezuela	5	275	1	127
Other	9 [4]	1,445 [4]	4	1,271
Total[5]	749	60,281	766	66,789
Puerto Rico:				
Bahamas, The	--	--	1	60
Dominican Republic	69	2,741	35	1,415
Turks and Caicos Islands	--	--	1	32
Other	(3)	19	(3)	6
Total[5]	70	2,760	37	1,513
Grand total[5]	818	63,041	803	68,302

-- Zero.

[1]Includes portland and masonry cements.

[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

[3]Less than ½ unit.

[4]U.S. data may appear to be revised because Puerto Rico data are now shown separately.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 17

U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Belgium	2 [4]	624 [4]	665 [4]	1	149	161
Brazil	442	18,206	22,359	467	25,153	29,837
Bulgaria	231	12,478	15,069	303	16,921	20,325
Canada	5,753	319,651	338,988	5,404	319,259	338,523
China[5]	2,119 [4]	72,644 [4]	114,209 [4]	4,726	202,089	319,988
Colombia	2,121 [4]	83,935 [4]	116,107 [4]	1,844	94,981	123,758
Croatia	25	4,668	5,671	34	6,659	8,103
Denmark	156 [4]	11,681 [4]	16,786 [4]	227	16,316	24,978
Dominican Republic	--	--	--	77	4,406	6,188
Egypt	339	17,147	26,166	569	33,419	48,355
France	79	15,163	17,710	74	16,509	19,508
Germany	14	2,029	3,779	3	926	1,918
Greece	2,011	65,398	105,253	2,786	104,910	172,406
Hong Kong	--	--	--	77	1,858	1,911
Indonesia	630	22,490	41,804	865	29,481	58,713
Japan	2	593	867	4	1,155	1,832
Korea, Republic of	1,729	48,014	80,415	2,526	87,370	144,854
Mexico	1,429 [4]	62,520 [4]	81,067 [4]	2,173	110,281	138,030
Netherlands	7	3,338	4,111	31	5,033	5,865
Norway	365	23,388	25,642	522	25,299	32,574
Peru	644	21,335	35,871	1,047	35,546	60,527
Philippines	301	8,360	13,293	312	9,728	18,220
Spain	408 [4]	19,477 [4]	28,380 [4]	236	16,497	22,895
Sweden	1,058	31,483	55,336	1,050	35,421	59,660
Taiwan	1,068	42,014	69,345	1,759	71,448	124,679
Thailand	2,808	90,620	148,475	2,893	117,719	193,668
Turkey	755 [4]	26,602 [4]	42,737 [4]	675	28,873	50,665
United Arab Emirates	2	126	204	5	468	698
United Kingdom	19	6,097	6,625	14	4,907	5,211
Venezuela	2,505	99,419	140,571	2,484	119,203	170,362
Other	4 [4]	596 [4]	650 [4]	76	5,213	6,063
Total[6]	27,026 [4]	1,130,098 [4]	1,558,154 [4]	33,261	1,547,198	2,210,475
Puerto Rico:						
Denmark	217	6,638	13,255	212	8,054	13,499
Korea, Republic of	--	--	--	146	5,130	9,410
Other	62	2,592	4,019	33	2,406	3,234
Total[6]	279	9,230	17,274	391	15,590	26,142
Grand total[6]	27,305	1,139,328	1,575,428	33,652	1,562,788	2,236,617

-- Zero.

[1]Includes portland, masonry, and other hydraulic cements.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]U.S. data may appear to be revised because Puerto Rico data are now shown separately.

[5]China may be underrepresented and it is believed that all or some imports from Japan should be assigned to China.

[6]Data may not add to totals shown because of independent rounding.

TABLE 18

U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Anchorage, AK:						
Canada	11	731	1,350	8	449	898
Korea, Republic of	111	3,280	5,281	134	4,643	8,859
Total[4]	122	4,011	6,631	143	5,092	9,757
Baltimore, MD:						
Belgium	(5)	7	11	--	--	--
China	(5)	5	5	12	1,225	2,606
Germany	(5)	6	7	(5)	9	9
Netherlands	1	215	232	(5)	36	39
Norway	--	--	--	89	3,458	3,458
Taiwan	--	--	--	25	822	1,758
Venezuela	--	--	--	7	294	484
Total[4]	1	233	256	134	5,844	8,354
Boston, MA:						
Netherlands	(5)	83	102	(5)	48	51
Venezuela	127	4,756	6,634	132	5,292	8,246
Total[4]	128	4,839	6,737	132	5,339	8,298
Buffalo, NY:						
Canada	796	46,241	48,993	817	48,849	52,421
Croatia	--	--	--	(5)	76	112
Germany	(5)	12	13	--	--	--
United Kingdom	12	2,696	2,797	6	1,398	1,447
Total[4]	807 r	48,950	51,802	823	50,323	53,980
Charleston, SC:						
Brazil	--	--	--	37	2,126	2,151
China	6	758	1,062	--	--	--
Colombia	293	11,619	15,866	299	16,435	20,142
Greece	451	16,273	27,461	686	25,491	45,975
Italy	--	--	--	(5)	362	1,146
Netherlands	(5)	18	22	(5)	48	54
Spain	46	391	1,048	23	1,428	1,450
Sweden	(5)	58	68	(5)	13	16
Switzerland	--	--	--	(5)	12	15
United Kingdom	2	1,105	1,126	2	883	967
Venezuela	7	683	1,132	55	3,023	3,993
Total[4]	805 r	30,905	47,785	1,102	49,820	75,909
Chicago, IL:						
Canada	34	1,833	1,936	--	--	--
Japan	(5)	72	83	(5)	74	85
Netherlands	1	580	726	1	729	866
Spain	--	--	--	(5)	2	3
United Kingdom	--	--	--	(5)	3	3
Total[4]	35 r	2,485	2,745	1	809	958
Cleveland, OH:						
Canada	699	35,946	37,412	791	42,374	44,236
Mexico	(5)	7	11	--	--	--
Netherlands	(5)	278	319	(5)	360	411
United Kingdom	(5)	65	88	--	--	--
Total[4]	699	36,295	37,830	792	42,734	44,647

See footnotes at end of table.

TABLE 18—Continued

U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Columbia-Snake, OR:						
Canada	128	6,720	7,224	111	5,277	5,787
China	506	16,053	22,564	672	23,704	39,359
Korea, Republic of	21	715	1,056	84	2,853	4,399
Total[4]	655 r	23,488	30,843	867	31,834	49,545
Detroit, MI:						
Brazil	127	5,454	5,504	53	2,298	2,318
Canada	1,320	82,765	85,106	1,263	79,344	81,192
Denmark	(5)	5	5	--	--	--
Germany	--	--	--	(5)	20	21
Netherlands	(5)	47	59	(5)	82	95
South Africa	--	--	--	(5)	8	9
United Kingdom	1	252	304	1	339	339
Total[4]	1,448	88,523	90,978	1,317	82,092	83,974
Duluth, MN, Canada	172	7,854	8,762	158	7,121	7,951
El Paso, TX, Mexico	368	17,004	20,703	724	30,161	37,437
Great Falls, MT:						
Canada	51	2,528	2,619	62	3,078	3,282
Japan	(5)	4	4	--	--	--
Total[4]	51	2,532	2,622	62	3,078	3,282
Honolulu, HI:						
China	55	1,757	3,257	39	1,221	2,362
Korea, Republic of	21	609	1,449	--	--	--
Philippines	301	8,360	13,293	312	9,728	18,220
Taiwan	--	--	--	77	2,541	4,524
Thailand	40	1,080	1,794	--	--	--
Total[4]	417	11,806	19,793	428	13,490	25,106
Houston-Galveston, TX:						
Chile	(5)	29	35	--	--	--
China	--	--	--	243	9,063	17,052
Colombia	119	7,511	7,944	116	8,371	9,462
Egypt	29	2,282	2,971	263	13,428	21,985
France	(5)	84	94	(5)	18	20
Germany	(5)	90	110	(5)	113	136
Greece	206	6,266	9,252	292	11,042	16,723
Korea, Republic of	1,138	31,751	49,999	1,259	45,315	70,928
Peru	31	1,141	1,576	47	1,013	1,603
Thailand	--	--	--	309	15,682	27,591
Turkey	69	2,158	3,360	44	2,024	3,265
United Arab Emirates	--	--	--	1	106	170
United Kingdom	(5)	158	190	1	249	249
Venezuela	375	16,464	22,446	44	2,462	3,552
Total[4]	1,969	67,934	97,977	2,619	108,886	172,737
Laredo, TX, Mexico	158	18,052	18,989	142	16,531	17,386
Los Angeles, CA:						
China	1,196	42,085	64,956	1,874	80,939	128,099
Colombia	2	176	257	1	165	290
Egypt	2	150	245	(5)	37	73
Indonesia	78	5,857	8,775	211	7,385	13,630
Japan	(5)	142	233	2	647	1,079

See footnotes at end of table.

TABLE 18—Continued

U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Los Angeles, CA—Continued:						
Malaysia	--	--	--	(5)	4	4
Netherlands	--	--	--	(5)	17	22
Peru	1	86	128	2	196	294
Taiwan	260	10,487	14,904	214	9,694	14,053
Thailand	974	36,655	62,244	745	34,031	55,466
United Arab Emirates	1	79	114	3	308	437
United Kingdom	1	172	172	(5)	189	189
Total[4]	2,513	95,889	152,028	3,053	133,613	213,635
Miami, FL:						
Belgium	2	596	630	1	132	140
Brazil	(5)	6	9	--	--	--
China	--	--	--	85	3,231	6,250
Colombia	30	1,800	2,798	16	1,782	2,472
Denmark	4	862	1,369	51	3,647	5,536
Egypt	14	546	847	33	1,225	2,149
Germany	(5)	25	29	(5)	120	132
Greece	485	14,784	21,498	439	16,157	26,207
Guyana	1	384	387	--	--	--
Italy	--	--	--	(5)	14	17
Mexico	--	--	--	86	8,564	10,781
Peru	(5)	10	15	--	--	--
Spain	346	18,593	26,575	96	7,743	12,769
Sweden	1,055	28,737	52,156	1,006	32,229	55,452
Taiwan	--	--	--	13	941	1,448
Thailand	--	--	--	80	2,996	5,959
Turkey	248	7,546	10,905	238	9,189	15,442
United Kingdom	(5)	125	158	(5)	74	74
Venezuela	109	5,473	7,786	120	6,783	9,389
Total[4]	2,294	79,488	125,161	2,265	94,826	154,218
Milwaukee, WI, Canada	278	14,090	14,365	198	8,836	8,936
Minneapolis, MN, Canada	--	--	--	38	2,086	2,302
Mobile, AL:						
China	--	--	--	15	653	1,077
Colombia	231	7,761	13,351	137	5,977	8,988
Egypt	--	--	--	16	769	1,295
Greece	--	--	--	14	689	1,152
Korea, Republic of	--	--	--	15	631	1,017
Peru	61	1,858	3,902	--	--	--
Taiwan	--	--	--	8	352	612
Thailand	97	2,288	3,763	61	2,711	4,786
Turkey	12	351	626	--	--	--
United Kingdom	(5)	45	62	--	--	--
Venezuela	128	5,512	7,602	248	12,760	16,706
Total[4]	528 r	17,815	29,307	514	24,542	35,632
New Orleans, LA:						
China	5	542	760	552	29,337	38,095
Colombia	213	6,865	9,068	180	6,937	9,141
Croatia	25	4,663	5,666	33	6,230	7,544
Egypt	268	13,102	20,069	153	13,371	14,892

See footnotes at end of table.

TABLE 18—Continued
U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
New Orleans, LA—Continued:						
Greece	370	11,530	19,002	245	9,553	17,018
Korea, Republic of	437	11,659	22,630	897	29,316	52,462
Netherlands	(5)	58	72	--	--	--
Norway	29	2,875	5,129	--	--	--
Peru	550	18,240	30,249	998	34,336	58,631
Spain	--	--	--	78	5,652	6,533
Taiwan	--	--	--	528	16,179	40,089
Thailand	464	12,887	25,976	238	7,511	15,827
Turkey	137	7,526	13,006	102	6,647	11,095
United Kingdom	(5)	6	7	(5)	177	177
Venezuela	52	2,303	3,387	90	5,658	7,162
Total[4]	2,551	92,255	155,023	4,095	170,906	278,666
New York, NY:						
China	--	--	--	8	281	611
Colombia	1	90	155	1	125	176
Croatia	(5)	5	5	--	--	--
France	--	--	--	(5)	5	5
Germany	11	1,040	1,232	--	--	--
Greece	255	7,910	14,699	403	14,728	25,929
Netherlands	(5)	102	123	26	2,194	2,443
Norway	336	20,513	20,513	432	21,841	29,116
Poland	(5)	85	90	(5)	59	62
Sweden	3	2,273	2,652	7	1,812	2,164
Taiwan	--	--	--	37	1,194	2,490
Thailand	10	230	250	--	--	--
Turkey	31	1,054	2,018	159	6,023	11,573
United Kingdom	2	952	1,055	1	719	723
Venezuela	190	7,317	10,642	190	10,891	14,172
Total[4]	839	41,571	53,435	1,265	59,872	89,464
Nogales, AZ, Mexico	546 r	25,276	39,130	1,068	46,007	63,252
Norfolk, VA:						
Bulgaria	231	12,478	15,069	303	16,921	20,325
Canada	10	322	538	--	--	--
China	--	--	--	36	1,306	2,753
Colombia	163	5,549	7,948	156	7,509	10,618
France	79	15,080	17,616	74	16,486	19,483
Germany	(5)	32	37	(5)	91	101
Greece	--	--	--	33	1,205	2,263
Netherlands	(5)	166	212	(5)	170	205
Sweden	1	415	460	11	511	578
United Kingdom	(5)	191	216	1	346	421
Venezuela	26	915	1,370	84	3,447	6,277
Total[4]	511	35,149	43,467	697	47,992	63,025
Ogdensburg, NY:						
Canada	384	26,212	26,654	336	24,042	24,402
Germany	(5)	4	4	(5)	5	5
United Kingdom	(5)	2	2	--	--	--
Total[4]	384	26,219	26,661	336	24,047	24,407
Pembina, ND, Canada	181	8,799	9,570	178	8,686	9,081

See footnotes at end of table.

TABLE 18—Continued
U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Philadelphia, PA:						
Belgium	(5)	21	24	(5)	18	21
China	(5)	13	17	--	--	--
Germany	3	694	2,195	2	401	1,270
Netherlands	3	1,355	1,719	2	993	1,257
Switzerland	--	--	--	74	4,598	4,618
Thailand	404	9,673	10,826	417	11,535	13,941
Total[4]	410	11,755	14,780	494	17,545	21,106
Portland, ME:						
Canada	98	9,624	9,653	156	18,254	19,168
Venezuela	31	1,667	1,677	--	--	--
Total[4]	128 r	11,291	11,330	156	18,254	19,168
Providence, RI:						
China	--	--	--	103	3,787	6,536
Turkey	--	--	--	82	3,120	5,908
Venezuela	648	22,773	33,043	555	22,125	34,829
Total[4]	648	22,773	33,043	740	29,031	47,274
San Diego, CA:						
Mexico	58	2,181	2,234	153	9,019	9,175
Taiwan	545	22,464	31,726	549	27,211	38,988
Thailand	76	2,955	3,932	15	1,468	1,999
Total[4]	678 r	27,600	37,892	717	37,698	50,162
San Francisco, CA:						
China	351	11,424	21,572	671	31,530	47,192
Denmark	(5)	13	14	--	--	--
Indonesia	553	16,634	33,029	654	22,096	45,082
Israel	--	--	--	(5)	8	8
Japan	--	--	--	(5)	3	3
Taiwan	263	9,063	22,716	200	8,128	13,149
Thailand	561	19,696	31,386	837	33,716	53,981
United Arab Emirates	1	47	89	1	55	91
United Kingdom	(5)	78	92	(5)	87	87
Total[4]	1,728 r	56,955	108,898	2,363	95,623	159,593
Savannah, GA:						
Colombia	3	263	385	79	4,309	5,420
Germany	(5)	127	152	--	--	--
Netherlands	(5)	143	168	(5)	25	26
Romania	(5)	3	3	--	--	--
United Kingdom	1	248	357	1	392	460
Total[4]	4	783	1,065	81	4,726	5,907
Seattle, WA:						
Canada	1,469	64,454	73,179	1,153	56,704	63,696
China	--	--	--	119	4,626	7,069
Germany	--	--	--	(5)	167	242
Japan	1	374	548	1	431	665
Korea, Republic of	--	--	--	136	4,612	7,189
Netherlands	(5)	11	12	(5)	14	17
Taiwan	--	--	--	51	2,097	3,236
Thailand	184	5,157	8,304	28	808	1,386
Total[4]	1,654	69,996	82,043	1,489	69,459	83,502

See footnotes at end of table.

TABLE 18—Continued
U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
St. Albans, VT, Canada	123	11,532	11,628	134	14,160	15,172
St. Louis, MO:						
China	(5)	6	10	(5)	9	17
Croatia	--	--	--	1	353	447
Netherlands	(5)	284	344	(5)	318	379
Total[4]	1	290	353	1	681	842
Tampa, FL:						
Australia	--	--	--	(5)	37	37
Brazil	315	12,745	16,846	377	20,729	25,368
China	(5)	2	6	297	11,178	20,911
Colombia	932	37,284	51,443	586	29,828	39,721
Denmark	152	10,801	15,398	177	12,669	19,442
Egypt	27	1,066	2,034	103	4,589	7,961
Greece	244	8,635	13,340	675	26,044	37,140
Hong Kong	--	--	--	77	1,858	1,911
Spain	16	493	756	39	1,672	2,139
Sweden	--	--	--	25	856	1,451
Taiwan	--	--	--	57	2,288	4,332
Thailand	--	--	--	163	7,260	12,732
Turkey	258	7,967	12,821	50	1,869	3,382
United Kingdom	--	--	--	(5)	49	73
Venezuela	652	25,004	35,194	852	41,566	58,773
Total[4]	2,595	103,997	147,839	3,478	162,493	235,374
U.S. Virgin Islands:						
Bangladesh	2	95	134	--	--	--
Barbados	--	--	--	2	111	147
Venezuela	79	3,063	4,274	63	2,684	3,721
Total[4]	81	3,158	4,408	65	2,795	3,868
Wilmington, NC:						
Colombia	134	5,017	6,891	270	13,543	17,328
United Arab Emirates	--	--	--	77	4,406	6,188
Venezuela	83	3,490	5,384	42	2,217	3,057
Total[4]	217	8,506	12,275	390	20,166	26,573
U.S. total[4]	27,026 [6]	1,130,098 [6]	1,558,154 [6]	33,261	1,547,198	2,210,475
Puerto Rico, San Juan, PR:						
Argentina	--	--	--	(5)	4	4
Belgium	3	226	456	1	39	95
China	25	523	1,231	--	--	--
Colombia	3	238	319	5	589	806
Costa Rica	(5)	38	41	(5)	3	4
Denmark	217	6,638	13,255	212	8,054	13,499
Dominican Republic	(5)	11	11	--	--	--
Honduras	--	--	--	15	578	588
Korea, Republic of	--	--	--	146	5,130	9,410
Mexico	10	1,032	1,412	12	1,189	1,733
Panama	(5)	15	17	--	--	--
Spain	4	222	226	(5)	4	4
Turkey	16	288	308	--	--	--
Total[4]	279	9,230	17,274	391	15,590	26,142
Grand total[4]	27,305	1,139,328	1,575,428	33,652	1,562,788	2,236,617

See footnotes at end of table.

TABLE 18—Continued

U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

[r]Revised. -- Zero.

[1]Includes all varieties of hydraulic cement and clicker.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Data may not add to totals shown because of independent rounding.

[5]Less than ½ unit.

[6]U.S. data may appear to be revised because Puerto Rico data are now shown separately.

Source: U.S. Census Bureau.

TABLE 19
U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Country	Quantity	Customs[1]	C.i.f.[2]	Quantity	Customs[1]	C.i.f.[2]
United States:						
Brazil	315	12,745	16,846	377	20,729	25,368
Bulgaria	231	12,478	15,069	303	16,921	20,325
Canada	4,744	247,821	264,773	4,301	242,961	260,188
China[3]	2,052 [4]	69,477 [4]	109,802 [4]	4,149	169,832	277,318
Colombia	1,874	71,964	100,591	1,599	78,333	103,969
Denmark	14 [4]	577 [4]	934 [4]	--	--	--
Egypt	291	13,359	20,841	350	15,843	27,309
Greece	2,007	64,313	104,168	2,755	103,952	171,448
Indonesia	630	22,490	41,804	865	29,481	58,713
Korea	1,729	48,014	80,415	2,443	84,944	141,159
Mexico	1,193	35,662	52,577	1,856	75,290	99,365
Norway	304	17,006	17,006	504	23,645	30,562
Peru	543	19,040	31,578	671	25,497	42,607
Philippines	301 [4]	8,360 [4]	13,293 [4]	312	9,728	18,220
Spain	253 [4]	6,614 [4]	10,223 [4]	52	1,882	3,033
Sweden	1,055	28,737	52,156	1,031	33,085	56,902
Taiwan	1,068	42,014	69,345	1,759	71,448	124,679
Thailand	2,726	86,160	140,787	2,864	113,556	188,138
Turkey	671 [4]	21,061 [4]	33,327 [4]	581	22,759	40,446
Venezuela	1,953	74,662	106,281	1,682	76,026	113,914
Other	13	1,185	1,390	98	3,533	3,663
Total[5]	23,968 [4]	903,741 [4]	1,283,206 [4]	28,551	1,219,444	1,807,328
Puerto Rico:						
China	25	523	1,231	--	--	--
Denmark	204	5,140	11,605	202	7,192	11,822
Korea	--	--	--	78	3,240	5,824
Spain	4	222	226	(6)	4	4
Turkey	16	288	308	--	--	--
Other	(6)	26	29	(6)	6	8
Total[5]	250	6,198	13,398	280	10,442	17,658
Grand total[5]	24,218	909,939	1,296,604	28,832	1,229,886	1,824,986

-- Zero.

[1]The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[3]China may be underrepresented and it is thought that all or some imports from Japan should be assigned to China.

[4]U.S. data may appear to be revised because Puerto Rico data are now shown separately.

[5]Data may not add to totals shown because of independent rounding.

[6]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 20

U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

Country	2004 Quantity	2004 Value Customs[1]	2004 Value C.i.f.[2, 3]	2005 Quantity	2005 Value Customs[1]	2005 Value C.i.f.[2, 3]
United States:						
Australia	--	--	--	(4)	37	37
Belgium	2 [5]	603 [5]	641 [5]	1	132	140
Brazil	(4)	6	9	37	2,126	2,151
Canada	308	35,247	36,802	329	39,057	40,454
Chile	(4)	29	35	--	--	--
China	--	--	--	17	1,672	3,408
Colombia	27 [5]	2,735 [5]	3,533 [5]	42	4,112	5,507
Denmark	142 [5]	11,091 [5]	15,839 [5]	227	16,316	24,978
Dominican Republic	--	--	--	77	4,406	6,188
Egypt	48	3,788	5,325	24	2,200	2,780
Germany	(4)	23	27	(4)	34	36
Greece	3	1,085	1,085	31	958	958
Israel	--	--	--	(4)	8	8
Japan	--	--	--	(4)	10	10
Malaysia	--	--	--	(4)	4	4
Mexico	186 [5]	22,417 [5]	23,569 [5]	251	29,302	32,353
Netherlands	1	173	181	7	592	815
Norway	61	6,382	8,636	17	1,653	2,012
Peru	1	96	143	2	196	294
Spain	155	12,863	18,157	73	6,903	11,231
Switzerland	--	--	--	74	4,598	4,618
Thailand	23	2,939	4,354	29	4,163	5,530
Turkey	84	5,532	9,401	94	6,114	10,219
United Arab Emirates	2	126	204	5	468	698
Venezuela	125	5,774	8,914	121	7,007	9,628
Total[6]	1,168 [5]	110,910 [5]	136,855 [5]	1,457	132,067	164,055
Puerto Rico:						
Belgium	3	226	456	1	39	95
Colombia	3	238	319	5	589	806
Denmark	13	1,498	1,650	10	862	1,677
Mexico	10	1,032	1,412	12	1,189	1,733
Total[6]	29	2,994	3,836	28	2,680	4,311
Grand total[6]	1,197	113,904	140,691	1,485	134,747	168,366

-- Zero.

[1]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight and other delivery charges to the first port of entry.

[3]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of data for gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[4]Less than ½ unit.

[5]U.S. data may appear to be revised because Puerto Rico data are now shown separately.

[6]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21

U.S. AND PUERTO RICO IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2004			2005		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Brazil	127	5,454	5,504	53	2,298	2,318
Canada	639	30,869	31,283	740	33,792	34,176
China	11	1,244	1,751	557	29,966	38,458
Colombia	220	9,237	11,982	203	12,536	14,282
Croatia	--	--	--	(4)	64	94
Egypt	--	--	--	184	12,379	14,627
France	77	13,614	15,953	72	15,250	18,106
Korea, Republic of	--	--	--	83	2,427	3,695
Peru	100	2,199	4,150	374	9,853	17,626
Spain	--	--	--	33	2,061	2,098
Sweden	--	--	--	15	542	599
Thailand	59	1,521	3,334	--	--	--
Venezuela	398	17,419	22,962	543	27,360	36,078
Total[5]	1,630 r	81,557	96,919	2,858	148,528	182,158
Puerto Rico:						
Honduras	--	--	--	15	578	588
Korea, Republic of	--	--	--	69	1,891	3,586
Total[5]	--	--	--	83	2,469	4,174
Grand total[5]	1,630 r	81,557	96,919	2,941	150,996	186,332

[r]Revised. -- Zero.

[1]For all types of hydraulic cement.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2001	2002	2003	2004	2005[e]
Afghanistan[e]	50	60	70	70	60
Albania	--	--	578	573	575 [3]
Algeria[e]	8,300	9,000	9,000	9,000	9,000
Angola	550 [r]	597 [r]	700 [r]	754 [r]	760
Argentina	5,545	3,911 [r]	5,217 [r]	6,254	7,595 [3]
Armenia	300	355	384	501 [r]	605 [3]
Australia[e]	7,500	7,550	8,000	8,000	9,000
Austria	3,802 [r]	3,918 [r]	3,886 [r]	3,976 [r]	4,736 [3]
Azerbaijan	523 [r]	848	1,013	1,428 [r]	1,538 [3]
Bahrain	89	67	129 [r]	153 [r]	191 [3]
Bangladesh[e]	5,005 [3, 4]	5,000	5,000	5,000	5,100
Barbados	250	298	325 [r]	322 [r]	320
Belarus	1,803	2,171	2,472	2,731 [r]	3,131 [3]
Belgium	7,157 [r]	6,980 [r]	6,550 [r]	6,715 [r]	7,000
Benin[e]	250	250	250	250	250
Bhutan[e]	160	160	160	170	170
Bolivia	983	1,010	1,138	1,276	1,440 [3]
Bosnia and Herzegovina	704	913	891	1,045	1,000
Brazil	38,927	38,027	34,010	34,413 [r]	36,673 [3]
Brunei	227	241	236 [r]	242 [r]	240
Bulgaria[e]	2,088 [3]	2,137 [3]	2,100	2,100	2,100
Burkina Faso[e]	50	30	30	30	30
Burma[5]	378	471 [r]	572	519 [r]	543 [3]
Cameroon	980 [r]	937 [r]	949 [r]	1,032 [r]	1,000
Canada	12,793 [r]	13,079 [r]	13,416 [r]	13,863 [r]	14,179 [3]
Chile	3,513	3,462	3,622	3,798	3,999 [3]
China	661,040	725,000	862,080	970,000 [r]	1,038,300 [p]
Colombia	6,830	6,064 [r]	7,337 [r]	7,822 [r]	9,959 [3]
Congo (Kinshasa)	201	265	331	403 [r]	410
Costa Rica[e]	1,200	1,200	1,600 [r]	1,900 [r]	2,000
Côte d'Ivoire[e]	650	650	650	650	650
Croatia	3,246	3,378	3,654	3,811	3,520 [3]
Cuba	1,324	1,327	1,346 [r]	1,366 [r]	1,370
Cyprus	1,369	1,438	1,637	1,689	1,805 [3]
Czech Republic	3,550	3,217	3,465	3,829 [r]	3,978 [3]
Denmark	2,047	2,028 [r]	1,953 [r]	2,150 [r]	2,200
Dominican Republic	2,746	3,050	2,783 [r]	2,636	2,640
Ecuador[e]	2,920 [3]	3,000	3,100	3,100	3,100
Egypt	25,700	28,155	26,639	28,763 [r]	29,000
El Salvador	1,174	1,318	1,390	1,256 [r]	1,400
Eritrea[e]	45	45	45	45	45
Estonia	405	466	506	615	650
Ethiopia[6]	900	900	1,130 [r]	1,316 [r]	1,568 [3]
Fiji[e]	95	95	100	100	100
Finland	1,325	1,198	1,493 [r]	1,691 [r]	1,321 [3]
France	19,839	19,437 [r]	19,655 [r]	20,962 [r]	21,277 [3]
French Guiana[e]	58 [3]	62 [3]	60 [r]	60 [r]	60
Gabon[e]	240 [r, 3]	257 [r, 3]	260 [r]	260 [r]	260
Georgia	335	347	345 [r]	425 [r]	450
Germany	32,118	31,009	32,749 [r]	31,854 [r]	30,629 [3]
Ghana[e]	1,900	1,900	1,900	1,900 [r]	1,900
Greece	14,819 [r]	14,282 [r]	14,638 [r]	15,039 [r]	15,000
Guadeloupe	265	230	230	230	230
Guatemala[e]	2,000	1,800	1,800 [r]	1,800 [r]	1,800

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2001	2002	2003	2004	2005[e]
Guinea[e]	315 [3]	360	360	360	360
Haiti[e]	204 [3]	290 [3]	300	300	300
Honduras[e]	1,321 [3]	1,360	1,400	1,800 [r]	2,000
Hong Kong	1,279	1,206	1,189 [r]	1,039 [r]	1,005 [3]
Hungary	3,452	3,510	3,573	3,349 [r]	3,500
Iceland	125	83 [r]	90 [r]	90 [r, e]	95
India[e]	105,000	115,000	123,000 [3]	130,000 [r]	145,000
Indonesia	31,300	34,640	35,500 [r]	36,000 [e]	37,000
Iran	26,640	28,600	30,460 [r]	32,198 [r]	32,650 [3]
Iraq[e]	6,000	6,834 [3]	1,901 [r, 3]	2,500 [r]	3,000
Ireland	3,450 [r]	3,320 [r]	3,830 [r]	4,000 [r]	4,000
Israel	4,700 [e]	4,584	4,632	4,494	4,700
Italy	39,804	41,416 [r]	43,433 [r]	46,045 [r]	46,404 [3]
Jamaica	596	614	608	808 [r]	845 [3]
Japan	76,550	71,828	68,766	67,376 [r]	69,629 [3]
Jordan	3,173	3,558	3,515	3,908	4,046 [3]
Kazakhstan	2,029	2,129	2,570	3,662 [r]	3,975 [3]
Kenya	1,319	1,463	1,658	1,789	2,123 [3]
Korea, North[e]	5,160	5,320	5,540	5,630 [r]	5,700
Korea, Republic of	52,046	55,514	59,194	54,330 [r]	51,391 [3]
Kuwait	921	1,584	1,863 [r]	2,635 [r]	2,700
Kyrgyzstan	469	533	757	800 [e]	900
Laos[e]	92	240	250	250	350
Latvia	W	260	295	284	280
Lebanon	2,890	2,852	3,000 [r, e]	3,100 [r, e]	3,300
Liberia	63	54	25 [r]	40 [r]	40
Libya[e]	3,000	3,300	3,500 [3]	3,600	3,600
Lithuania	529	606	597	753	832 [3]
Luxembourg	729 [r]	728 [r]	714 [r]	797 [r]	750
Macedonia	630	600 [e]	768	820	800
Madagascar[e]	52 [3]	35 [r]	80 [r]	130 [r]	180
Malawi	181	174	24 [r]	120 [r]	120
Malaysia	13,820	14,336	17,243	15,690 [r]	17,860 [3]
Martinique[e]	255 [3]	221 [3]	220 [r]	220 [r]	220
Mauritania[e]	200	200	200	300 [r, 3]	300
Mexico	32,110	33,372	33,593	34,992	36,000
Moldova	200	300	255 [r]	440 [r]	500
Mongolia	68	148	162	62 [r]	112 [3]
Morocco[e]	10,000	10,200	10,400	11,000 [r]	11,000
Mozambique	265	285	362	370 [r, e]	400
Nepal[e, 4]	285	290	295	285	290
Netherlands	3,380 [r]	3,085 [r]	2,450 [r]	2,380 [r]	2,400
New Caledonia	93	100	100 [e]	100 [e]	100
New Zealand[e]	1,080 [3]	1,090	1,100	1,110 [3]	1,100
Nicaragua	514	549	590	600 [r, e]	610
Niger[e]	47 [r]	54 [r]	55 [r]	55 [r]	55
Nigeria[e]	2,400	2,100	2,300	2,300	2,400
Norway	1,642 [r]	1,631 [r]	1,650 [r]	1,420 [r]	1,500
Oman[e]	1,370 [3]	1,700	2,100	2,500	2,500
Pakistan[e]	11,000	11,000	13,000	16,000	18,000
Panama[e]	820	770	800 [r]	820 [r]	840
Paraguay[e]	650 [3]	650	660	650 [r]	650
Peru	3,950	3,980	4,000	4,590	4,600
Philippines	8,653	12,614	13,060 [r]	13,050 [r]	13,000

See footnotes at end of table.

TABLE 22—Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2001	2002	2003	2004	2005[e]
Poland	11,918	10,948	11,653	12,566 r	12,646 3
Portugal	10,162 r	9,759 r	8,567 r	8,843 r	9,000
Qatar[e]	1,240	1,340	1,400	1,400	1,400
Réunion[e]	380	380	380	380	380
Romania	5,668	5,680	5,992	6,239 r	7,032 3
Russia	35,300	37,700	41,000	45,700 r	48,700 3
Rwanda	91	101	105	104	105
Saudi Arabia[e]	20,608 3	22,000	23,000	25,400 r	26,064 3
Senegal	1,539	1,653 r	1,694 r	1,700 r, e	1,700
Serbia and Montenegro	2,418	2,396	2,075	2,240	2,200
Sierra Leone	113	144	169 r	180 r	180
Singapore[e]	600	200	150 3	-- r	--
Slovakia	3,123	3,141	3,147	3,158	3,499 3
Slovenia	1,237 r	1,178 r	1,370 r	1,186 r	1,200
South Africa, sales[7]	8,036	8,525	8,883 r	12,348	13,000
Spain, including Canary Islands	40,512	42,417	44,747 r	46,593 r	50,347 3
Sri Lanka	1,108	1,018	1,164	1,150 r, e	1,180
Sudan	190	205	272	307 r	310
Suriname[e]	65 3	65	65	65	65
Sweden	2,645 r	2,642 r	2,476 r	2,588 r	2,600
Switzerland	3,950 r	3,771	3,613 r	3,851 r	4,022 3
Syria	5,005 r	4,679 r	4,824 r	4,757 r	4,800
Taiwan	18,128	19,363	18,474	19,050	19,891 3
Tajikistan	70	100	166 r	194 r	253 3
Tanzania	900	1,026	1,186	1,281 r	1,375 3
Thailand	27,913	31,679	32,530	35,626	37,872 3
Togo[e]	800	800	800	800	800
Trinidad and Tobago	697	744	766	768 r	770
Tunisia	5,721	6,022	6,038	6,358	6,500
Turkmenistan[e]	450	450	450	450	450
Turkey	30,125	32,577	35,077	38,796 r	42,787 3
Uganda	431	506	507	559 r	650
Ukraine	5,800	7,142	8,900	10,600	12,183 3
United Arab Emirates[e]	6,100	7,000	8,000	8,000	8,000
United Kingdom	11,854	11,265 r	11,650 r	11,730 r	11,470 3
United States, including Puerto Rico[8]	90,450 9	91,266	94,329	99,015	100,903 3
Uruguay[e]	1,015 3	1,000	1,050	1,050	1,050
Uzbekistan[e]	4,000	4,000	4,000	4,800 r	5,068 3
Venezuela[e]	8,700	7,000	7,700	9,000	10,000
Vietnam	16,073	21,121	24,127 r	25,320	29,000 3
Yemen	1,493 r	1,561 r	1,541 r	1,546	1,550
Zambia[e]	215 3	230 3	350 r	480 e	435
Zimbabwe[e]	800	600	400	400	400
Total	1,740,000 r	1,850,000	2,030,000 r	2,190,000 r	2,310,000

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

[e]Estimated. [p]Preliminary. [r]Revised. W Withheld to avoid disclosing company proprietary data; not included in "Total." -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are believed to be accurate to no more than three significant digits.

[2]Table includes data available through October 6, 2006. Data may include clinker exports for some countries.

[3]Reported figure.

[4]Data for year ending June 30 of that stated.

[5]Data are for fiscal year ending March 31 of the following year.

[6]July 7 of the year listed.

[7]Data are revised to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted to: 2001—1,129; 2002—1,099; 2003—1,190; 2004—1,436; and 2005—1,440 (estimated).

[8]Portland and masonry cements only.

[9]Tonnage has been rounded to four significant digits.

science for a changing world

2006 Minerals Yearbook

CEMENT

U.S. Department of the Interior
U.S. Geological Survey

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CEMENT

By Hendrik G. van Oss

Domestic survey data and tables were prepared by Richard H. Kraft, statistical assistant, and the world production table was prepared by Linder Roberts, international data coordinator.

Production of portland and masonry cement in the United States in 2006 was 98.2 million metric tons (Mt), second only to the record level in 2005. Cement sales totaled 127 Mt. Imports of cement reached a new record of 32.1 Mt. Cement prices increased significantly (tables 1, 11–12) in most districts and, as a result, the overall value of cement sales to domestic final customers increased to $12.9 billion. Based on typical portland cement mixing ratios in concrete, the delivered value of concrete (excluding mortar) in the United States in 2006 was estimated to be at least $54 billion.

Indications of percentage or other changes expressed in this report compare activity in 2006 with that of 2005 unless specified otherwise. Except where otherwise indicated, activity levels in this report exclude those in Puerto Rico. And except for some trade data, the cements covered in this report are limited to those hydraulic varieties broadly classified as portland and/or masonry cement; these are the binding agents in concrete and most mortars. Varieties included as portland cement are listed in table 15 and include blended cements[1]. Masonry cements include true masonry cements, portland-lime cements, and plastic cements; currently, the category does not include natural cement for mortar, minor production of which resumed in 2004 after a hiatus of 34 years. Certain other hydraulic cements (notably aluminous cement) are included in the trade data in tables 16–18 and 21 (clinker) and within the world hydraulic cement production data in table 22. Excluded are pure (unblended) supplementary cementitious materials (SCM) such as fly ash, other pozzolans, and ground granulated blast furnace slag (GGBFS).

The bulk of this report is based on data compiled from U.S. Geological Survey (USGS) annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are independent of U.S. cement manufacturers. For 2006, forms were received from 151 of 156 facilities canvassed, a response rate of 97%. The respondents included all but one of the production sites and accounted for about 99% of total cement sales. For 2005, forms were received from 146 of 150 facilities canvassed, a response rate of 97%. For both years, however, telephone inquiries to the nonrespondents obtained their cement and clinker production data, and thus the production data represent 100% response. The USGS canvass (and this report's tables) do not include the sales of several importers that have yet to participate in the surveys. To the degree that they are selling independently of the participating companies, the missing importers' sales volumes for 2005-06 are estimated to be perhaps as much as 1% of the total portland cement sales tonnages shown in this report. Background information on cement and its manufacture, as well as on the USGS cement canvasses, is given in van Oss (2005).

[1]Sales data for blended cements (also called composite cements) listed separately from portland cement are available within the monthly cement reports of the USGS Mineral Industry Surveys series, starting with January 1998.

Legislation and Government Programs

Since 1990, the dominant trade issue has been the existence of antidumping remedies against Japan and Mexico. These had been contested in international courts. On January 6, the U.S. International Trade Commission (ITC) announced that it would conduct a 5-year sunset review on the antidumping duties against Mexico and an expedited review of the duties against Japan (U.S. International Trade Commission, 2006). Then, on January 19, it was announced that an agreement had been reached with Mexico resolving the trade dispute (U.S. Department of Commerce, 2006). Under the new agreement, the substantial antidumping tariffs on imported gray portland cement from Mexico were to be reduced to $3 per metric ton and import volumes would be limited to an annual quota of 3 Mt; an additional quota of 0.2 Mt would be allowed in the case of need resulting from a natural disaster. In addition, the Mexican companies affected would receive a return of duties paid that had been held in escrow; for example, CEMEX S.A. de C.V. (CEMEX) would receive about $100 million (CEMEX S.A. de C.V., 2006b). The agreement, which went into effect on April 3, would be for 3 years, after which, providing that the quota had not been exceeded, the tariffs and import quota would be eliminated entirely.

Environmental Issues

Most emissions associated with the cement industry are those from the manufacture of the intermediate product called clinker. By far, the largest emissions are of carbon dioxide (CO_2) derived from the calcination of carbonate raw materials and the combustion of fuels, but the industry is also a significant source of emissions of nitrogen oxides (NOx) and sulfur oxides (SOx). Overall, generation of CO_2 by the U.S. cement industry in 2006 amounted to about 80 to 83 Mt, or about 0.90 to 0.94 metric ton (t) CO_2 per ton of clinker; the high end of the range reflects fuel combustion emissions derived using "standard" heat values for the fuels consumed (table 7) and the low end uses the heat values actually reported by the individual plants. The fuel combustion emissions exclude those associated with generation of the electricity purchased by the cement industry. Both ends of the range include a standard emissions from calcination of 0.51 ton CO_2 per ton of clinker as detailed in van Oss and Padovani (2003, p. 123–126) and by the Intergovernmental Panel on Climate Change (2006). This emissions factor for calcination assumes that all the calcium oxide (CaO) in the clinker is derived from a carbonate source. If reasonable assumptions are made regarding the average CaO content of slags, ashes, and similar alternative raw materials burned in the kiln (table 6), the emissions factor for 2006 is reduced by about 2.5% to 0.50 ton CO_2 per ton of clinker, and the total emissions of CO_2 are thus reduced by about 1 Mt from the range noted above. The percentage savings can be significantly larger at the individual plants that actually burn these alternative raw materials. The fuel combustion component of emissions (0.39 to 0.43 t CO_2 per ton of clinker for the industry overall) represents a 9% to10% unit reduction from the range in 2000 calculated by van Oss and Padovani (2003, p. 99); this reduction appears to reflect technological upgrades at various plants. Strategies to reduce unit (per ton of product) emissions include encouraging the use of SCM in finished cement (blended cements and cements classified on a performance basis rather than a compositional basis) and in concrete to reduce the clinker content of these products, and on allowing addition of “inert” fillers to boost cement output without simultaneously boosting clinker output. In regard to the latter, the ASTM International standard for portland cement (ASTM C–150–05) now allows for the addition of up to 5% ground limestone in the finish mill; widespread adoption of limestone addition was not expected unless the States’ departments of transportation incorporate the practice into the otherwise similar American Association of State Highway and Transportation Officials (AASHTO) standard M85. Strategies to reduce plant emissions mainly involve improving energy efficiencies, such as through plant upgrades, switching to lower carbon fuels, and incorporating alternative raw materials into the kiln feed that would reduce the need to burn so much limestone or other carbonate raw materials.

The cement industry is subject to scrutiny concerning storage of cement kiln dust (CKD) and emissions of hexavalent chromium, hydrocarbons, and mercury. On December 20, the U.S. Environmental Protection Agency (EPA) issued a final rule governing emissions limits for hydrocarbons and mercury by new cement kilns, and stipulated restrictions on the burning of fly ash from boilers equipped with mercury scrubbing systems (such as carbon injection) unless the cement plant could demonstrate no net mercury emissions increase from the use of the ash (U.S. Environmental Protection Agency, 2006).

Production

Portland cement production in 2006 was 92.8 Mt, down slightly from the 2005 record (table 3). Data were not collected on the production of individual varieties of portland cement, but the breakout would approximate the ratios evident in the breakout of portland cement sales, by type (table 15). Ideally, these ratios should be adjusted for cement imports, which are dominantly of Types I, II, and V. Yearend stockpiles increased significantly in most districts, but the data are not necessarily indicative of fluctuations during the year.

Ranking of companies is made difficult because of the existence of some common parent companies and joint ventures. With common parents combined under the larger subsidiary’s name and with joint ventures apportioned, the 10 leading companies at yearend 2006 were, in descending order of portland cement production, Holcim (US) Inc.; CEMEX, Inc.; Lafarge North America, Inc.; Buzzi Unicem USA, Inc. (including Alamo Cement Co.); Lehigh Cement Co.; Ash Grove Cement Co.; Essroc Cement Corp.; Texas Industries Inc. (TXI); California Portland Cement Co.; and St. Marys Cement, Inc. The U.S. industry continued to be heavily consolidated: the leading 5 cement companies, combined, had about 56% of total U.S. portland cement production, and the leading 10 companies continued to account for about 80% of total production. Of these named companies, all except Ash Grove and TXI were foreign owned as of yearend.

Despite a significant downturn in residential construction during the year, masonry cement production fell only slightly to 5.4 Mt (table 4); yearend stocks of masonry cement rose by nearly 30%. As in past years, the reported production understates true output, primarily because a large, but unknown, tonnage of masonry cement (especially portland-lime cement) is made at job sites by combining purchased portland cement and lime.

Clinker production in 2006 reached a new record of 88.6 Mt (table 5), but was a combination of a very strong first 4 months and a mostly lackluster rest of the year. The early increases were in response to strong market conditions and the effects of new kilns and/or other plant upgrades that had been completed in 2005 and early 2006. In the second half of the year, clinker output exceeded the amount needed for cement production and, along with higher levels of clinker imports, yielded a large increase in yearend clinker stockpiles.[2]

Apparent annual clinker production capacity fell by about 1% overall to 101 Mt. Apparent annual capacity is calculated based on plant-reported daily capacities and a reported split-out of downtime between that for scheduled routine maintenance (used in the calculation) and all other downtime. These components are not always reported correctly. Most plants have total downtimes in excess of routine maintenance, thus an overall capacity utilization of 85% or higher is considered to indicate a plant (or district) operating more or less at full practicable capacity. Partial year operation of new or old kilns yields low capacity utilization ratios because, whereas the annual capacities for these kilns are fully counted, they will have relatively low comparative clinker outputs. A large capacity decline in 2006 in eastern Pennsylvania was because of the permanent closure of one plant’s kilns in 2005. A large capacity decline in South Carolina reflected the replacement in 2005 of wet kilns with a single dry kiln (both types’ capacities were counted in 2005). Clinker production in South Carolina rose significantly, however, owing to a full year’s operation on the new dry kiln. Large capacity increases in Alabama and Illinois reflected upgrades at several plants. Overall, the average annual clinker capacity in 2006 remained about 0.96 Mt per plant, but rose slightly to 0.58 Mt per kiln.

Nonfuel raw materials consumed to make clinker and cement are listed in table 6. The 2006 ratios among clinker raw materials (as contributors of major oxides) appear to be broadly

[2]Yearend stockpiles of clinker are an artifact of data collection convenience rather than a reflection of full-year market conditions or production capacity. Generally, if the clinker is not required for immediate cement production, a plant will try to build up its stocks of clinker prior to scheduled extended kiln shutdowns so as to provide continuity of clinker feed to the finish (cement) mill. These shutdowns can be at any time of the year.

similar to those in 2005. Direct comparison of ratios among raw materials should be done with caution; tonnage and tonnage ratio changes could reflect widespread raw material substitution, activities at just a few plants, or even errors in reporting. Thus, for example, the large increase noted for cement rock in 2006 may reflect erroneous differentiation between this material and limestone by some respondents. The increase in consumption of limestone for finished cement appears to be in excess of that needed for masonry cement and may thus reflect increased incorporation of a ground limestone addition (of up to 5%) to Type-I portland cement as allowed for in the 2005 revision of the ASTM C–150 portland cement standard. The decline in consumption of CKD is likely owing to incomplete reporting. The 15% decrease in consumption of fly ash for cement appears proportional to the decline in sales of blended cements incorporating fly ash (table 15). In contrast, the 30% increase in granulated slag consumption for cement is almost double the relative increase in sales of blended cements incorporating slag.

The tonnages of other blast furnace slag and steel slag consumed to make clinker are broadly similar to sales of slag to make clinker collected on the USGS canvass of ferrous slag processors (air-cooled blast furnace slag sales of 0.37 Mt in 2005 and 0.11 Mt in 2006; steel slag sales of 0.60 Mt in both years) (van Oss, 2007), at least if the two slag types are summed. The differences between the two canvasses may simply reflect a difference between purchases and consumption by the cement industry in a given year, but likely also reflect respondent errors in differentiating the two slag types on the cement canvass. A comparison cannot be made for granulated slag because most of the material sold by slag processors (for cementitious use) went directly to the concrete industry rather than to cement companies and so is invisible to the USGS canvasses of the cement industry.

For fly ash and bottom ash, comparison can be made between the data in table 6 and those published for sales (for cement or as raw feed for clinker) of coal combustion products published by the American Coal Ash Association (ACAA). For fly ash, table 6 shows consumption of 2.95 Mt of fly ash for clinker and 0.13 Mt for cement; the corresponding ACAA number is about 3.8 Mt (American Coal Ash Association, 2007). For bottom ash, consumption was about 1.2 Mt for clinker only (table 6), and the ACAA reported 0.84 Mt of bottom ash sales. The differences in the two data sets probably reflects a difference between consumption (table 6)—which is from a mix of ongoing purchases and drawdown of stockpiles—and sales (ACAA), and the fact that the ACAA data are extrapolated. The ACAA also reported minor sales (about 16,000 t) of boiler slag, but the host category in table 6 (“other slag”) contains a number of slag types (mostly from various smelters) and the identity of the slags is poorly constrained. Consumption of gypsum by the cement industry was 5.44 Mt in 2006 (table 6). Of this amount, at least 0.66 Mt was synthetic gypsum (the differentiation from natural gypsum is not required on the USGS canvass). This is much higher than the 0.24 Mt flue gas desulfurization (FGD) gypsum reported by the ACAA and reflects the fact that the USGS data are a combination of purchased FGD gypsum from the coal-fired powerplants (perhaps similar to the ACAA data) and gypsum recovered from the cement plant’s own SOx scrubbers.

Fuels consumed by the cement industry are listed in table 7. As with the nonfuel raw materials, data shifts can reflect activities at just a few plants. In terms of overall mass of fuels (in total) and the ratios thereof to clinker production, changes in 2006 were insignificant, and most of the relative tonnage changes were minor. Although not listed in table 7, overall heat consumption in 2006 was about 4.5 billion joules (GJ)[3] per metric ton of clinker, about 2% higher than in 2005. Wet plants in 2006 averaged about 6.5 GJ per ton of clinker, about 3% lower than the ratio in 2005, and dry kiln plants averaged about 4.1 GJ per ton of clinker, unchanged from the ratio in 2005. Combination plants (operating both wet and dry kilns) averaged 4.9 GJ per ton in 2006, also unchanged. Overall, 2006 continued a multiyear trend of generally decreasing unit heat or fuel consumption by the industry;[4] this reflected a number of plant conversions from wet to dry technology and a variety of other energy-saving measures. As noted earlier, the fuel reductions have also led to a reduction in unit fuel combustion emissions of CO_2.

Unit electricity consumption increased for all plant types in 2006 (table 8) for reasons that could be related to maintenance issues or upgrades (total downtime, not just that for routine maintenance). Modern dry process plants have higher average electricity consumption per ton of cement product than wet process plants because of a complex array of blowers and fans associated with the modern kiln lines. For the same technology and overall plant capacity, a plant that operates multiple kilns will generally have higher unit electricity consumption than a plant operating a single kiln. The wet-dry difference in 2006 is exceptionally small, mostly reflecting an increase in the unit consumption by the remaining wet plants.

In February, Lafarge S.A. (France) announced an offer to purchase the 46.8% of the shares in Lafarge North America that it did not already own. After the initial offer was rejected, a higher price was offered and accepted; the purchase was completed in May (Cement Americas, 2006d; Lafarge North America, 2006). In another consolidation move, in October, CEMEX S.A. de C.V announced a bid to purchase the worldwide assets of the Australian company Rinker Group Ltd., including its U.S. subsidiary, Rinker Materials Corp. Although the offer was rejected as being too low, CEMEX increased the offer early in 2007 (Cement Americas, 2006a).

There were no plant openings during the year. Although not reported in the 2005 edition of this report, CEMEX restarted the grinding of clinker on a minor basis at its PCG plant in Houston, TX, in mid-2005, and operated it as a clinker grinding plant throughout 2006. The facility is the former Gulf Coast Portland Cement Co. plant that ceased grinding clinker in 1995, at which time it switched to the grinding of petroleum coke. In the only cement plant “closure” in 2006, St. Marys Cement’s Badger grinding plant in Milwaukee, WI, was switched over to the grinding of granulated blast furnace slag early in the year.

[3]The USGS canvass solicits information on heat consumption in terms of millions of British thermal units (MBtu), where 1 MBtu=1.055056 GJ, and data are based on high or gross heat values of fuels rather than low or net heats.

[4]For example, the overall unit heat consumption for 2006 was 10% lower than that in 2000 reported by van Oss and Padovani (2002; table 4).

In February, CEMEX announced that it would build a second kiln at its Balcones plant in New Braunfels, TX. The new line would essentially double the plant's existing capacity to about 2 million metric tons per year (Mt/yr) and was expected to be completed in 2008 (CEMEX S.A. de C.V., 2006a).

Near yearend, Illinois Cement Co. (a subsidiary of Eagle Materials, Inc.) completed the precalciner addition to the kiln at its LaSalle, IL, plant, thereby increasing its clinker capacity to about 0.9 Mt/yr. This was the first completed phase of a multiyear project to expand Eagle Materials' overall cement production capacity. In January, Eagle Materials also announced plans to double the capacity of its subsidiary Nevada Cement plant at Fernley, NV, to about 1 Mt/yr; the upgrade would replace the existing two long dry kilns with a single, preheater-precalciner dry kiln. The company also announced a similar upgrade (to about 1 Mt/yr) of its Mountain Cement Co. plant in Laramie, WY, also by replacing a pair of long dry kilns. Both of the upgrades were anticipated to be completed in late 2008 (Eagle Materials, Inc., 2006).

Two new plants were under construction in Florida. In February, an environmental permit was received by Sumter Cement Co., LLC for the construction of a 1.56 Mt/yr (clinker) plant at Center Hill. The project was originally announced as an expansion project of Suwannee American Cement LLC, which operates a plant at Branford, but was reorganized under Sumter Cement name. Sumter Cement, like Suwannee American, is a 50-50 joint venture between Brazilian company Votorantim Cementos and Florida-based Anderson Columbia Co.; Votorantim will be the plant operator. The new plant was expected to become operational in 2009. Suwannee American had permission to add a second kiln line (1 Mt/yr) at its Branford plant (Bell, 2006; Florida Department of Environmental Protection, 2006b; Suwannee American Cement LLC, 2008). An environmental permit was also issued for a new 1.04 Mt/yr (clinker) cement plant at Sumterville, FL, organized under the name American Cement Co. (Florida Department of Environmental Protection, 2006a, p.1). American Cement was a joint-venture of Oldcastle Materials and New Jersey-based Trap Rock Industries, Inc.

Apart from Suwannee American, two existing plants in Florida received permission to expand capacity. In January 2006, Titan America announced that it had recently received environmental approval for a further expansion of clinker capacity of its Pennsuco plant at Medley, to about 2.2 Mt/yr (Titan America, 2006). The company had already replaced its old wet kilns with a new 1.6-Mt/yr dry kiln in 2004. Florida Rock Industries was given approval for a second kiln line at its Newberry, FL, cement plant. The new line was to have a capacity of about 1 Mt/yr of clinker (Bell, 2006).

National Cement Co. of Alabama added a third finish mill at its Ragland, AL, plant; the new 1.2-Mt/yr mill came online at yearend (International Cement Review, 2006a). Work was underway at GCC-Rio Grande, Inc.'s new 2.6-Mt/yr cement plant at Pueblo, CO; the plant was expected to become operational in late 2007 (Cement Americas, 2006b; International Cement Review, 2006a). Essroc Cement Corp. began construction of a new precalciner kiln line at its Martinsburg, WV, plant. The new 1.5-Mt/yr line was intended to replace the three existing wet kilns at Martinsburg, as well as, ultimately, the two existing wet kilns at the nearby Frederick, MD, plant (Concrete Monthly, 2006). In January, Keystone Cement Co. announced a modernization program for its Bath, PA, plant in which the facility's capacity would be nearly doubled by replacing the two existing wet kilns with a single precalciner dry kiln of about 1 Mt/yr capacity. The new kiln line was expected to come online in 2009 (Keystone Cement Co., 2006).

In August, Lafarge North America announced plans to expand its Harleyville, SC, plant through the addition of a second 1.3-Mt/yr kiln line. The project was anticipated to be completed by yearend 2009 (Cement Americas, 2006c).

Consumption

The measure of consumption preferred by the cement industry for market analysis is the monthly sales tonnages (strictly, cement shipments to final domestic customers) by State, data for which are provided by the USGS monthly surveys and which have been summarized in table 9. Although the national totals in table 9 are close to those of tables 11, 12, and 14, the individual State totals in table 9 are very different. Table 9 reveals the sales destinations and so directly provides the location and amounts of consumption. In contrast, the regional totals in tables 11, 12, and 14 simply pertain to the locations of the reporting entities (chiefly the production sites), not the locations of consumption. It is very common for shipments to cross State lines.

Domestic portland cement consumption in 2006 was 122 Mt, only slightly lower than the 2005 record. This virtual tie with 2005 belied very different month-by-month consumption levels for the 2 years. In 2005, consumption was at record levels in nearly every month, supported by (then) record imports. This trend continued strongly through the first quarter of 2006; total portland cement sales for the quarter were up almost 15%, and imports were up 40%. Then, except for May (up slightly), sales began a steady monthly decline relative to the record 2005 levels; still, the year-to-date sales for 2006 were ahead of 2005 through November. Relative to 2005, imports in 2006 were higher in every month through July (year-to-date up 21%), and although they declined in every month thereafter, imports for the year overall were a new record. The reported import origins of monthly sales lagged actual cement imports in most months in 2006; for the year the lag appears to be about 1.3 Mt, which suggests a major import component to the buildup of cement stockpiles (tables 1, 9).

Although it is difficult to accurately estimate the overall volume of sales by importers not participating in the USGS canvasses, much less their sales into specific States, it is possible to do so for Texas because of the existence of a special tax on cement sales and associated public data on the sales tonnages (by company) through the Texas Comptroller of Public Accounts. On the assumption that certain importers identified on the Texas tax reports only sell to final customers, it may be estimated that the USGS sales data for Texas overall (table 9) understate the consumption in Texas by approximately 0.27 Mt in 2006. For markets serviced by the Philadelphia, PA, customs district, USGS data understate sales by about 0.46 Mt (table 18).

In recent years, it has been common for California, Florida, and Texas, as a group, to be general indicators of the trend of national consumption, but this was not the case in 2006 owing to a 6.6% decline in consumption in California. Only 9 States (none among the leading 10) showed consumption increases of 10% or more for the year. The lackluster performance in many States appears to reflect a decline in housing construction, as discussed below. The strong increases seen in Louisiana and in Mississippi were largely owing to reconstruction work in the aftermath of Hurricane Katrina in 2005. Much of the strong increase in New England is merely an artifact of more complete reporting during the year (certain import sales data became available for 2006 but not for 2005).

As a key construction material, cement consumption levels within a given category of construction will broadly reflect levels of construction spending, although significant time lags may exist between the onset or cutoff of spending and changes in the consumption of cement. Construction spending data are available in current dollars from the U.S. Census Bureau, but the Portland Cement Association has converted the data to constant 2000 dollars to provide the basis for a more meaningful analysis of spending trends. In terms of constant dollars, overall construction spending in 2006 was stagnant at $879 billion (Portland Cement Association, 2008), which is in accord with the nearly identical level of cement sales tonnages 2005–06 noted earlier. The residential construction sector continued to be dominant at $467 billion, but unlike its 6.4% increase in 2005, the residential spending level in 2006 was a 4.0% decline. The residential decline in 2006 was led by a nearly 8% decline (to $303 billion) in single-family housing construction; multifamily construction spending actually increased by nearly 8% to $39 billion. The nonresidential construction sector was up by 7.7% overall to $168 billion, and much of this increase could in part be credited to lag effects of the very strong housing sector in 2005 and early 2006. Public sector construction was up by 2.4% to about $195 billion, led by a 4.7% increase (to $54 billion) in spending for highways and streets. Construction for sewage treatment and waste disposal rose by about 9% to nearly $18 billion; this also could be a lag effect of the construction boom in 2005 to early 2006.

Concrete competes with other construction materials. Overall, the effect of competing materials can be crudely evaluated through use of a calculated "penetration rate" or intensity factor for cement, here defined the tonnage of cement consumed per $1 million in construction spending. Changes in penetration rates can reflect cost or performance advantages of concrete compared to competing construction materials, the specific sizes and types of construction projects, shifts in spending between new construction and repairs, lag times between construction spending and concrete consumption, and total cement consumption underreported because of partial substitution in concrete mixes of portland cement by other cementitious materials. Using the apparent consumption data in table 1, the overall construction spending data show a generally increasing trend in penetration rates for 2002–06; $1 million in construction spending bought, in chronological order, about 135 t of cement in 2002; 138 t in 2003; 143 t in 2004; 146 t in 2005; and 145 t in 2006.

Sales to final customers of different types of portland cement are listed in table 15. As in past years, sales were dominated by Types I and II cements and sulfate-resistant varieties of cement (Type V and Type II/V hybrids reported as Type V). Sales of oil-well cements rose by just 2.8% to about 1.5 Mt, well below the 2.1 Mt sales of cement to "oil well" drilling customers (up by 15.1%) in table 14. Although the respective increases are both in accord with higher levels of drilling activity in 2006, the relatively low sales of specialized oil-well cements indicate a high proportion of relatively shallow holes (these can make use of less specialized cements) being drilled, and this is in accord with the fact that most of the drilling activity in 2006 was for natural gas exploration.

Following on a nearly 70% increase in 2005, blended cement sales rose a further 7.6% in 2006 to about 3.4 Mt. Blends incorporating natural pozzolans were up fivefold, but this reporting category may include some mischaracterized material. Blends incorporating GGBFS were up by nearly 14%, which is in accord with slag sales data collected through the USGS ferrous slags canvass. Sales of blended cement incorporating fly ash fell by 16%, and could reflect issues of higher carbon content in some ashes as a result of more powerplants switching to low-NOx burners (high carbon ashes are not suitable for use in blended cements without prior carbon removal, which adds to their cost). However, the apparent decline could also reflect some ash-content blended cements being characterized as "other blended cement" as a result of their being part of three component mixes (for example, blends with both fly ash and CKD). In any case, the continued increase in sales of blended cements overall would support the notion that the large 2005 jump was not an aberration. If sustained, higher blended cement sales will indicate not only a greater degree of acceptance of the environmental and performance benefits of incorporating SCM in concrete, but an increasing willingness of concrete companies to incorporate the SCM by purchasing finished blended cements rather than doing the blending themselves from purchased components.

Masonry cement sales fell slightly to 5.4 Mt according to the monthly data (table 9) or to 5.3 Mt according to the annual canvass (table 12). In either case, the relative decline is small compared with the decline in new single-family housing construction (12.6% on the average monthly number of units), and this may reflect the increases in spending on multifamily housing and on repairs and improvements. The decline in masonry sales is not in accord with a 1.3% increase in reported sales (of portland cement) to brick manufacturers (table 14) and the 4.7% increase in the sales of block cements (table 15), but instead appears to be more reflective of a decline in clay brick sales.

Data on the mill net values for shipments to final customers by plants and import terminals (terminal nets) are listed in tables 11–13. The average mill net value of portland cement in 2006 was about $99.50 per metric ton, up by about $10.50 per ton. Further, it represents a nearly 28% unit value ("price") increase in just 2 years. The increases were largely in response to rapidly escalating energy costs (major cost components of both of cement manufacture and transport), and should be viewed in the context of relatively stagnant cement prices in 2000–03 and, despite widespread cement shortages, a relatively small price increase in 2004. Masonry cement prices also rose in 2006, but more modestly; analysis of the increase is difficult because of a high proportion of masonry cement sales being in bagged or packaged form.

Foreign Trade

Trade data from the U.S. Census Bureau are listed in tables 16–21. Exports of hydraulic cement and clinker fell by about 6% to about 0.7 Mt (table 16), after excluding from the 2006 official trade data an apparent excess (0.74 Mt) of aluminous cement exports to Mexico from Laredo, TX[5]. Exports overall continued to be very small compared with imports, and Canada continued to be the dominant recipient of the exports.

Overall, imports of cement and clinker in 2006 increased by 6.9% to a record 35.6 Mt (table 17). The cement component of the imports (table 1, and table 17 minus table 21) increased by 5.7% to a record 32.1 Mt. Even more persistent than cement consumption, imports were up strongly for about the first half of 2006, and recorded increases in almost all months through July (up by 21.4% year-to-date). Thereafter, monthly imports fell steadily, although not enough to erase the net gain for the year, but it was clear that the brunt of the cement sales declines was being accommodated by reduced imports. This, in turn, reflected the fact that since the early 1990s, the majority of cement imports have been controlled by domestic cement producers, and they import only as needed to make up for production shortfalls.

The apparent imports of clinker (table 21) increased by nearly 20% to 3.4 Mt. The data are incomplete, however, with regards to overland imports from Canada; the tonnages listed are insufficient to feed the grinding plants in Michigan, Washington, and Wisconsin (all of which source their clinker from Canada). The unreported Canadian clinker appears to be mostly coming in by truck, at a value of less than $2,000 (customs value) per truckload; such shipments are classified as “informal entries” and data on them are not routinely transmitted by the U.S. Customs Service to the U.S. Census Bureau for recordation into the official trade data (reproduced in tables 17-21). This recordation problem presumably does not exist for imports by rail or by barge or ship because these shipments are larger. Clinker imports from Canada have been estimated to be higher than those reported in tables 1 and 21 by about 0.5 Mt in 2005 and 0.7 Mt in 2006.

The 10 busiest customs districts of entry in 2006 were, in descending order, New Orleans, LA; Tampa, FL; Los Angeles, CA; Houston-Galveston, TX; San Francisco, CA; Miami, FL; Seattle, WA; Detroit, MI; New York, NY; and Nogales, AZ; the ranking was identical for 2005 except for the 10th position, which was Charleston, SC (table 18). These customs districts together accounted for about 70% of total imports in both years.

The United States imported cement and (or) clinker from 37 countries in 2006, the leading 10 of which were, in descending order, China, Canada, Thailand, the Republic of Korea, Mexico, Taiwan, Greece, Colombia, Venezuela, and Sweden. Together, these major sources accounted for about 90% of the total inflows. Imports from China were up by 123% to 10.5 Mt—the same percentage increase as that in 2005—and China easily displaced Canada from the first place position Canada had held in 2005 and in almost all recent past years. The tonnage from Canada fell by 6.4% to 5.1 Mt, not counting informal entries of clinker, as discussed earlier. Imports from Taiwan and Thailand showed large percentage increases in 2006, whereas large percentage declines were seen for Greece, Sweden, and, especially, Venezuela. Notwithstanding a drastic reduction in antidumping tariffs, imports from Mexico rose only modestly during the year and remained well below the agreed-upon quota of 3 Mt.

As in past years, gray portland cement was the dominant cement variety imported; in 2006, imports of this material totaled 30.7 Mt (table 19), or 86% of total cement and clinker imports. White cement imports were 1.3 Mt in 2006, down by 10.6% (table 20). As in past years, the 2006 data on white cement imports appears to include some material (for example, from the Dominican Republic and at least some of the material from Venezuela) that, based on low unit values, is likely either gray portland cement and/or gray clinker for which a white cement tariff code was recorded by the importers. Even excluding these questionable tonnages (relatively small in 2006), the imports of white cement appear to be enough in themselves to fully supply the sales of white portland cement (table 15). However, given that the three U.S. white cement plants all produced at more or less full capacity during the year and recorded no unduly large shifts in cement stockpiles, there would appear to be an overall excess of at least 0.2 Mt of white cement relative to the sales, even accounting for white cement exports (just 24,104 t in 2006) and white material incorporated within the overall sales of masonry cement (tables 9, 12, and 16). It also is possible that the white cement component of total cement sales is being underreported by some respondents to the USGS annual canvass.

Owing to fuel cost increases and some shortages of ships, there have been widespread, largely informal, reports in recent years of substantially higher fuel-related shipping costs for imports as well as some steep rises in the chartering rates for cement ships and other bulk carriers. The difference between the unit customs value and that on a cost, insurance, freight (c.i.f.) basis is a proxy for the shipping cost (tables 17–21). For imported gray portland cement (table 19), this difference was $20.61 per metric ton, and becomes $23.84 per ton if Canada and Mexico are removed (on the assumption that their data are anomalous because of a large majority percentage of overland imports); this is essentially unchanged from the difference in 2005 and only about 5% higher than that in 2004. If transportation costs have indeed gone up significantly, as would seem logical, then either a large majority of the imports are on a long-term contract basis (shielded from shipping rate fluctuations) or the unit cost difference is no longer a good proxy for the shipping cost component. A possible explanation for the latter would be if the customs value no longer represents the original free-on-board-ship value of the cargo; perhaps owing to middleman markups.

[5]The total exports of cement and clinker to Mexico for 2006 in the official (U.S. Census Bureau) data are 0.779 Mt, but for the component aluminous cement exported from Laredo, TX, the data include several months of data in kilograms misreported as tons. These were converted to metric tons for the correction to table 16, resulting in a net reduction of 0.744 Mt for the Mexico destination and the U.S. total.

World Review

World hydraulic cement production data are listed in table 22. Although the data are supposed to include all forms of hydraulic cement, data for the United States are for portland plus masonry cement only, and data for some other countries also may be incomplete. For some countries, the production data may include their exports of clinker.

World cement output in 2006 was an estimated 2.6 billion metric tons (Gt), up by about 9%. Production was from more than 150 countries. China was again by far the world's leading producer; its output was up by nearly 13% to 1.2 Gt or 47% of the world total. China was also the worlds leading cement exporter. The remaining top 15 producing countries were, in descending order, India, the United States, Japan, the Republic of Korea, Russia, Spain, Italy, Turkey, Mexico, Brazil, Thailand, Indonesia, Germany, and Iran. Cumulatively, the top 5 countries had about 62% of total world output; the top 10 countries, about 72%; and the top 15 countries, about 79%.

Regionally, Asia contributed about 66% of world production and included 7 of the 15 leading producing countries. Western Europe had about 9% of total output; North America, about 6%; the Middle East (including Turkey), about 6%; Central America and South America, about 4%; Africa, about 4%; the Commonwealth of Independent States, about 3%; and Eastern Europe, 2%.

Outlook

The severe decline in housing starts that characterized much of 2006 was expected to continue into 2007. The "lag effect" construction (such as schools, churches, and shopping malls) that had accompanied the housing boom appeared to have significantly tapered off by mid-2006, and this type of nonresidential construction was expected to play only a modest role in the 2007 market. Accordingly, other forms of private sector construction, as well as that in the public sector (especially for transportation infrastructure) were expected to become more dominant in 2007. Overall, cement sales were expected to decline somewhat in 2007, with a modest recovery expected by 2008 or 2009 and with long-term growth of several percent yearly in the medium to long term. In the near term, any reduction in sales was expected to be accommodated largely through further reduced imports and not reduced cement production. Capacity increases from new plants and/or expansions at existing plants were expected to significantly reduce the need for imports in the medium- to long-term, assuming no significant shutdown of domestic capacity because of environmental concerns (such as those about CO_2 emissions).

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TABLE 1
SALIENT CEMENT STATISTICS[1]

(Thousand metric tons and thousand dollars unless otherwise specified)

	2002	2003	2004	2005	2006
United States:[2]					
Production:					
Cement[3]	89,732	92,843	97,434	99,319	98,167
Clinker	81,517	81,882	86,658	87,405	88,555
Shipments from mills and terminals:[3, 4, 5]					
Quantity	108,500	111,000	120,000	128,000 [r]	127,000
Value [6]	8,250,000	8,340,000	9,520,000	11,700,000 [r]	12,900,000
Average value[6] dollars per metric ton	76.00	75.00	79.50	91.00	101.50
Stocks at mills and terminals, yearend	7,680	6,610	6,740 [r]	7,450 [r]	9,380
Exports of cement and clinker	834	837	749	766	723 [7]
Imports for consumption:[8]					
Cement	22,198	21,015	25,396	30,403	32,141
Clinker	1,603	1,808	1,630	2,858	3,425
Total[9]	23,801	22,823	27,026	33,261	35,566
Consumption, apparent[10]	110,020	114,090	121,950 [r]	128,250 [r]	127,660
World, production[11]	1,850,000	2,030,000	2,190,000	2,350,000 [r]	2,560,000 [e]

[e]Estimate. [r]Revised.
[1]Unless otherwise indicated, data are for portland (including blended) and masonry cements only. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.
[2]Excludes Puerto Rico.
[3]Includes cement produced from imported clinker.
[4]Includes imported cement.
[5]Shipments to final domestic customers. Data are from an annual survey of plants and terminals and may differ from the totals in table 9, which are based on consolidated monthly surveys from companies.
[6]Value at mill or independently reporting terminal of cement shipments to final domestic customers.
[7]Official export data have been corrected to remove an apparent excess 743,939 metric tons of aluminous cement from Laredo, TX, into Mexico.
[8]All forms of hydraulic cement or clinker, respectively.
[9]Data may not add to totals shown because of independent rounding.
[10]Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of cement minus change in yearend cement stocks.
[11]Total hydraulic cement. May include clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Illinois, metropolitan Chicago	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois, excluding Chicago	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reeves, Reagan, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3

PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

District[5]	2005					2006				
			Capacity[2]					Capacity[2]		
	Active plants	Production[3] (thousand metric tons)	Finish grinding (thousand metric tons)	Percentage utilized[6]	Stocks at yearend[4] (thousand metric tons)	Active plants	Production[3] (thousand metric tons)	Finish grinding (thousand metric tons)	Percentage utilized[6]	Stocks at yearend[4] (thousand metric tons)
Maine and New York	5	3,241	4,569	70.9	220	5	3,356	4,203	79.8	235
Pennsylvania, eastern	7	4,715	5,410	87.2	270	7	4,411	4,530 [7]	81.3	277 [7]
Pennsylvania, western	3	1,573	1,719	91.5	126 [7]	3	1,605	1,770 [7]	90.7	117
Illinois	4	3,237	3,410 [7]	95.0	199 [7]	4	3,108	3,420 [7]	91.0	171 [7]
Indiana	4	3,058	3,723	82.2	223	4	3,025	3,720 [7]	81.3	234
Michigan and Wisconsin	6	5,599	7,330 [7]	76.4	323 [7]	5	5,437	7,328	74.2	422 [7]
Ohio	2	986	1,333	74.0	57	2	966	1,304	74.1	60
Iowa, Nebraska, South Dakota	5	4,502	6,062	74.3	392	5	4,558	6,048	75.4	516
Kansas	4	2,887	3,110 [7]	92.8	146	4	3,003	3,329	90.2	249
Missouri	5	5,332	7,017	76.0	444	5	5,240	6,958	75.3	678
Florida[8]	7	5,726	7,301	78.4	537 [7]	7	5,876	7,301	80.5	591 [7]
Georgia, Virginia, West Virginia	4	2,370	3,440 [7]	68.9	268	4	2,446	3,440 [7]	71.2	280
Maryland	3	2,552	2,706	94.3	146	3	2,651	3,087	85.9	222 [7]
South Carolina	3	3,267	5,018	65.1	185	3	3,315	5,109	64.9	223
Alabama	5	5,123	5,948	86.1	270	5	5,201	6,036	86.2	403
Kentucky, Mississippi, Tennessee	4	3,311	3,679	90.0	304	4	3,492	3,700 [7]	94.3	348
Arkansas and Oklahoma	4	2,810	3,280 [7]	85.6	128	4	2,703	3,260 [7]	83.0	233
Texas, northern	6	6,639	7,560 [7]	87.8	803	6	6,467	7,594	85.2	903 [7]
Texas, southern	5	4,916	5,620 [7]	87.5	211	6	4,882	5,850 [7]	83.4	411
Arizona and New Mexico	3	2,788	3,480 [7]	80.2	106	3	2,549	3,310 [7]	77.0	163
Colorado and Wyoming	3	2,648	3,025	87.5	185	3	2,579	3,450 [7]	72.8	238
Idaho, Montana, Nevada, Utah	6	3,085	3,740 [7]	82.6	203	6	3,043	3,750 [7]	81.2	256
Alaska and Hawaii	--	--	--	--	71	--	--	--	--	97
California, northern	3	2,696	2,944	91.6	127 [7]	3	2,454	2,853	86.0	318 [7]
California, southern	8	8,868	10,200 [7]	86.6	217 [7]	8	8,495	10,238	83.0	435 [7]
Oregon and Washington	4	1,974	2,448	80.6	163	4	1,906	2,540 [7]	75.1	158 [7]
Importers[9]	--	--	--	--	639 [r, 7]	--	--	--	--	456 [7]
Total or average[10]	113	93,904	114,000 [7]	82.3	6,910 [r, 7]	113	92,768	115,000 [7]	80.6	8,700 [7]
Puerto Rico	2	1,584	2,462	64.3	45	2	1,546	2,462	62.8	26 [7]
Grand total or average[10]	115	95,488	117,000 [7]	81.9	6,960 [r, 7]	115	94,313	118,000 [7]	80.2	8,720 [7]

[r]Revised. -- Zero.

[1]Even when presented unrounded, data are thought to be accurate to no more than three significant digits. Includes data for white cement.

[2]Reported grinding capacity is based on fineness needed to produce a plant's normal output mix, including masonry cement, and allowing for downtime for routine maintenance.

[3]Includes cement made from imported clinker.

[4]Includes imported cement. Includes stocks at mills and terminals and in transit.

[5]District assignation is the location of the reporting facilities, including terminals. Includes independent importers for which district assignations were possible.

[6]Calculated relative to portland cement output; utilization percentage would be higher if calculated to include masonry cement output.

[7]Data contains estimates for nonrespondent or incompletely reporting facilities.

[8]Production and grinding capacity data exclude a plant that produced only masonry cement.

[9]Data include only those importers or terminals for which district assignations were not possible.

[10]Data may not add to totals shown because of independent rounding.

TABLE 4

MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

District[4]	2005 Active plants	2005 Production[2] (thousand metric tons)	2005 Stocks at yearend[3] (thousand metric tons)	2006 Active plants	2006 Production[2] (thousand metric tons)	2006 Stocks at yearend[3] (thousand metric tons)
Maine and New York	4	119	18	4	119	20
Pennsylvania	6	399	60 [5]	9	384	63 [5]
Indiana and Ohio	4	555	72	6	529	75
Michigan	4	228	46 [5]	4	176	38 [5]
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	W	W	2	W	W
Missouri	2	W	W	2	W	W
Florida	5	902	35	5	900	45
Georgia, Maryland, Virginia, West Virginia	5	543	51	6	511	63
South Carolina	3	498	26	3	575	48
Alabama	4	475	77	4	526	67
Kentucky, Mississippi, Tennessee	3	W	W	3	W	W
Arkansas and Oklahoma	4	188	18	4	193	21
Texas, northern	5	213	21	4	184	112
Texas, southern	3	182	13	3	198	9
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	1	W	W
California, northern	3	67	11	3	92	12
California, southern	4	627	12	4	605	18
Importers[6]	--	--	4 [5]	--	--	3 [5]
Total[7]	76	5,415	532 [5]	74	5,399	689 [5]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Includes masonry, portland-lime, and plastic cements. Even where presented unrounded, data are thought to be accurate to no more than three significant figures.

[2]Includes cement produced from imported clinker.

[3]Includes imported cement.

[4]District assignation is the location of the reporting facilities, including importers for which regional assignations were possible.

[5]Data contains estimates for nonrespondents or incompletely reporting facilities.

[6]Data include only those importers or terminals for which district assignations were not possible.

[7]Data may not add to totals shown because of independent rounding.

TABLE 5

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2006, BY DISTRICT[1]

District	Active plants[2] Process used Wet	Active plants[2] Process used Dry	Active plants[2] Process used Both	Active plants[2] Total	Number of kilns[4]	Daily capacity[3, 4] (thousand metric tons)	Average days of routine maintenance[4]	Apparent annual capacity[4, 5] (thousand metric tons)	Production (thousand metric tons)	Percentage of capacity utilized	Yearend stocks[6] (thousand metric tons)
Maine and New York	2	2	--	4	5	10.9	31.7	3,650 [7]	3,094	84.9 [7]	98 [7]
Pennsylvania, eastern	2	4	--	6	10	14.6	32.0 [7]	4,760 [7]	4,132	86.9 [7]	186
Pennsylvania, western	2	1	--	3	7	5.2	20.1 [7]	1,800 [7]	1,584	88.1 [7]	50
Illinois	--	4	--	4	8	10.0	11.3	3,484	2,575	73.9	82
Indiana	1	3 [8]	--	4	8	10.3	21.5	3,507	3,101	88.4	131
Michigan	1	2	--	3	8	14.1	25.6	4,747	4,119	86.8	380
Ohio	1	1	--	2	3	3.4	20.2	1,159	1,049	90.5	93
Iowa, Nebraska, South Dakota	--	4	1	5	9	14.0	17.6	4,841	4,222	87.2	235
Kansas	1	3	--	4	9	9.8	17.0	3,388	2,951	87.1	153
Missouri	2	3	--	5	6	16.1	25.8	5,372	4,757	88.6	193
Florida	--	6	--	6	7	17.7	24.5	5,954	5,630	94.6	380
Georgia, Virginia, West Virginia	1	2	--	3	5	8.3	10.5	2,901	2,464	84.9	154
Maryland	1	2	--	3	4	8.1	20.0 [7]	2,754	2,663	96.7 [7]	130 [7]
South Carolina	--	3	--	3	3	12.3	20.7	4,260	3,525	82.8	379
Alabama	--	5	--	5	5	17.0	22.4	5,833	5,186	88.9	219
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.5	17.4	3,669	3,280	89.4	168
Arkansas and Oklahoma	2	2	--	4	10	8.0	24.5 [7]	2,730 [7]	2,575	94.4 [7]	137
Texas, northern	2	3	1	6	16	22.4	15.0	7,753	6,389	82.4	442
Texas, southern	--	4	1	5	6	13.8	15.3 [7]	4,810 [7]	4,411	91.7 [7]	332
Arizona and New Mexico	--	3	--	3	7	8.6	11.6	3,014	2,627	87.2	310
Colorado and Wyoming	--	3	--	3	4	8.9	22.1	2,974	2,493	83.9	253
Idaho, Montana, Nevada, Utah	3	3	--	6	8	8.5	18.8	2,918	2,800	96.0	81
California, northern	--	3	--	3	3	8.8	39.6	2,781	2,341	84.2	98
California, southern	--	8	--	8	17	29.6	21.3	10,143	8,829	87.0	655
Oregon and Washington	1	2	--	3	3	6.2	30.9	2,055	1,758	85.5	34
Total or average[9]	23	79	3	105	175	296.9	20.6 [7]	101,000 [7]	88,555	87.5 [7]	5,370 [7]
Puerto Rico	--	2	--	2	2	5.9	28.3	1,979	1,490	75.3	71
Grand total or average[9]	23	81	3	107	177	302.8	20.7 [7]	103,000 [7]	90,045	87.2 [7]	5,440 [7]

-- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes white cement plants. Includes all plants active for at least one day during the year.

[3]Sum of reported daily kiln capacities for each plant in district.

[4]Kilns active at least one day during the year. Excludes idle kilns (full year) that cannot be restarted, fully permitted, in less than 6 months.

[5]Sum of apparent annual kiln capacities: for each kiln, calculated as 365 days minus days reported as shut down for routine maintenance and then multiplied by the reported (unrounded) daily capacity.

[6]Includes imported clinker and clinker stockpiles at grinding plants.

[7]Data contain estimates for nonrespondent or incompletely reporting facilities and have been rounded to no more than three significant digits.

[8]Includes one semidry kiln.

[9]Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

	2005		2006	
Raw materials	Clinker	Cement[3]	Clinker	Cement[3]
Calcareous:				
Limestone (includes aragonite, marble, chalk, coral)	114,000	2,230	114,000	2,380
Cement rock (includes marl)	11,300	2	13,300	52
Cement kiln dust (CKD)[4]	334	414	178	364
Lime[5]	9	30	121	21
Other	26	21	22	19
Aluminous:				
Clay	4,790	--	4,770	--
Shale	3,780	30	3,010	37
Other[6]	721	--	637	--
Ferrous:				
Iron ore	813	--	752	--
Mill scale	656	--	754	--
Other[7]	84	--	55	--
Siliceous:				
Sand and calcium silicate	3,010	--	3,620	--
Sandstone, quartzite, soils, other	950	--	1,030	--
Fly ash	2,950	153	2,950	130
Other ash, including bottom ash	1,210	--	1,190	--
Granulated blast furnace slag[8]	144	521	207	678
Other blast furnace slag	255	--	324	--
Steel slag	525	--	490	--
Other slags	58	2	145	2
Natural rock pozzolans[9]	--	8	--	15
Other pozzolans[10]	222	62	139	14
Other:				
Gypsum and anhydrite	--	5,370	--	5,440
Other, n.e.c.[11]	84	108	66	92
Total[12]	146,000	8,940	148,000	9,240
Clinker, imported, raw materials equivalent[13]	--	4,750	--	4,210
Grand total[12]	146,000	13,700	148,000	13,500

-- Zero.

[1]Excludes Puerto Rico.

[2]Data have been rounded to three significant digits to reflect inherent reporting accuracy and the incorporation of estimates for some facilities.

[3]Includes portland, blended, and masonry cements.

[4]Data are underreported.

[5]Data are probably underreported, especially regarding incorporation within masonry cements.

[6]Includes alumina, aluminum dross, bauxite, catalysts, staurolite, and other materials.

[7]Includes iron sludges, pyrite, and other materials.

[8]Includes both ground (GGBFS) and unground material.

[9]Includes pozzolana and burned clays and shales except where reported directly as clay or shale.

[10]Includes diatomite, silica fume, other microcrystalline silica, and other pozzolans, even if not used as such.

[11]Not elsewhere classified. Includes fluorspar.

[12]Data may not add to totals shown because of independent rounding.

[13]Converted as the weight of foreign clinker consumed times 1.7.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS[1]

	Clinker produced[3]			Fuel consumed[2]					Waste fuel	
Kiln process	Active plants	Quantity (thousand metric tons)	Percentage of total	Coal[4] (thousand metric tons)	Petroleum coke (thousand metric tons)	Oil[5] (thousand liters)	Natural gas (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
2005:										
Wet	23	11,807	13.5	1,480	586	29,300	22,800	85	9	479,000
Dry	79	70,809	81.0	7,340	1,740	58,000	310,000	315	110	894,000
Both[6]	4	4,790	5.5	679	21	--	62,000	5	10	93,300
Total[7]	106	87,405	100.0	9,490	2,350	87,300	395,000	405	130	1,470,000
2006:										
Wet	23	11,659	13.2	1,530	518	33,700	18,000	90	19	585,000
Dry	79	72,742	82.1	7,340	1,860	46,700	306,000	323	283	360,000
Both	3	4,154	4.7	661	13	--	44,800	5	--	42,600
Total[7]	105	88,555	100.0	9,540	2,390	80,400	369,000	418	302	988,000

-- Zero.

[1]Data exclude Puerto Rico.

[2]All fuel data have been rounded to three significant digits.

[3]Clinker data were all reported; although unrounded, data are thought to be accurate to no more than three significant digits.

[4]Essentially all reported to be bituminous.

[5]Distillate and residual fuel oil. Excludes used oils that were reported under liquid wastes.

[6]Fuel quantities may not represent normal operating conditions owing to the inclusion of a plant that underwent conversion from wet to dry technology the year.

[7]Data may not add to totals shown because of independent rounding.

TABLE 8

ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS[1]

	Electric energy used[2]							
	Generated at plant		Purchased		Total[3]			
Plant process	Number of plants	Quantity (million kilowatthours)	Number of plants	Quantity (million kilowatthours)	Quantity[2] (million kilowatthours)	Percentage	Finished cement produced[4] (thousand metric tons)	Average consumption (kilowatthours per metric ton of cement produced)
2005								
Integrated plants:								
Wet	--	--	23	1,770	1,770	13.2 r	13,075	135
Dry	5	486	79	10,400	10,900	81.3 r	78,423	139
Both[5]	--	--	4	770	770	5.7	5,029	153
Total or average[3]	5	486	106	12,900 r	13,400 r	100.0	96,527	139
Grinding plants[6]	--	--	7	214	214	--	2,562	84
Exclusions[7]	--	--	2	XX	XX	--	229	XX
2006								
Integrated plants:								
Wet	1	(8)	23	1,770	1,770	13.1	12,741	139
Dry	5	476	79	10,600	11,100	82.3	79,014	141
Both	--	--	3	622	622	4.6	4,098	152
Total or average[3]	6	476	105	13,000	13,500	100.0	95,854	141
Grinding plants[6]	--	--	6	160	160	--	1,962	81
Exclusions[7]	--	--	2	XX	XX	--	351	XX

[r]Revised. XX Not applicable. -- Zero.

[1]Data exclude Puerto Rico.

[2]Electricity data are rounded to no more than three significant digits because they contain estimates.

[3]Data may not add to totals shown because of independent rounding.

[4]Include portland and masonry cements. Data are all reported and have not been rounded.

[5]Electricity consumption may not represent normal operating conditions owing to the inclusion of one plant that underwent conversion from wet to dry kiln technology during the year.

[6]Excludes plants that reported production of only masonry cement.

[7]Plants that reported production only of masonry cement.

[8]Less than ½ unit.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2005	Portland cement 2006	Masonry cement 2005	Masonry cement 2006
Destination:				
Alabama	1,738	1,798	183	196
Alaska[3]	173	176	--	--
Arizona	4,671	4,611	102	103
Arkansas	1,205	1,187	97	87
California, northern	5,377	4,761	148	130
California, southern	9,945	9,549	540	530
Colorado	2,521	2,641	33	31
Connecticut[3]	799	814	19	18
Delaware[3]	208	247	13	12
District of Columbia[3]	205	210	(4)	(4)
Florida	11,233	11,180	1,052	1,015
Georgia	4,395	4,484	357	394
Hawaii[3]	431	462	7	6
Idaho	704	724	1	1
Illinois, excluding Chicago	2,437	1,921	28	27
Illinois, metropolitan Chicago[3]	2,101 r	2,634	70	71
Indiana	2,182	2,173	92	84
Iowa	1,933	1,920	6	3
Kansas	1,537	1,546	11	11
Kentucky	1,486	1,330	117	104
Louisiana[3]	2,167 r	2,546	65	72
Maine	234	334	5	5
Maryland	1,568	1,614	92	95
Massachusetts[3]	1,242	1,196	22	21
Michigan	2,924	2,505	135	101
Minnesota[3]	2,016	1,902	39	15
Mississippi	1,067	1,176	69	80
Missouri	2,816	2,626	52	44
Montana	380	396	1	1
Nebraska	1,362 r	1,306	6	5
Nevada	2,602	2,626	27	29
New Hampshire[3]	229	336	5	7
New Jersey[3]	1,964	1,923	94	96
New Mexico	901	900	8	8
New York, eastern	653	662	19	18
New York, western[3]	817	798	27	25
New York, metropolitan[3]	1,681	1,893	92	104
North Carolina[3]	2,900	3,109	352	357
North Dakota[3]	359	368	2	2
Ohio	3,893	3,727	171	154
Oklahoma	1,603	1,543	71	69
Oregon	1,237	1,318	1	1
Pennsylvania, eastern	2,214	2,172	71	67
Pennsylvania, western	1,096	1,107	56	54
Rhode Island[3]	188	212	3	3
South Carolina	1,778	1,851	166	177
South Dakota	483	588	2	2
Tennessee	2,242 r	2,259	278	284
Texas, northern	6,793	6,499	164	170
Texas, southern	7,876 r	8,122	257	268
Utah	1,526	1,697	(4)	(4)

See footnotes at end of table.

TABLE 9—Continued
CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2005	Portland cement 2006	Masonry cement 2005	Masonry cement 2006
Destination—Continued:				
Vermont[3]	129	158	3	3
Virginia	2,666	2,639	203	188
Washington	2,238	2,351	2	2
West Virginia	512	562	27	26
Wisconsin	2,348	2,171	25	22
Wyoming	466	466	1	--
Total[5]	122,445 r	122,026	5,489	5,401
Foreign countries[6]	1,857 r	1,813	(4)	(4)
Puerto Rico	424 r	473	--	--
Grand total[5]	124,726 r	124,312	5,489	5,401
Origin:				
United States	94,004	91,933	5,429	5,354
Puerto Rico	1,584	1,558	--	--
Foreign countries[7]	29,139 r	30,821	60	47
Total shipments[5]	124,726 r	124,312	5,489	5,401

[r]Revised. -- Zero.
[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.
[2]Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 10-12, and 14-15, which are from annual surveys of individual plants and importers. Includes any revisions to monthly data available through April 30, 2008. Although presented unrounded, data are thought to be accurate to no more than three significant digits.
[3]Has no cement plants.
[4]Less than ½ unit.
[5]Data may not add to totals shown because of independent rounding.
[6]Includes shipments to U.S. possessions and territories.
[7]Imported cement sold to final customers in the United States as reported by domestic producers and other importers. Data do not match the imports in tables 17 and 21.

TABLE 10
SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES,
IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total shipments
	In bulk	In containers[3]	In bulk	In containers[3]	In bulk	In containers[3]	to consumer[4]
2005:							
Railroad	12,000	13	1,570	18	488	--	2,080
Truck	3,920	200	62,700	1,940	55,100 r	727 r	121,000 r
Barge and boat	8,970	--	80	--	559 r	--	639 r
Total[4]	24,900	214	64,400	1,960	56,200 r	727 r	123,000 r, 5
2006:							
Railroad	11,600	12	1,740	16	804	1	2,560
Truck	4,700	285	63,500	1,760	52,700	736	119,000
Barge and boat	7,870	--	67	--	558	--	625
Total[4]	24,100	297	65,300	1,780	54,000	737	122,000 5

[r]Revised. -- Zero.
[1]Includes imported cement and cement made from imported clinker. Data exlude Puerto Rico.
[2]Data are rounded to no more than three significant digits because they include estimates.
[3]Includes packages, bags, jumbo bags, and supersacks.
[4]Data may not add to totals shown because of independent rounding.
[5]Shipments based on an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 11

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1]

	2005			2006		
		Value[2]			Value[2]	
District[3, 4]	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	3,434	$305,647	89.00	4,420 [5]	$451,000 [5]	102.00 [5]
Pennsylvania, eastern	4,686	411,000 [5]	87.50 [5]	4,629	463,000 [5]	100.00 [5]
Pennsylvania, western	1,563	139,204	89.06	1,520 [5]	147,000 [5]	97.00 [5]
Illinois	3,670 [r, 5]	325,000 [r, 5]	88.50 [5]	3,616	358,000 [5]	99.00 [5]
Indiana	3,141	249,419	79.40	3,075	271,264	88.23
Michigan and Wisconsin	6,170 [5]	574,000 [5]	93.00 [5]	6,050 [5]	596,000 [5]	99.00 [5]
Ohio	984	89,069	90.48	949	94,360	99.47
Iowa, Nebraska, South Dakota	5,151	474,693	92.16	5,208	518,164	99.49
Kansas	2,376	200,526	84.41	2,526	240,854	95.35
Missouri	6,281	546,361	86.99	5,896	562,930	95.47
Florida	10,841	982,819	90.65	10,591	1,084,593	102.41
Georgia, Virginia, West Virginia	3,001	256,000	85.50 [5]	3,259	324,928	99.69
Maryland	2,842	234,277	82.41	2,960 [5]	264,000 [5]	89.50 [5]
South Carolina	3,827	289,278	75.59	3,723	330,187	88.69
Alabama	5,459	448,929	82.24	5,718	515,186	90.10
Kentucky, Mississippi, Tennessee	3,281	284,667	86.77	3,305	327,267	99.02
Arkansas and Oklahoma	2,998	250,345	83.51	2,830	262,542	92.77
Texas, northern	8,096	681,000 [5]	84.00 [5]	7,877	746,000 [5]	94.50 [5]
Texas, southern	6,674	534,932	80.15	6,543	607,741	92.89
Arizona and New Mexico	4,600 [5]	465,000 [5]	101.00 [5]	4,610	524,592	113.79
Colorado and Wyoming	2,704	237,000	87.50	2,842	281,020	98.87
Idaho, Montana, Nevada, Utah	3,473	323,457	93.13	3,420	361,630	105.74
Alaska and Hawaii	560	78,247	139.72	591	82,662	139.81
California, northern	4,518	443,260	98.11	4,063	434,390	106.91
California, southern	11,575	1,125,323	97.22	10,964	1,197,612	109.23
Oregon and Washington	3,040 [5]	268,000 [5]	88.00 [5]	2,690 [5]	252,000 [5]	93.50 [5]
Importers[6]	8,300 [r, 5]	788,000 [r, 5]	95.00 [r, 5]	7,950 [5]	848,000 [7]	106.50 [5]
Total or average[7]	123,000 [r, 5, 8]	11,000,000 [r, 5]	89.00 [5]	122,000 [5, 8]	12,100,000 [7]	99.50 [5]
Puerto Rico	1,867	W	W	1,820	W	W
Grand total[7]	125,000 [r, 5, 8]	W	W	124,000 [5, 8]	W [7]	W

[r]Revised. W Withheld to avoid disclosing company proprietary data.

[1]Includes portland cement (gray and white) and cement produced from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Values represent mill net or ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded value data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[3]District is the location of the reporting entity, not necessarily the location of sales (see table 9 for sales data, by State).

[4]Includes shipments by independent importers where regional assignations were possible.

[5]Data are rounded (unit values to the nearest $0.50) because they include estimated data.

[6]Importers for which district assignations were not possible.

[7]Data may not add to totals shown because of independent rounding.

[8]Shipments calculated on the basis of an annual survey of plants and importers; may differ from data in table 9, which are based on consolidated company monthly data.

TABLE 12

MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1, 2]

District[4]	2005 Quantity (thousand metric tons)	2005 Value[3] Total (thousands)	2005 Value[3] Average (dollars per metric ton)	2006 Quantity (thousand metric tons)	2006 Value[3] Total (thousands)	2006 Value[3] Average (dollars per metric ton)
Maine and New York	118	$12,751	108.06	128 [5]	$15,200 [5]	118.50 [5]
Pennsylvania	342 [5]	42,600 [5]	124.50 [5]	347	47,300 [5]	136.00 [5]
Illinois, Indiana, Ohio	536	68,340	127.50	520	70,762	136.14
Michigan	232 [5]	28,000 [5]	120.50 [5]	200 [5]	25,800 [5]	129.00 [5]
Iowa, Nebraska, South Dakota	40	3,728	93.20	17	2,055	120.85
Kansas and Missouri	169	21,279	125.91	149	20,257	135.73
Florida	945	134,930	142.78	913	148,507	162.69
Georgia, Maryland, Virginia, West Virginia	476	75,800 [5]	159.50 [5]	427	69,549	162.70
South Carolina	473	51,539	108.96	484	57,986	119.86
Alabama	500	57,727	115.45	538	68,100 [5]	126.50 [5]
Kentucky, Mississippi, Tennessee	127	16,364	128.85	137	18,802	137.04
Arkansas and Oklahoma	190	20,508	107.94	179	20,800	116.30
Texas, northern	188	26,200 [5]	139.00 [5]	202	31,600 [5]	156.50 [5]
Texas, southern	186	19,814	106.53	204	24,391	119.78
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	156	18,706	119.91	147	18,820	127.62
Alaska and Hawaii	5	1,234	246.80	4	1,135	264.55
California, northern; Oregon; Washington	71	9,060 [5]	127.50 [5]	93	11,421	123.44
California, southern	628	72,178	114.93	604	77,900 [5]	129.00 [5]
Importers[6]	24 [5]	3,480 [5]	145.00 [5]	17 [5]	2,730 [5]	169.50 [5]
Total or average[7]	5,410 [5, 8]	684,000 [5]	126.50 [5]	5,310 [5, 8]	733,000 [5]	138.00 [5]

[1]Shipments are to final customers and include imported cement and cement made from imported clinker. Data exclude Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes gray, white, and colored varieties of masonry, portland-lime, and plastic cements.

[3]Values represent ex-plant (free on board) valuations of total sales to final customers, including sales from distribution terminals. Even where presented unrounded, data should be viewed as cement value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[4]District is the location of the reporting entity, not necessarily the location of sales (see table 9 for sales data, by State).

[5]Data are rounded (unit values to the nearest $0.50) because they include estimated data.

[6]Importers for which district assignations were not possible.

[7]Data may not add to totals shown because of independent rounding.

[8]Tonnages based on an annual survey of plants and terminals and may differ from the totals in table 9, which represent consolidated monthly surveys of companies.

TABLE 13

AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

Year	Gray portland cement	White portland cement[3]	All portland cement	Prepared masonry cement	All classes of cement
2005	88.50	176.00	89.00	126.50	91.00
2006	99.00	191.00	99.50	138.00	101.50

[1]Excludes Puerto Rico. Values are the average of sales to final customers, free on board plant or import terminal, less all discounts, allowances, and onward delivery charges to customers or distribution terminals, but inclusive of bagging charges.

[2]Data are rounded to the nearest $0.50 because they include estimates.

[3]The unit values for white cement include a component of resales showing significant price markups.

TABLE 14

PORTLAND CEMENT SHIPMENTS IN 2006, BY DISTRICT AND TYPE OF CUSTOMER [1]

(Thousand metric tons)

District [2, 3]	Ready-mixed concrete	Concrete product manufacturers	Contractors	Building material dealers	Oil well, mining, waste	Government and miscellaneous [4]	Total [5, 6]
Maine and New York	3,530	409	99	349	--	28	4,420
Pennsylvania, eastern	2,920	1,150	140	298	--	119	4,629
Pennsylvania, western	1,070	263	124	18	22	21	1,520
Illinois	2,690	315	137	63	259	153	3,616
Indiana	2,350	462	171	64	10	17	3,075
Michigan and Wisconsin	4,850	562	307	112	57	159	6,050
Ohio	724	158	24	32	1	9	949
Iowa, Nebraska, South Dakota	3,970	607	378	50	67	135	5,208
Kansas	1,950	192	200	72	87	23	2,526
Missouri	4,730	434	576	56	5	100	5,896
Florida	7,630	2,140	237	562	--	20	10,591
Georgia, Virginia, West Virginia	2,200	758	167	96	9	27	3,259
Maryland	2,360	301	167	70	4	58	2,960
South Carolina	2,550	689	193	64	3	223	3,723
Alabama	4,330	668	224	134	23	337	5,718
Kentucky, Mississippi, Tennessee	2,560	444	123	78	22	78	3,305
Arkansas and Oklahoma	2,040	140	319	106	68	153	2,830
Texas, northern	5,080	496	1,030	70	676	528	7,877
Texas, southern	4,390	757	754	187	445	15	6,543
Arizona and New Mexico	3,370	665	259	152	158	8	4,610
Colorado and Wyoming	1,970	269	220	11	219	151	2,842
Idaho, Montana, Nevada, Utah	2,690	234	77	56	210	151	3,420
Alaska and Hawaii	538	48	--	--	--	5	591
California, northern	3,330	405	132	181	--	12	4,063
California, southern	7,820	2,350	237	459	96	--	10,964
Oregon and Washington	1,870	539	71	148	63	4	2,690
Importers [7]	6,020	827	527	370	93	120	7,950
Total [6]	89,500	16,275	6,890	3,859	2,597	2,652	122,000
Puerto Rico	820	386	82	504	--	25	1,820
Grand total [6]	90,400	16,662 [8]	6,972 [9]	4,363	2,597 [10]	2,677	124,000

-- Zero.

[1] Includes imported cement and cement ground from imported clinker. Except for district totals, data have been rounded to three significant digits but are likely to be accurate to only two significant digits. District totals are accurate to no more than three significant digits.

[2] District is the location of the reporting entity, not necessarily the location of sales (see table 9 for sales data, by State).

[3] Includes shipments by independent importers for which district assignations were possible.

[4] Includes shipments for which customer types were not specified.

[5] District totals are unrounded except in accord with table 11.

[6] Data may not add to totals shown because of independent rounding.

[7] Shipments by importers for which district assignations were not possible.

[8] Grand total shipments to concrete product manufacturers include brick and block—6,400; precast and prestressed—3,770; pipe—1,960; and other or unspecified—4,530.

[9] Grand total shipments to contractors include airport—147; road paving—4,010; soil cement—1,340; and other or unspecified—6,970.

[10] Grand total shipments include oil well drilling—2,130; mining—239; and waste stabilization—230.

TABLE 15
PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE[1, 2]

(Thousand metric tons)

Type	2005	2006
General use and moderate heat (Types I and II) (gray)[3]	94,800 r	93,500
High early strength (Type III)	3,960	3,810
Sulfate resisting (Type V)[3]	18,100	17,700
Block	555	581
Oil well	1,440	1,480
White[4]	1,190	1,180
Blended:		
Portland, natural pozzolans	40	216
Portland, granulated blast furnace slag	1,880	2,140
Portland, fly ash	362	304
Other blended cement[5]	883	718
Total[6]	3,160	3,400
Expansive and regulated fast setting	62 r	42
Miscellaneous[7]	2	59 [8]
Grand total[6, 9]	123,000 r	122,000

[r]Revised.
[1]Sales to domestic final customers only. Includes sales of imported cement. Excludes Puerto Rico.
[2]Data are rounded to no more than three significant digits.
[3]Cements classified as Type II/V hybrids are included with Type V.
[4]Mostly Types I and II but may include Types III-V and block cements.
[5]Includes blends with other pozzolans (cement kiln dust, silica fume, other).
[6]Data may not add to totals shown because of independent rounding.
[7]Includes low heat (Type IV), waterproof, and other portland-type cements.
[8]Includes some ASTM C-1157 cements possibly included with other cement types in former years.
[9]Data are based on an annual survey of plants and importers; totals may differ from those in table 9, which are based on consolidated monthly data from companies.

TABLE 16

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value[2]	Quantity	Value[2]
United States:				
Argentina	1	123	(3)	185
Australia	3	288	4	248
Azerbaijan	3	160	--	--
Bahamas	31	3,733	22	2,615
Brazil	1	124	2	112
British Virgin Islands	(3)	39	1	132
Canada	650	52,313	601	52,845
Cayman Islands	1	162	1	118
China	4	461	3	403
Colombia	(3)	63	1	216
Cyprus	(3)	46	1	106
Dominican Republic	4	216	1	180
Ecuador	(3)	47	1	36
El Salvador	--	--	1	88
France	1	102	--	--
Greece	2	202	2	162
Guatemala	1	164	1	113
Hong Kong	3	185	3	183
Indonesia	1	33	--	--
Ireland	(3)	90	1	119
Israel	1	35	1	53
Jamaica	(3)	48	2	117
Japan	1	66	1	45
Korea, Republic of	2	140	3	164
Mexico	28	4,787	35 [4]	5,126 [4]
Netherlands	1	30	(3)	10
Netherlands Antilles	1	127	1	175
Panama	1	129	2	370
Peru	3	189	3	198
Saudi Arabia	9	907	(3)	21
Singapore	(3)	15	1	258
Spain	1	26	1	59
Sweden	1	60	1	52
Taiwan	4	179	6	427
Thailand	(3)	58	1	61
Tokelau Islands	--	--	1	47
Trinidad and Tobago	1	129	1	89
Turks and Caicos Islands	(3)	33	3	189
United Arab Emirates	1	211	4	350
United Kingdom	1	32	(3)	21
Venezuela	1	127	4	241
Other	3 r	910 r	4	1,914
Total[5]	766	66,789	723 [4]	67,914 [4]

See footnotes at end of table.

TABLE 16—Continued

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005		2006	
	Quantity	Value[2]	Quantity	Value[2]
Puerto Rico:				
Antigua and Barbuda	--	--	1	137
Aruba	--	--	5	326
Bahamas, The	1	60	--	--
Barbados	--	--	7	257
British Virgin Islands	(3)	3	4	568
Dominica	--	--	1	124
Dominican Republic	35	1,415	(3)	10
Guadaloupe	--	--	14	618
Haiti	--	--	3	231
Jamaica	--	--	15	738
Martinique	--	--	7	2,594
Netherlands Antilles	--	--	18	805
St. Vincent and the Grenadines	--	--	1	627
Trinidad and Tobago	--	--	1	461
Turks and Caicos Islands	1	32	9	506
Other	(3)	3 r	(3)	24
Total[5]	37	1,513	86	8,025
Grand total[5]	803	68,302	809 [4]	75,877 [4]

[r]Revised. -- Zero.

[1]Includes portland and masonry cements.

[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

[3]Less than ½ unit.

[4]Official export data have been corrected to remove an apparent excess (743,939 metric tons and $38.253 million) of aluminous exports from Laredo, TX.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 17
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Brazil	467	25,153	29,837	454	23,133	30,388
British Virgin Islands[4]	--	--	--	16	1,993	2,559
Bulgaria	303	16,921	20,325	295	16,297	19,634
Canada	5,404	319,259	338,523	5,059	325,217	345,126
China	4,726	202,089	319,988	10,542	469,112	734,103
Colombia[4]	1,844	94,981	123,758	1,862	110,909	139,797
Croatia	34	6,659	8,103	29	5,817	6,986
Denmark	227	16,316	24,978	270	20,369	31,185
Dominican Republic	77	4,406	6,188	24	1,295	1,788
Egypt	569	33,419	48,355	275	16,902	24,485
France	74	16,509	19,508	97	22,805	25,380
Greece	2,786	104,910	172,406	1,950	91,745	135,493
Indonesia	865	29,481	58,713	130	5,045	8,620
Japan	4	1,155	1,832	3	1,097	2,403
Korea, Republic of	2,526	87,370	144,854	2,544	106,553	157,391
Mexico	2,173	110,281	138,030	2,264	142,081	171,928
Norway	522	25,299	32,574	233	9,849	15,077
Peru	1,047	35,546	60,527	822	40,108	54,371
Philippines	312	9,728	18,220	--	--	--
Romania	--	--	--	212	9,444	13,523
Spain	236	16,497	22,895	69	7,362	10,043
Sweden	1,050	35,421	59,660	889	37,760	57,483
Taiwan	1,759	71,448	124,679	2,180	93,516	148,997
Thailand	2,893	117,719	193,668	3,798	180,136	268,166
Turkey	675	28,873	50,665	591	30,801	46,815
United Arab Emirates	5	468	698	2	198	329
United Kingdom	14	4,907	5,211	7	2,943	3,037
Venezuela	2,484	119,203	170,362	943	48,907	66,850
Other	187	13,178	15,918	6	4,131	4,904
Total[5]	33,261	1,547,198	2,210,475	35,566	1,825,530	2,526,864
Puerto Rico:						
China	--	--	--	78	2,891	4,686
Colombia	5	589	806	12	1,427	1,882
Denmark	212	8,054	13,499	27	1,508	2,337
Korea, Republic of	146	5,130	9,410	201	9,649	15,716
Mexico	12	1,189	1,733	12	1,281	1,816
Other	15	628	695	(6)	29	30
Total[5]	391	15,590	26,142	330	16,785	26,467
Grand total[5]	33,652	1,562,788	2,236,617	35,896	1,842,315	2,553,331

-- Zero.

[1]Includes portland, masonry, and other hydraulic cements.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Material from British Virgin Islands is thought to be from Colombia.

[5]Data may not add to totals shown because of independent rounding.

[6]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Anchorage, AK:						
Canada	8	449	898	11	526	1,557
France	--	--	--	(4)	2	5
Korea, Republic of	134	4,643	8,859	120	4,624	8,430
Total[5]	143	5,092	9,757	131	5,152	9,992
Baltimore, MD:						
Canada	--	--	--	76	4,206	5,527
China	12	1,225	2,606	--	--	--
Germany	(4)	9	9	--	--	--
Netherlands	(4)	36	39	(4)	20	24
Norway	89	3,458	3,458	--	--	--
Romania	--	--	--	132	6,058	8,893
Sweden	--	--	--	(4)	176	212
Taiwan	25	822	1,758	35	1,225	1,225
United Kingdom	--	--	--	(4)	82	96
Venezuela	7	294	484	18	639	639
Total[5]	134	5,844	8,354	262	12,404	16,617
Boston, MA:						
Canada	--	--	--	29	1,654	2,328
China	--	--	--	4	132	267
Netherlands	(4)	48	51	(4)	22	24
Venezuela	132	5,292	8,246	42	1,922	2,929
Total[5]	132	5,339	8,298	74	3,730	5,547
Buffalo, NY:						
Canada	817	48,849	52,421	828	55,681	59,501
Croatia	(4)	76	112	--	--	--
United Kingdom	6	1,398	1,447	4	1,159	1,196
Total[5]	823	50,323	53,980	832	56,841	60,697
Charleston, SC:						
Brazil	37	2,126	2,151	--	--	--
China	--	--	--	9	327	696
Colombia	299	16,435	20,142	245	16,851	20,447
Greece	686	25,491	45,975	745	33,868	51,026
Italy	(4)	362	1,146	--	--	--
Japan	--	--	--	(4)	269	1,033
Netherlands	(4)	48	54	(4)	33	37
Spain	23	1,428	1,450	--	--	--
Sweden	(4)	13	16	--	--	--
Switzerland	(4)	12	15	--	--	--
United Kingdom	2	883	967	1	234	238
Venezuela	55	3,023	3,993	--	--	--
Total[5]	1,102	49,820	75,909	998	51,582	73,477
Chicago, IL:						
France	--	--	--	(4)	53	56
Japan	(4)	74	85	(4)	151	181
Netherlands	1	729	866	1	826	993
Poland	--	--	--	(4)	20	21
Spain	(4)	2	3	--	--	--
United Kingdom	(4)	3	3	(4)	3	5
Total[5]	1	809	958	2	1,053	1,255

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Cleveland, OH:						
Canada	791	42,374	44,236	931	48,944	51,003
China	--	--	--	1	19	22
Netherlands	(4)	360	411	(4)	348	405
Total[5]	792	42,734	44,647	932	49,311	51,430
Columbia-Snake, OR:						
Canada	111	5,277	5,787	18	870	915
China	672	23,704	39,359	1,011	42,203	61,500
Korea, Republic of	84	2,853	4,399	--	--	--
Thailand	--	--	--	3	129	208
Total[5]	867	31,834	49,545	1,032	43,202	62,623
Dallas, Fort Worth, TX: China	--	--	--	(4)	6	8
Detroit, MI:						
Brazil	53	2,298	2,318	--	--	--
Canada	1,263	79,344	81,192	1,213	87,486	89,240
Germany	(4)	20	21	--	--	--
Japan	--	--	--	(4)	2	2
Netherlands	(4)	82	95	(4)	358	409
South Africa	(4)	8	9	(4)	27	28
United Kingdom	1	339	339	(4)	159	159
Total[5]	1,317	82,092	83,974	1,214	88,032	89,837
Duluth, MN, Canada	158	7,121	7,951	--	--	--
El Paso, TX, Mexico	724	30,161	37,437	709	37,617	44,531
Great Falls, MT, Canada	62	3,078	3,282	25	1,425	1,495
Honolulu, HI:						
China	39	1,221	2,362	298	10,566	19,071
Philippines	312	9,728	18,220	--	--	--
Taiwan	77	2,541	4,524	196	7,104	11,797
Total[5]	428	13,490	25,106	495	17,671	30,868
Houston-Galveston, TX:						
British Virgin Islands[6]	--	--	--	(4)	67	78
China	243	9,063	17,052	1,718	75,458	127,082
Colombia[6]	116	8,371	9,462	209	15,550	16,800
Croatia	--	--	--	(4)	6	8
Egypt	263	13,428	21,985	49	4,549	6,323
France	(4)	18	20	(4)	72	83
Germany	(4)	113	136	(4)	84	110
Greece	292	11,042	16,723	81	3,591	5,751
Korea, Republic of	1,259	45,315	70,928	1,009	41,838	68,752
Netherlands	--	--	--	(4)	42	47
Peru	47	1,013	1,603	--	--	--
Sweden	--	--	--	(4)	42	47
Taiwan	--	--	--	43	1,591	3,096
Thailand	309	15,682	27,591	259	10,001	18,590
Turkey	44	2,024	3,265	--	--	--
United Arab Emirates	1	106	170	--	--	--
United Kingdom	1	249	249	1	563	563
Venezuela	44	2,462	3,552	--	--	--
Total[5]	2,619	108,886	172,737	3,371	153,455	247,330

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Laredo, TX:						
Canada	--	--	--	(4)	2	2
Mexico	142	16,531	17,386	222	23,833	25,147
Total[5]	142	16,531	17,386	222	23,835	25,149
Los Angeles, CA:						
China	1,874	80,939	128,099	2,015	92,601	140,948
Colombia	1	165	290	(4)	39	54
Egypt	(4)	37	73	--	--	--
Germany	--	--	--	(4)	31	47
India	--	--	--	1	113	132
Indonesia	211	7,385	13,630	72	2,772	5,067
Japan	2	647	1,079	2	511	926
Korea, Republic of	--	--	--	(4)	5	5
Malaysia	(4)	4	4	--	--	--
Netherlands	(4)	17	22	--	--	--
Peru	2	196	294	--	--	--
Taiwan	214	9,694	14,053	41	2,190	3,020
Thailand	745	34,031	55,466	1,289	64,689	97,756
Turkey	--	--	--	(4)	8	9
United Arab Emirates	3	308	437	2	153	261
United Kingdom	(4)	189	189	(4)	77	78
Total[5]	3,053	133,613	213,635	3,422	163,188	248,302
Miami, FL:						
Belgium	1	132	140	--	--	--
Brazil	--	--	--	12	503	737
British Virgin Islands[6]	--	--	--	16	1,910	2,459
China	85	3,231	6,250	461	16,996	35,216
Colombia[6]	16	1,782	2,472	24	1,581	2,192
Denmark	51	3,647	5,536	42	3,061	4,960
Egypt	33	1,225	2,149	48	2,833	4,222
Germany	(4)	120	132	--	--	--
Greece	439	16,157	26,207	219	10,186	14,469
India	--	--	--	(4)	6	11
Italy	(4)	14	17	--	--	--
Mexico	86	8,564	10,781	85	8,972	11,268
Portugal	--	--	--	(4)	2	3
Spain	96	7,743	12,769	69	7,362	10,043
Sweden	1,006	32,229	55,452	882	35,729	54,958
Taiwan	13	941	1,448	66	2,392	4,726
Thailand	80	2,996	5,959	40	1,482	2,867
Turkey	238	9,189	15,442	186	8,440	12,075
United Kingdom	(4)	74	74	(4)	8	9
Venezuela	120	6,783	9,389	36	2,356	3,203
Total[5]	2,265	94,826	154,218	2,186	103,822	163,421
Milwaukee, WI, Canada	198	8,836	8,936	--	--	--
Minneapolis, MN, Canada	38	2,086	2,302	179	11,129	12,067
Mobile, AL:						
China	15	653	1,077	162	5,878	13,678
Colombia	137	5,977	8,988	--	--	--

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Mobile, AL—Continued:						
Egypt	16	769	1,295	--	--	--
Greece	14	689	1,152	162	7,230	11,488
Korea, Republic of	15	631	1,017	--	--	--
Taiwan	8	352	612	--	--	--
Thailand	61	2,711	4,786	168	7,878	13,072
Venezuela	248	12,760	16,706	29	1,900	2,160
Total[5]	514	24,542	35,632	521	22,885	40,398
New Orleans, LA:						
China	552	29,337	38,095	1,327	72,471	94,281
Colombia	180	6,937	9,141	321	14,871	18,299
Croatia	33	6,230	7,544	29	5,662	6,806
Egypt	153	13,371	14,892	--	--	--
Greece	245	9,553	17,018	--	--	--
Korea, Republic of	897	29,316	52,462	1,024	42,114	57,984
Peru	998	34,336	58,631	822	40,108	54,371
Spain	78	5,652	6,533	--	--	--
Taiwan	528	16,179	40,089	464	18,048	33,155
Thailand	238	7,511	15,827	522	34,059	39,512
Turkey	102	6,647	11,095	119	9,814	13,915
United Kingdom	(4)	177	177	--	--	--
Venezuela	90	5,658	7,162	--	--	--
Total[5]	4,095	170,906	278,666	4,629	237,149	318,323
New York, NY:						
China	8	281	611	143	5,490	9,040
Colombia	1	125	176	2	561	617
Croatia	--	--	--	(4)	142	162
Denmark	--	--	--	40	3,600	3,988
France	(4)	5	5	(4)	3	4
Germany	--	--	--	(4)	34	39
Greece	403	14,728	25,929	448	23,791	32,936
Netherlands	26	2,194	2,443	(4)	264	291
Norway	432	21,841	29,116	233	9,849	15,077
Poland	(4)	59	62	(4)	52	56
Sweden	7	1,812	2,164	2	1,612	1,945
Taiwan	37	1,194	2,490	86	3,099	5,247
Thailand	--	--	--	42	1,773	3,807
Turkey	159	6,023	11,573	122	5,644	9,384
United Kingdom	1	719	723	(4)	52	52
Venezuela	190	10,891	14,172	89	6,012	6,964
Total[5]	1,265	59,872	89,464	1,207	61,978	89,609
Nogales, AZ, Mexico	1,068	46,007	63,252	1,080	59,042	76,311
Norfolk, VA:						
Bulgaria	303	16,921	20,325	295	16,297	19,634
Canada	--	--	--	13	963	963
China	36	1,306	2,753	242	9,468	16,644
Colombia	156	7,509	10,618	--	--	--

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Norfolk, VA—Continued:						
France	74	16,486	19,483	97	22,675	25,232
Germany	(4)	91	101	--	--	--
Greece	33	1,205	2,263	--	--	--
Netherlands	(4)	170	205	(4)	124	145
Romania	--	--	--	80	3,384	4,627
Sweden	11	511	578	(4)	31	34
United Kingdom	1	346	421	(4)	191	225
Venezuela	84	3,447	6,277	7	244	478
Total[5]	697	47,992	63,025	734	53,378	67,982
Ogdensburg, NY:						
Canada	336	24,042	24,402	418	33,199	33,502
Germany	(4)	5	5	(4)	3	3
Total[5]	336	24,047	24,407	418	33,202	33,505
Pembina, ND, Canada	178	8,686	9,081	122	5,934	6,205
Philadelphia, PA:						
Belgium	(4)	18	21	(4)	29	31
Germany	2	401	1,270	(4)	15	23
Korea, Republic of	--	--	--	143	8,559	8,589
Netherlands	2	993	1,257	2	1,287	1,572
Switzerland	74	4,598	4,618	--	--	--
Thailand	417	11,535	13,941	460	13,695	16,028
United Kingdom	--	--	--	(4)	120	123
Total[5]	494	17,545	21,106	605	23,704	26,364
Portland, ME, Canada	156	18,254	19,168	84	10,307	11,042
Providence, RI:						
Canada	--	--	--	32	2,119	2,854
China	103	3,787	6,536	55	2,104	4,385
Turkey	82	3,120	5,908	164	6,895	11,431
Venezuela	555	22,125	34,829	400	18,577	26,573
Total[5]	740	29,031	47,274	652	29,695	45,243
San Diego, CA:						
Mexico	153	9,019	9,175	76	5,250	5,315
Taiwan	549	27,211	38,988	604	31,805	44,028
Thailand	15	1,468	1,999	40	2,221	3,215
Total[5]	717	37,698	50,162	720	39,277	52,559
San Francisco, CA:						
China	671	31,530	47,192	1,611	75,588	111,273
Indonesia	654	22,096	45,082	39	1,572	2,595
Israel	(4)	8	8	--	--	--
Japan	(4)	3	3	(4)	33	48
Taiwan	200	8,128	13,149	399	17,351	25,230
Thailand	837	33,716	53,981	750	33,936	55,304
United Arab Emirates	1	55	91	1	45	68
United Kingdom	(4)	87	87	1	266	266
Total[5]	2,363	95,623	159,593	2,800	128,793	194,784

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Savannah, GA:						
China	--	--	--	1	85	175
Colombia	79	4,309	5,420	185	12,556	16,238
Finland	--	--	--	(4)	14	16
Netherlands	(4)	25	26	(4)	84	94
Romania	--	--	--	(4)	2	3
United Kingdom	1	392	460	(4)	29	29
Total[5]	81	4,726	5,907	186	12,771	16,555
Seattle, WA:						
Canada	1,153	56,704	63,696	952	46,055	50,848
China	119	4,626	7,069	419	18,251	26,620
Germany	(4)	167	242	--	--	--
Japan	1	431	665	(4)	129	213
Korea, Republic of	136	4,612	7,189	248	9,413	13,631
Netherlands	(4)	14	17	(4)	78	92
Taiwan	51	2,097	3,236	--	--	--
Thailand	28	808	1,386	--	--	--
Total[5]	1,489	69,459	83,502	1,619	73,925	91,404
St. Albans, VT, Canada	134	14,160	15,172	128	14,718	16,076
St. Louis, MO:						
China	(4)	9	17	--	--	--
Croatia	1	353	447	(4)	7	9
Netherlands	(4)	318	379	(4)	216	253
Total[5]	1	681	842	(4)	224	262
Tampa, FL:						
Australia	(4)	37	37	--	--	--
Brazil	377	20,729	25,368	442	22,630	29,651
British Virgin Islands[6]	--	--	--	(4)	17	22
China	297	11,178	20,911	1,053	40,990	72,176
Colombia[6]	586	29,828	39,721	551	29,248	40,165
Denmark	177	12,669	19,442	187	13,709	22,237
Egypt	103	4,589	7,961	179	9,521	13,939
Greece	675	26,044	37,140	295	13,080	19,823
Hong Kong	77	1,858	1,911	--	--	--
Mexico	--	--	--	51	4,440	5,383
Spain	39	1,672	2,139	--	--	--
Sweden	25	856	1,451	5	171	287
Taiwan	57	2,288	4,332	244	8,711	17,472
Thailand	163	7,260	12,732	226	10,273	17,807
Turkey	50	1,869	3,382	--	--	--
United Kingdom	(4)	49	73	--	--	--
Venezuela	852	41,566	58,773	265	14,173	19,954
Total[5]	3,478	162,493	235,374	3,499	166,961	258,917
U.S. Virgin Islands:						
Barbados	2	111	147	--	--	--
Venezuela	63	2,684	3,721	56	3,083	3,951
Total[5]	65	2,795	3,868	56	3,083	3,951
Wilmington, NC:						
China	--	--	--	13	479	1,021
Colombia	270	13,543	17,328	324	19,650	24,985
Dominican Republic	77	4,406	6,188	24	1,295	1,788

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Wilmington, NC—Continued:						
Indonesia	--	--	--	18	700	958
Mexico	--	--	--	42	2,927	3,973
Venezuela	42	2,217	3,057	--	--	--
Total[5]	390	20,166	26,573	421	25,051	32,726
U.S. total[5]	33,261	1,547,198	2,210,475	35,566	1,825,530	2,526,864
Puerto Rico (San Juan):						
Argentina	(4)	4	4	--	--	--
Belgium	1	39	95	--	--	--
Canada	--	--	--	(4)	21	22
China	--	--	--	78	2,891	4,686
Colombia	5	589	806	12	1,427	1,882
Costa Rica	(4)	3	4	--	--	--
Denmark	212	8,054	13,499	27	1,508	2,337
France	--	--	--	(4)	4	4
Honduras	15	578	588	--	--	--
Korea, Republic of	146	5,130	9,410	201	9,649	15,716
Mexico	12	1,189	1,733	12	1,281	1,816
Spain	(4)	4	4	(4)	4	4
Total[5]	391	15,590	26,142	330	16,785	26,467
Grand total[5]	33,652	1,562,788	2,236,617	35,896	1,842,315	2,553,331

[r]Revised. -- Zero.
[1]Includes all varieties of hydraulic cement and clicker.
[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
[4]Less than ½ unit.
[5]Data may not add to totals shown because of independent rounding.
[6]Material from British Virgin Islands is thought to be from Colombia.

Source: U.S. Census Bureau.

TABLE 19

U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Country	Quantity	Customs[1]	C.i.f.[2]	Quantity	Customs[1]	C.i.f.[2]
United States:						
Brazil	377	20,729	25,368	454	23,133	30,388
Bulgaria	303	16,921	20,325	295	16,297	19,634
Canada	4,301	242,961	260,188	4,089	243,292	261,558
China	4,149	169,832	277,318	9,260	397,302	641,665
Colombia	1,599	78,333	103,969	1,598	90,910	116,940
Egypt	350	15,843	27,309	215	11,010	16,540
Greece	2,755	103,952	171,448	1,950	91,745	135,493
Indonesia	865	29,481	58,713	130	5,045	8,620
Korea, Republic of	2,443	84,944	141,159	2,307	92,336	143,143
Mexico	1,856	75,290	99,365	1,875	97,221	122,203
Norway	504	23,645	30,562	233	9,849	15,077
Peru	671	25,497	42,607	431	17,791	28,132
Philippines	312	9,728	18,220	--	--	--
Romania	--	--	--	212	9,442	13,520
Spain	52	1,882	3,033	--	--	--
Sweden	1,031	33,085	56,902	886	35,900	55,245
Taiwan	1,759	71,448	124,679	2,180	93,516	148,997
Thailand	2,864	113,556	188,138	3,255	142,552	223,448
Turkey	581	22,759	40,446	487	22,015	34,587
Venezuela	1,682	76,026	113,914	795	39,210	55,213
Other	98	3,532	3,664	5	567	587
Total[3]	28,551	1,219,444	1,807,328	30,655	1,439,133	2,070,990
Puerto Rico:						
China	--	--	--	78	2,891	4,686
Denmark	202	7,192	11,822	18	661	911
Korea, Republic of	78	3,240	5,824	201	9,649	15,716
Other	(4)	11 r	12 r	2	4	4
Total[3]	280	10,442	17,658	299	13,205	21,317
Grand total[3]	28,832	1,229,886	1,824,986	30,952	1,452,338	2,092,307

[r]Revised. -- Zero.

[1]The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[3]Data may not add to totals shown because of independent rounding.

[4]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 20

U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Country	Quantity	Customs[1]	C.i.f.[2, 3]	Quantity	Customs[1]	C.i.f.[2, 3]
United States:						
Belgium	1	132	140	--	--	--
Brazil	37	2,126	2,151	--	--	--
British Virgin Islands[5]	--	--	--	16	1,993	2,559
Canada	329	39,057	40,454	347	42,832	43,938
China	17	1,672	3,408	38	3,577	5,752
Colombia[5]	42	4,112	5,507	25	3,638	4,461
Denmark	227	16,316	24,978	265	19,916	30,732
Dominican Republic	77	4,406	6,188	24	1,295	1,788
Egypt	24	2,200	2,780	60	5,893	7,945
Germany	(4)	34	36	(4)	20	29
Greece	31	958	958	--	--	--
India	--	--	--	1	119	143
Mexico	251	29,302	32,353	305	36,126	40,150
Netherlands	7	592	815	--	--	--
Norway	17	1,653	2,012	--	--	--
Peru	2	196	294	--	--	--
Spain	73	6,903	11,231	69	7,362	10,043
Switzerland	74	4,598	4,618	--	--	--
Thailand	29	4,163	5,530	41	4,896	7,441
Turkey	94	6,114	10,219	104	8,779	12,220
United Arab Emirates	5	468	698	2	198	329
Venezuela	121	7,007	9,628	4	379	395
Other	(4)	59	59	24	5	6
Total[6]	1,457	132,067	164,055	1,302	137,027	167,929
Puerto Rico:						
Belgium	1	39	95	--	--	--
Colombia	5	589	806	12	1,427	1,882
Denmark	10	862	1,677	8	847	1,426
Mexico	12	1,189	1,733	12	1,281	1,816
Total[6]	28	2,680	4,311	33	3,555	5,124
Grand total[6]	1,485	134,747	168,366	1,335	140,582	173,053

-- Zero.

[1]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight and other delivery charges to the first port of entry.

[3]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of data for gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[4]Less than ½ unit.

[5]Material from British Virgin Islands is thought to be from Colombia.

[6]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 21
U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2005			2006		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Brazil	53	2,298	2,318	--	--	--
Canada	740	33,792	34,176	608	36,110	36,471
China	557	29,966	38,458	1,240	67,499	85,729
Colombia	203	12,536	14,282	239	16,361	18,396
Croatia	(4)	64	94	(4)	36	48
Egypt	184	12,379	14,627	--	--	--
France	72	15,250	18,106	96	21,697	24,138
Korea, Republic of	83	2,427	3,695	237	14,213	14,243
Peru	374	9,853	17,626	391	22,317	26,239
Spain	33	2,061	2,098	--	--	--
Sweden	15	542	599	--	--	--
Thailand	--	--	--	502	32,688	37,278
Venezuela	543	27,360	36,078	111	5,899	7,824
Total[5]	2,858	148,528	182,158	3,425	216,821	250,366
Puerto Rico:						
Honduras	15	578	588	--	--	--
Korea, Republic of	69	1,891	3,586	--	--	--
Total[5]	83	2,469	4,174	--	--	--
Grand total[5]	2,941	150,996	186,332	3,425	216,821	250,366

-- Zero.

[1]For all types of hydraulic cement.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2002	2003	2004	2005	2006[e]
Afghanistan[e]	60	70	70	60	50
Albania	--	578	573	575	600
Algeria[e]	9,000	9,000	11,000 [r]	11,296 [r, 3]	15,000
Angola	597	700	754	1,315 [r]	1,373 [3]
Argentina	3,911	5,217	6,254	7,595	8,929 [3]
Armenia	355	384	501	605	610
Australia[e]	7,550	8,000	8,000	9,000	9,000
Austria	3,918	3,886	3,976	4,736	4,700
Azerbaijan	848	1,013	1,428	1,538	1,605 [3]
Bahrain	67	129	153	191	190
Bangladesh[e]	5,000	5,000	5,000	5,100	5,100
Barbados	298	325	322	320 [e]	320
Belarus	2,171	2,472	2,731	3,131	3,495 [3]
Belgium	6,980	6,550	6,715	7,594 [r]	8,192 [3]
Benin[e]	250	250	250	250	250
Bhutan[e]	160	160	170	170	180
Bolivia	1,010	1,138	1,276	1,440	1,636 [3]
Bosnia and Herzegovina	913	891	1,045	1,026 [r]	1,226 [3]
Brazil	38,027	34,010	34,413	36,673	39,540 [p]
Brunei	241	236	242	266 [r]	270
Bulgaria[e]	2,137 [3]	2,100	2,100	2,100	2,000
Burkina Faso[e]	30	30	30	30	30
Burma[4]	471	572	519	543	570 [3]
Cameroon	937	949	1,032	1,000 [e]	1,000
Canada	13,079	13,416	13,863	14,179	14,355 [3]
Chile	3,462	3,622	3,798	3,999	4,112 [3]
China	725,000	862,080	970,000	1,068,850 [r]	1,204,110 [p, 3]
Colombia	6,604 [5]	7,337	7,822	9,959	10,038 [3, 5]
Congo (Brazzaville)	--	--	--	100	100
Congo (Kinshasa)	265	331	403	511 [r]	530 [3]
Costa Rica[e]	1,200	1,600	1,900	2,000	2,000
Côte d'Ivoire[e]	650	650	650	650	650
Croatia	3,378	3,654	3,811	3,481 [r]	3,633 [3]
Cuba	1,327	1,346	1,401 [r]	1,567 [r]	1,705 [3]
Cyprus	1,438	1,637	1,689	1,805	1,786 [3]
Czech Republic	3,217	3,465	3,829	3,978	4,222 [3]
Denmark	2,028	1,953	2,150	2,120 [r]	2,115 [3]
Dominican Republic	3,050	2,907 [r]	2,654 [r]	2,779 [r]	2,800
Ecuador[e]	3,000	3,100	3,000 [r]	3,000 [r]	3,000
Egypt	28,155	26,639	28,763	29,000 [e]	29,000
El Salvador	1,323 [r]	1,391 [r]	1,265 [r]	1,131 [r]	1,311 [3]
Eritrea[e]	45	45	45	45	45
Estonia	466	506	615	650	700
Ethiopia[6]	900	1,130	1,316	1,568	1,700
Fiji[e]	111 [r, 3]	120 [r]	120 [r]	143 [r, 3]	150
Finland	1,198	1,493	1,295 [r]	1,357 [r]	1,685 [3]
France	19,437	19,655	20,962	21,277	22,270 [3]
French Guiana[e]	62 [3]	60	60	60	60
Gabon[e]	257 [3]	260	260	260	260
Georgia	347	345	425	450 [e]	450
Germany	31,009	32,749	31,854	30,629	33,516 [3]
Ghana[e]	1,900	1,900	1,900	1,900	1,900
Greece	14,282	14,638	15,039	15,166 [r]	15,674 [3]
Guadeloupe	230	230	230	230 [e]	230
Guatemala[e]	2,000 [r]	2,000 [r]	2,200 [r]	2,400 [r]	2,500
Guinea[e]	360	360	360	360	360
Haiti[e]	290 [3]	290 [r, 3]	300	300	300
Honduras	1,224 [r]	1,268 [r]	1,392 [r]	1,384 [r]	1,400
Hong Kong	1,206	1,189	1,039	1,005	1,010
Hungary	3,510	3,573	3,349	3,371 [r]	3,724 [3]

See footnotes at end of table.

TABLE 22—Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2002	2003	2004	2005	2006[e]
Iceland	83	90	90 e	95 e	95
India[e]	115,000	123,000 3	130,000	145,000	160,000
Indonesia	34,640	35,500	33,230 r	33,917 r	35,000
Iran	28,600	30,460	32,198	32,650	33,000
Iraq[e]	6,834 3	1,901 3	2,500	3,000	3,500
Ireland	3,320	3,830	5,000 r, e	5,083 r	4,981 3
Israel	4,584	4,632	4,494	5,093 r	5,089 3
Italy	41,722 r	43,580 r	45,343 r	40,284 r	47,814 3
Jamaica	614	608	808	845	761 3
Japan	71,828	68,766	67,376	69,629	69,942 3
Jordan	3,558	3,515	3,908	4,046	3,967 3
Kazakhstan	2,129	2,570	3,662	3,975	4,200
Kenya	1,463	1,658	1,789	2,123	2,200
Korea, North[e]	5,320	5,540	5,630	5,700	5,700
Korea, Republic of	55,514	59,194	54,330	51,391	54,971 3
Kuwait	1,584	1,863	2,635	2,145 r	2,200
Kyrgyzstan	533	757	870 r	900 e	1,211 3
Laos[e]	240	250	250	250 r	250
Latvia	260	295	284	280 e	280
Lebanon	2,852	3,500 r	4,500 r	4,500 r	5,000
Liberia	54	25 e	121 r	144 r	155 3
Libya[e]	3,300	3,500 3	3,600	3,621 r, 3	3,600
Lithuania	606	597	753	832	850
Luxembourg	728	714	797	760 r	800
Macedonia	600 e	768	820	800	800
Madagascar[e]	30 r	200 r	170 r	150 r	150
Malawi	109 r	161 r	120	160 r, e	200
Malaysia	14,336	17,243	15,690	17,860	18,000
Martinique[e]	221 3	220	220	220	220
Mauritania[e]	200	200	300 3	300	374 3
Mexico	33,372	33,593	34,992	37,452 r	40,616 3
Moldova	300	255	440	641 r	837 3
Mongolia	148	162	62	112	141 3
Morocco[e]	10,200	10,400	11,000	11,000	11,000
Mozambique	490 r	600 r	570 r	560 r	720 3
Nepal[e]	290	295	285	290	295
Netherlands	3,085	2,450	2,380	2,496 r	2,790
New Caledonia	100	100	115 r	119 r	125
New Zealand[e]	1,000 r	1,080 r	1,110 3	1,100	1,100
Nicaragua	549	890 r	521 r	530 r	530
Niger[e]	54	54 r	54 r	54 r	54
Nigeria[e]	2,100	2,300	2,300	2,400	3,000
Norway	1,631	1,650	1,420	1,613 r	1,695 3
Oman[e]	1,700	2,100	2,500	2,621 r, 3	2,600
Pakistan[e]	11,000	13,000	15,000 r	17,000 r	20,000
Panama	748 r	889 r	1,042 r	1,050 r	1,050
Paraguay[e]	450 r	520 r	470 r	550 r	600
Peru	3,980	4,000	4,590	4,600 e	5,000
Philippines	13,400 r	13,060	13,346 r	15,494 r	12,033 3
Poland	10,948	11,653	12,566	12,646	14,688 3
Portugal	9,759	8,567	8,843	8,438 r	8,340 3
Qatar[e]	1,340	1,400	1,400	1,500 r, 3	1,500
Réunion[e]	380	380	380	380	400
Romania	5,680	5,992	6,239	7,032	7,000
Russia	37,700	41,000	45,700	48,500 r	54,700 3
Rwanda	101	110 r	104	101 r	100
Saudi Arabia	23,287 r	24,147 r	25,380 r	26,064	27,053 3
Senegal	1,653	1,694	2,391 r	2,623 r	2,884 3
Serbia and Montenegro[7]	2,396	2,075	2,240	2,276 r	2,565 3
Sierra Leone	144	169	180	172 r	234 3

See footnotes at end of table.

TABLE 22—Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2002	2003	2004	2005	2006[e]
Singapore[e]	200	150 [3]	--	--	--
Slovakia	3,141	3,147	3,158	3,499	3,593 [3]
Slovenia	1,178	1,370	1,186	1,114 [r]	1,269 [3]
South Africa, sales[8]	8,525	8,883	12,348	13,000 [e]	13,000
Spain, including Canary Islands	42,417	44,747	46,593	50,347	54,033 [3]
Sri Lanka	1,018	1,164	1,400 [r]	1,500 [r]	1,600
Sudan	205	272	307	331 [r]	202 [3]
Suriname[e]	65	65	65	65	65
Sweden	2,642	2,476	2,588	2,709 [r]	2,952 [3]
Switzerland	3,771	3,613	3,851	4,022	4,040 [3]
Syria	4,679	4,824	4,757	4,700 [r, e]	4,700
Taiwan	19,363	18,474	19,050	19,891	19,294 [3]
Tajikistan	100	166	194	253	282 [3]
Tanzania	1,026	1,186	1,281	1,366 [r]	1,422 [p]
Thailand	31,679	32,530	35,626	37,872	39,408 [3]
Togo[e]	800	800	800	800	800
Trinidad and Tobago	744	766	768	686 [r]	883 [3]
Tunisia	6,022	6,038	6,662 [r]	6,691 [r]	6,932 [3]
Turkey	32,577	35,077	38,796	42,787	47,499 [3]
Turkmenistan[e]	450	450	550 [r]	650 [r]	800
Uganda	506	507	559	630 [r, e]	630
Ukraine	7,142	8,900	10,600 [e]	12,183	13,732 [3]
United Arab Emirates[e]	7,000	8,000	9,000 [r]	9,800 [r, 3]	9,800
United Kingdom	11,089 [r]	11,215 [r]	11,405 [r]	11,216 [r]	12,119 [3]
United States, including Puerto Rico[9]	91,266	94,329	99,015	100,903	99,712 [3]
Uruguay[e]	1,000	1,050	1,050	1,050	1,050
Uzbekistan[e]	4,000	4,000	4,800	5,068 [3]	5,000
Venezuela[e]	7,000	7,700	9,000	10,000	11,000
Vietnam	21,121	24,127	26,153 [r]	30,808 [r]	32,690 [3]
Yemen	1,561	1,541	1,546	1,573 [r]	1,600
Zambia[e]	230 [3]	350	480	435	450
Zimbabwe[e]	600	400	500 [r]	600 [r]	700
Total	1,850,000	2,030,000	2,190,000	2,350,000 [r]	2,560,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are thought to be accurate to no more than three significant digits. Data are from a variety of sources, including the European Cement Association.

[2]Table includes data available through February 27, 2008. Data may include clinker exports for some countries.

[3]Reported figure.

[4]Data are for fiscal year ending March 31 of the following year.

[5]Data for 2002 and 2006 are for gray cement only; white cement output was likely to have been an additional 50,000 to 100,000 metric tons per year.

[6]Year ending July 7 of that stated.

[7]Serbia and Montenegro dissolved June 2006. Data are for Serbia only, as Montenegro has no cement plants.

[8]Data have been adjusted to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted, in metric tons, to: 2002—1,099,044; 2003—1,190,000; 2004—1,436,000; 2005—1,440,000 (estimated); and 2006—1,440,000.

[9]Portland and masonry cements only.

science for a changing world

2007 Minerals Yearbook

CEMENT [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

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Cement

By Hendrik G. van Oss

Domestic survey tables were prepared by Michelle B. Blackwell, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Production of portland and masonry cement in the United States in 2007 fell by nearly 3% to 95.5 million metric tons (Mt) (table 1). Cement sales to final customers totaled 114.8 Mt in 2007, down by about 10% (table 9). Imports of cement totaled 21.5 Mt, fully one-third below the record imports in 2006. Despite lower sales volumes, cement prices on average increased modestly in 2007; sales overall totaled $11.8 billion for the year (tables 1, 11−13). Based on typical portland cement mixing ratios in concrete, the delivered value of concrete (excluding mortar) in the United States in 2007 was estimated to be at least $52 billion.

Percentage or other changes expressed in this report compare activity in 2007 with that of 2006 unless specified otherwise. Except where otherwise indicated, activity levels in this report exclude those in Puerto Rico. Except for some trade data, cements covered in this report are limited to those hydraulic varieties broadly classified as portland cement (including blended cement[1] and other varieties listed in table 15) and/or masonry cement (including portland-lime and plastic cements); these are the binding agents in concrete and most mortars. Other hydraulic cements (notably aluminous cement) are included only in the trade data in tables 16–18 and 21 (clinker) and within the world production data in table 22. Excluded are pure (unblended) supplementary cementitious materials (SCM), such as fly ash, other pozzolans, and ground granulated blast furnace slag (GGBFS).

The bulk of this report is based on data compiled from U.S. Geological Survey (USGS) annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are independent of U.S. cement manufacturers. For 2007, forms were received from 151 of 153 facilities canvassed, a response rate of 99%, and which included all production sites. For 2006, forms were received from 151 of 156 facilities canvassed, including all but one of the production sites (the production data for this site were obtained by telephone). The data exclude several importers that have yet to participate in the surveys. To the degree that they are selling independently of the participating companies, sales by the missing importers for 2006–07 are estimated as being no more than 1% of the total portland cement sales tonnages shown in this report. Background information on cement and its manufacture, as well as on the USGS cement canvasses, is given in van Oss (2005).

[1]Sales data for blended cements (also called composite cements) listed separately from portland cement are available in the monthly cement reports of the U.S. Geological Survey Mineral Industry Surveys series, starting with January 1998.

Environmental Issues

Environmental issues associated with the cement industry mostly relate to the manufacture of the intermediate product called clinker. In clinker manufacture, the burning of large amounts of raw materials and fuels leads, or potentially leads, to significant emissions of carbon dioxide (CO_2), nitrogen oxides, sulfur oxides (SOx), mercury and some other metals, volatile organic carbon compounds, and particulates. Increasingly, these emissions are regulated or are being considered for regulation. The largest volume emissions are of CO_2. Overall, generation of CO_2 by the U.S. cement industry in 2007 was in the range of 77 to 81 Mt or about 0.90 to 0.94 metric ton (t) of CO_2 per ton of clinker; the high end of the range reflects fuel combustion emissions derived using “standard” heat values for the fuels consumed (table 7) and the low end uses the heat values actually reported by the individual plants. The fuel combustion emissions exclude those associated with generation of the electricity purchased by the cement industry. Both ends of the range include a standard emissions factor from calcination of limestone of 0.51 t of CO_2 per ton of clinker as detailed by the Intergovernmental Panel on Climate Change (2006). However, using typical average calcium oxide (CaO) contents of slags, ashes, and similar alternative raw materials burned in the kilns (table 6), the emissions factor for 2007 is reduced by about 3% to 0.49 t of CO_2 per ton of clinker, and the total emissions of CO_2 are thus reduced by about 1.3 Mt. The comparable reduction in 2006 was about 1 Mt or 2.5%. Relative reductions can be significantly larger at the individual plants that actually burn these alternative raw materials. The fuel combustion component of emissions (0.39 to 0.43 t of CO_2 per ton of clinker; unchanged from that in 2006) represents a 9% to 10% unit reduction from the range in 2000 calculated by van Oss and Padovani (2003, p. 99). Strategies to reduce unit (per ton of product) emissions include encouraging the use of SCM in finished cement and in concrete to reduce the clinker content of these products and allowing the addition of “inert” fillers to boost cement output without simultaneously boosting clinker output. In regard to the latter, both the ASTM International standard for portland cement (ASTM C–150–05) and the similar American Association of State Highway and Transportation Officials (AASHTO) standard M85 now allow for the addition of up to 5% ground limestone in the finish mill. Other approaches to reducing emissions include utilization of alternative raw materials and fuels, and technological upgrading of plants.

Production

Weakness in sales of portland cement in 2007 continued a trend from at least mid-2006 but had relatively little effect on cement production in either year. The industry was able to accommodate reduced demand largely through drawing down on cement stockpiles and by reducing imports. Portland cement output in 2007 fell by just 1.8% (table 3). Production declines were fairly evenly distributed regionally; only five districts showed increases.

The market for masonry cement fared poorly in 2007. A continuing decline in residential construction resulted in a 20% drop in masonry cement production to just 4.3 Mt and a 5% increase in yearend stocks (table 4). The production decline was in contrast to 2006, when, despite a prolonged downturn in residential construction, production fell only slightly.

With common parents combined under the larger subsidiary's name and with joint ventures apportioned, the 10 leading companies at yearend 2007 were, in descending order of portland cement production, Holcim (US) Inc.; CEMEX, Inc.; Lafarge North America Inc.; Lehigh Cement Co.; Buzzi Unicem USA Inc. (including Alamo Cement Co.); Ash Grove Cement Co.; Texas Industries, Inc. (TXI); Essroc Cement Corp.; California Portland Cement Co.; and St. Marys Cement Inc. The U.S. industry continued to be heavily consolidated—the leading 5 cement companies, combined, had nearly 60% of total U.S. portland cement production, and the leading 10 companies accounted for almost 83% of total production. Of the above named companies, all except Ash Grove and TXI were foreign owned as of yearend, and for the industry overall, about 80% of total cement output was by foreign-owned companies.

Clinker production in 2007 fell by 2.7% (table 5). Overall, production of clinker fell in all months except April and May and for the year in all but four districts. Yearend stocks[2] rose by 22%. Apparent annual clinker production capacity for the country was unchanged at 101 Mt, although there were regional changes. Capacity utilization for the country fell modestly to about 85%, but this calculation is dependent on the reported breakout of downtime for scheduled routine maintenance and this is not always reported correctly. Most plants have total downtimes in excess of routine maintenance; thus an overall capacity utilization of 85% or higher is considered to indicate a plant (or district) operating more or less at full practicable capacity. Partial year operation of new or old kilns yields low capacity utilization ratios because, whereas the annual capacities for these kilns are fully counted, they will have relatively low comparative clinker outputs. Significant capacity declines in Illinois and southern Texas in 2007 were because of closures (one kiln per district) at yearend 2006. A large apparent capacity increase in Maryland appears to be the result of underreporting of daily capacity at one plant in recent years.

Nonfuel raw materials consumed to make clinker and cement are listed in table 6. The 2007 ratios among clinker raw materials (as contributors of major oxides) appear to be broadly similar to those in 2006. Direct comparison of ratios among raw materials should be done with caution; tonnage and tonnage ratio changes could reflect widespread raw material substitution, activities at just a few plants, or even errors in reporting.

For fly ash and bottom ash, a comparison can be made between the data in table 6 and those published for sales (by coal-fired electric utilities) of coal combustion products (for cement or as raw feed for clinker) by the American Coal Ash Association (ACAA). For fly ash, table 6 lists consumption of 3.17 Mt of fly ash for clinker and 0.08 Mt for cement; the corresponding ACAA number (both uses combined) is about 3.3 Mt (American Coal Ash Association, 2008). For bottom ash, consumption was about 1.05 Mt for clinker only (table 6), and the ACAA reported 0.55 Mt of bottom ash sales. The difference in the two datasets probably reflects a difference between consumption (table 6)—which is from a mix of ongoing purchases and drawdown of stockpiles—and sales (ACAA) and the fact that the ACAA data are extrapolated. The ACAA also reported minor sales (about 6,200 t) of boiler slag, but the host category in table 6 ("other slag") contains a number of slag types (mostly from various smelters), and the identity of the slags is poorly constrained. Consumption of gypsum by the cement industry was 5.16 Mt in 2007 (table 6). Of this amount, at least 0.45 Mt was synthetic gypsum (the differentiation from natural gypsum is not required on the USGS canvass). This was notably less than the ACAA reported sales of 0.6 Mt of flue gas desulfurization (FGD) gypsum to the cement industry, and this material would exclude that from SOx scrubbers at the cement plants themselves.

Data for fuel quantities consumed by the cement industry are listed in table 7. As with the nonfuel raw materials, data shifts can reflect activities at just a few plants. In terms of overall mass ratios among fuels (in total) and overall to clinker production, few significant changes in 2007 are evident. Wet kilns reported burning significantly more fuel oil and less liquid waste during the year, but this may reflect a component of waste oil being reported as fuel oil. Changes in natural gas consumption likely relate to maintenance issues, as the fuel is mainly used for preliminary heating of kilns after shutdowns. Although not revealed in table 7, overall heat consumption (gross heat basis) in 2006–07 was about 4.5 billion joules (GJ) per metric ton of clinker. Wet plants were unchanged at an average of about 6.5 GJ per ton of clinker, and dry kiln plants averaged about 4.0 GJ per ton of clinker, down by about 2%. The two remaining combination plants (operating both wet and dry kilns) averaged 6.1 GJ per ton in 2007, up by 24.5% from the three plants in this category in 2006. Overall, 2007 continued a multiyear trend of generally decreasing unit heat or fuel consumption by the industry;[3] this trend reflected a number of plant conversions from wet to dry technology and a variety of other energy-saving measures. Improved energy efficiency has led to reductions in unit fuel combustion emissions of CO_2. As in past years, the largest share of heat energy used in 2007 was from coal (about 65%) and petroleum coke (20%).

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[2]Yearend stockpiles of clinker are an artifact of data collection convenience rather than a reflection of full-year market conditions or production capacity. Generally, if the clinker is not required for immediate cement production, a plant will try to build up its stocks of clinker prior to scheduled extended kiln shutdowns so as to provide continuity of clinker feed to the finish (cement) mill. These shutdowns can happen at any time of the year.

[3]For example, the overall unit heat consumption for 2007 was 11% lower than that in 2000 as reported by van Oss and Padovani (2002; table 4).

Overall unit electricity consumption increased in 2007 (table 8), likely related to maintenance issues or upgrades (total downtime, not just that for routine maintenance). Modern dry process plants have for many years reported higher average electricity consumption per ton of cement product than many wet process plants because of a complex array of blowers and fans associated with the modern kiln lines, but the difference has become very small in recent years, largely owing to increased consumption at the remaining wet plants.

In February, Vulcan Materials Co. announced that it would purchase Florida Rock Industries, Inc.; the acquisition was completed in November (Vulcan Materials Co., 2007a, b). Florida Rock had a number of concrete and aggregates facilities in Florida and adjacent States. In Florida itself, Florida Rock had an integrated cement plant at Newberry, a cement grinding plant at Port Manatee, and a cement and GGBFS grinding plant at Tampa.

In May, HeidelbergCement AG announced that it would purchase the worldwide assets of British construction materials company Hanson PLC. The purchase was completed in August (HeidelbergCement AG, 2007a, b). Apart from a variety of concrete and aggregates facilities in the United States, other U.S. assets of Hanson included the Permanente cement plant in California and a GGBFS grinding plant at Cape Canaveral, FL. The Hanson assets were to be operated by Heidelberg's U.S. subsidiary, Lehigh Cement.

In July, CEMEX, S.A. de C.V. announced that it had completed the purchase of the worldwide assets of Australian company Rinker Group Ltd (CEMEX, S.A. de C.V., 2007a). CEMEX's initial offer, made in October 2006, had been rejected, but the bid had been increased early in 2007. With this purchase, CEMEX acquired two cement plants in Florida (at Brooksville, near a cement plant already owned by CEMEX, and at Miami), and a large number of concrete plants. The approval process for this purchase required that CEMEX sell 39 ready-mixed concrete and aggregates operations in Arizona and Florida; these sales were completed in November (CEMEX, S.A. de C.V., 2007b).

At midyear, Holcim completed the purchase of the 21% of Canadian cement producer St. Lawrence Cement Group that it did not already own (International Cement Review, 2007). St. Lawrence had two integrated plants in the United States (Catskill, NY, and Hagerstown, MD); operational management of these two plants was expected to be transferred to Holcim beginning in 2008.

Construction of GCC Rio Grande, Inc.'s 1.0-million-metric-ton-per-year (Mt/yr) plant at Pueblo, CO, was completed late in the year but did not record any clinker production until January 2008. There were no other plant openings, and no plant closures, reported during the year.

In March, Votorantim Cimento North America (a subsidiary of Votorantim Group of Brazil) reported that it was planning to construct an integrated cement plant near Perry, GA, under the operating name Houston American Cement Co. (Perkins, 2007); the plant was targeted to be operational in 2010. In September, CEMEX announced its intention to build a 1.7-Mt/yr integrated plant near Seligman, AZ (CEMEX, Inc., 2007b). The new plant, scheduled for completion in 2012, was to service the Phoenix, AZ, market, but would presumably be able to supply the Las Vegas, NV, market as well. The Seligman project announcement followed Ash Grove's late August announcement cancelling plans (announced in 2004) to build a large integrated cement plant on the Moapa Indian Reservation near Las Vegas, NV (Cement Americas, 2007).

Upgrades were underway at a number of existing plants, but most projects were still ongoing as of yearend. One completed project was that at TXI's Oro Grande, CA, plant, where a new precalciner kiln line was completed in December. The new line, which was to replace the plant's seven existing long dry kilns, was first fired in January 2008. In March, CEMEX broke ground for its project to add a new kiln line at its Balcones plant at New Braunfels, TX; the project had been announced in 2006 and was to double the plant's existing capacity (CEMEX, Inc., 2007a). The new kiln was expected to be operational in late 2008. In October, Ash Grove broke ground on its expansion project at its Foreman, AR, plant. The company was building a 1.5-Mt/yr preheater-precalciner kiln to replace the existing three wet kilns and which will more than double the plant's current capacity. The project was expected to be completed late in 2009 (Texarkana Gazette, 2007). In October, Lehigh announced that it planned to expand its Mitchell, IN, plant. The upgrade would replace the plant's existing three preheater kilns with a single preheater-precalciner kiln of approximately 1.5-Mt/yr capacity. Startup was anticipated in 2012 (Cement Newsline, 2007; Lehigh Cement Co., 2007). In August, TXI awarded contracts for a new 1.1-Mt/yr kiln line at its Hunter plant at New Braunfels, TX. The project was scheduled to be completed in late 2009 (Zachry Construction Corp., 2007). In November, Lafarge announced the start of a project to expand its Joppa plant at Grand Chain, IL, by approximately 1.8 Mt/yr; the new kiln was expected to be online in late 2010 (Lafarge North America Inc, 2007).

Consumption

The consumption data preferred by the cement industry for market analysis are monthly cement shipments (sales) tonnages to final domestic customers, by State; these data are published monthly by the USGS and have been summarized in table 9. Although the national sales totals in table 9 are similar to the shipments totals in tables 11, 12, and 14, only the table 9 breakout tonnages represent State-level consumption. The regional breakouts in tables 11, 12, and 14 simply pertain to the locations of the reporting entities (chiefly the production sites), not the locations of consumption. It is very common for shipments to cross State lines.

The severe decline in new homes construction that had characterized most of 2006 continued through all of 2007 and was accompanied by a tightening of the loan market. Housing prices fell and, together with rises in the number of home foreclosures, caused State property tax revenues to decline and general levels of consumer spending to fall. These factors threatened to reduce current and future year expenditures in a number of construction sectors. Overall, domestic portland cement consumption in 2007 fell by about 11.5 Mt or 9.4%.

Although overall consumption in 2006 was nearly a record high, the performance that year had been based on a very strong first quarter, followed by a steady decline thereafter. This trend continued throughout 2007; sales declined in every month during the year relative to the same months in 2006. For 2007 overall, consumption was lower in all but a few States; of the traditionally leading consuming States, only Texas showed an increase in consumption during the year. As noted earlier, the market decline was largely accommodated by large apparent drawdowns of cement stockpiles and very large reductions in cement imports rather than by a major drop in production. In contrast, consumption of masonry cement fell by nearly 21% and was accommodated mainly by reduced production.

The portland cement consumption (sales) data in 2007 do not include sales by some importers that have yet to participate in the USGS monthly and annual surveys. An estimate of these missing importers' sales can be made by comparing official (U.S. Census Bureau) trade data (tables 17 and 21) with the import origins of sales (table 9). The official cement imports were about 1.2 Mt higher than the foreign origins tonnages. Adjusting for the (estimated) imports of cement varieties not canvassed by the USGS (chiefly aluminous cement) and for drawdowns of imported cement stockpiles, the difference suggests that the table 9 data for 2007 underreport true overall portland cement sales by about 1 Mt or nearly 1%. It is difficult to estimate the breakout of these missing sales by State, although it is possible to do so for Texas because of the existence of a special tax on cement sales and associated public data on the sales tonnages (by company) through the Texas Comptroller of Public Accounts. Based on these records, it may be estimated that the USGS sales data for Texas overall (table 9) understate the consumption by approximately 0.28 Mt in 2007. Based on trade data (table 18), USGS consumption data for markets serviced by the Philadelphia, PA, customs district understate sales by about 0.31 Mt.

As a key construction material, cement consumption levels and trends within a given category of construction will broadly reflect levels of construction spending, although significant time lags may exist between the onset or cutoff of spending and changes in the consumption of cement. In terms of 1996 constant dollars, overall construction spending in 2007 fell by 5.6% to $710 billion (Portland Cement Association, 2009). The residential construction sector continued to be dominant at $308 billion, down by 20.2%. The decline was led by a 27.4% fall (to $190 billion) in single-family housing construction; multifamily construction spending declined by a more modest 7.9% to $31 billion. The private nonresidential construction sector was up by 12.4% overall to $163 billion, possibly owing to continued lag effects of the very strong housing sector in 2005 and early 2006. Public sector construction was up by 4.8% to about $181 billion; however, the road construction component fell by 1.6% to about $48 billion. Sewage and waste disposal construction rose by 2.2% to nearly $17 billion, but water supply construction fell by 2.8% to about $10 billion.

A breakout of portland cement sales by customer type is given in table 14. Sales to ready-mixed concrete producers accounted for about 74% of total shipments, but the true tonnage for this type of concrete was larger because some of it was recorded under other customer categories, such as road paving contractors. As listed, the sales to ready-mixed customers declined by 9%, in line with the overall decline in portland cement consumption. The decrease in residential funding is at least qualitatively reflected in a 12% fall in sales tonnages to brick and block manufacturers, as well as in the large relative drop in masonry cement sales. Residential funding declines would also appear to have influenced a nearly 14% decline in portland cement sales to pipe manufacturers and a 12% drop in sales to building materials suppliers. However, a nearly 7% decline in sales to precast-prestressed concrete contractors is not in accord with the overall increase in spending levels for private nonresidential construction and for public sector construction. Sales to road contractors fell by almost 7%; a significantly larger drop than that in road and highway construction funding. Sales to oil and gas well drillers and to mining companies were up by about 8% and 13%, respectively, both in line with high commodity prices and exploration and mining activity during the year.

Sales to final customers of different types of portland cement are listed in table 15. As in past years, sales were dominated by Types I and II cements and sulfate-resistant varieties of cement (Type V and Type II/V hybrids reported as Type V). Sales of Type V cement fell by 18.6%, reflecting large overall declines in the construction market in the southwestern States, including California. Sales of oil-well cements rose 4.1% but continued to represent a lower tonnage than portland cement sales to "oil well drillers" (table 14); relatively shallow oil and gas drilling can use standard types of portland cement.

After several years of generally steady growth, blended cement sales declined significantly in 2007. Total sales of blended cements fell by 25.5%, but the reason for this is unclear given that the percentage decline was much larger than that for sales of portland cement overall (-9.8%), of sales to any particular customer type (table 14), or of public sector construction spending (where blended cements would most likely be used). Sales of blended cement containing GGBFS fell by 33.5% to 1.09 Mt compared with the downwards revised (by 0.24 Mt) 2006 value. The revision for 2006 was to correct for Type I portland cement sold under ASTM standard C–1157; at one time, this performance standard was just for blended cements, but the standard was subsequently broadened to include both ordinary and blended hydraulic cements. The overall tonnage of blended cement containing GGBFS in 2007 is similar to that for the year (1.047 Mt) published by the Slag Cement Association (2008).

Data on the mill net values for shipments to final customers by plants and import terminals (terminal nets) are listed in tables 11 to 13. Despite significantly reduced sales tonnages, the average mill net values of portland and masonry cement rose modestly in 2007. The average mill net value for portland cement increased by $2.00 to about $101.50 per metric ton; this followed a nearly 28% unit value increase during the two years 2005–06.

Foreign Trade

Trade data from the U.S. Census Bureau are presented in tables 16–21. Exports continued to be very small compared with imports, and Canada continued to be the dominant recipient of the exports. Exports of hydraulic cement and clinker rose by 22.5% to 0.89 Mt, the highest tonnage since 1948; both the 2006 and 2007 data have been corrected to remove an apparent excess (of 0.74 Mt and 0.65 Mt, respectively) of aluminous cement exports to Mexico through Laredo, TX. Imports of cement and clinker in 2007 were 22.5 Mt, a drop of 36.8% from the record levels in 2006 (table 17). The cement component of the imports (table 1; table 17 minus table 21) fell by 33.1% to 21.5 Mt. Overall declines were seen every month during the year and continued a trend that began in August 2006. It was clear that most of the decline in cement sales in 2007 was accommodated by reducing imports. This, in turn, reflected high spot-shipping rates during the year and the fact that since the early 1990s, the majority of cement imports have been controlled by domestic cement producers, and they largely import only to make up for production shortfalls.

Imports of clinker (table 21) fell by 71.6% to just 0.97 Mt, the lowest level since 1983. As in previous years, however, the data were incomplete with regards to overland imports from Canada; the tonnages listed were insufficient to supply the grinding plants in Michigan and Washington (all of which imported their clinker from Canada). The unreported Canadian clinker appeared to be mostly coming in by truck, at a value of less than $2,000 (customs value) per truckload; such shipments are classified as “informal entries” and data on them are not routinely transmitted by the U.S. Customs Service to the U.S. Census Bureau for recordation into the official trade data (reproduced in tables 17–21). This problem presumably does not exist for imports by rail or by ship because these shipments are larger. Clinker imports from Canada were estimated to be higher than those reported in tables 1 and 21 by about 0.7 Mt in 2006 and 0.6 Mt in 2007.

For cement and clinker combined, the 10 busiest customs districts of entry in 2007 were, in descending order, Houston-Galveston, TX; Los Angeles, CA; Seattle, WA; San Francisco, CA; Tampa, FL; Columbia-Snake, OR and WA; New Orleans, LA; Miami, FL; Detroit, MI; and New York, NY (table 18). These leading districts accounted for about 70% of the total imports for the year. The rankings were very different from those of 2006.

As in 2006, the United States imported cement and/or clinker from 37 countries in 2007. The leading 10 country suppliers were, in descending order, China, Canada (not including informal imports), the Republic of Korea, Taiwan, Mexico, Colombia, Greece, Brazil, Sweden, and Peru. Together, these major sources accounted for about 92% of the total imports. Imports from China in 2007 were about one-half those in 2006. This reflected not only much lower cement consumption levels in California, but also unit price increases resulting from the Chinese Government’s elimination at midyear of substantial export subsidies on cement. Other major import tonnage declines were from Thailand (-81%), and Greece (-64%). Notwithstanding almost insignificant antidumping tariffs, imports from Mexico fell by nearly 26% and were well below the agreed-upon annual quota of 3 Mt.

Gray portland cement (table 19) continued to be by far the dominant component of cement imports, although the official data understate the true total because some gray cement, typically, is misregistered by importers as white cement (table 20). In 2007, the misregistration was notable in the monthly data for “white” cement imports from Canada and China, but it occurred elsewhere as well. Generally, if the unit values (table 20) calculated on a cost-insurance-freight (c.i.f.) basis are below $90 to $100 per metric ton, the data likely include a component of gray portland cement or clinker. For 2007, although this value anomaly is not obvious in the table 20 data for Canada and China (owing to the data including significant valid white cement imports), the anomaly is present for the “white” cement from Taiwan.

After excluding the questionable “white” tonnages in table 20, remaining imports of white cement in 2007 (about 1.2 Mt) appear sufficient in themselves to fully supply the sales of white portland cement reported in table 15. However, given that the three U.S. white cement plants all produced clinker at 60% to 100% of capacity during the year and recorded no unduly large shifts in cement stockpiles, there would appear to be an estimated excess of about 0.3 Mt of white cement relative to the sales after accounting for white cement exports (28,411 t in 2007) and an estimate of white material incorporated within the overall sales of masonry cement (tables 9, 12). It is possible that the white cement component of total cement sales is being underreported (included within gray cement) by some respondents to the USGS annual canvass.

World Review

World hydraulic cement production data are listed in table 22. The data are intended to include all forms of hydraulic cement; however, the data for the United States are for portland plus masonry cement only and data for some other countries also may be incomplete. For some countries, the production data may include their exports of clinker.

World cement output in 2007 was an estimated 2.8 billion metric tons (Gt), up by about 6.5%. Production was from more than 150 countries. China continued to be, by far, the world’s leading producer, with an output of nearly 1.4 Gt (up by 9.5%) or about 49% of the world total. The remaining top 15 producing countries were, in descending order, India, the United States, Japan, the Republic of Korea, Russia, Spain, Turkey, Italy, Brazil, Mexico, Egypt, Vietnam, Indonesia, and Thailand. Cumulatively, the top 5 countries had about 63% of total world output; the top 10 countries, about 75%; and the top 15 countries, about 79%.

Regionally, Asia contributed about 67% of world production and included 9 of the 20 leading producing countries. Western Europe had about 8% of total output; the Middle East (including Turkey) and North America, nearly 6% each; Africa, Central America and South America (combined), and the Commonwealth of Independent States, about 4% each; and Eastern Europe, about 2%.

Outlook

The general economic downturn that characterized 2007 was expected to continue in 2008. Portland cement consumption was expected to decline by at least 10% in 2008, and masonry cement to decline by a higher percentage. Although imports of cement were expected to drop substantially in 2008, it was recognized that, unlike in 2007, the anticipated declines in cement consumption in 2008 and perhaps beyond would result in a significant drop in production of cement and clinker. It was unclear to what degree such a drop could be accomplished without closure of kilns or entire plants; some of the country's wet kiln plants were especially vulnerable in this regard. The continued viability of some of the new plant or plant expansion projects was likewise in doubt, especially for projects still far from completion. The August 1 catastrophic failure of the I–35W bridge in Minneapolis, MN, brought renewed attention at both State and Federal levels to the poor condition of many of the Nation's bridges and other transportation infrastructure, and it was widely agreed that major additional funding would be needed to address the infrastructure deficiencies. How this funding could be obtained at a time of greatly diminished tax revenues to the States remained an open question.

It was expected that States, and ultimately the Federal Government, would become more proactive in encouraging, and likely mandating, reductions in industrial emissions of greenhouse gases, and that there thus would be increasing incentive to use SCM in finished cement and concrete and alternative (noncarbonate, less energy-intensive) raw materials in clinker manufacture. In this regard, efforts to regulate the transportation, storage, and use of fly ash to help control mercury emissions by cement plants were viewed by the cement industry as counterproductive; fly ash is a popular alternative raw material and it is the most readily available SCM.

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TABLE 1

SALIENT CEMENT STATISTICS FOR THE UNITED STATES[1, 2]

(Thousand metric tons unless otherwise specified)

		2003	2004	2005	2006	2007
United States:[2]						
Production:						
Cement[3]		92,843	97,434	99,319	98,167	95,464
Clinker		81,882	86,658	87,405	88,555	86,130
Shipments from mills and terminals:[3, 4, 5]						
Quantity		111,000	120,000	128,000	127,000	114,000
Value[6]	thousands dollars	8,340,000	9,520,000	11,700,000	12,900,000	11,800,000
Average value[6]	dollars per metric ton	75.00	79.50	91.00	101.50	103.00
Stocks at mills and terminals, yearend		6,610	6,740	7,450	9,380	8,900
Exports of cement and clinker		837	749	766	723 [7]	886 [7]
Imports for consumption:[8]						
Cement		21,015	25,396	30,403	32,141	21,496
Clinker		1,808	1,630	2,858	3,425	972
Total[9]		22,823	27,026	33,261	35,566	22,468
Consumption, apparent[10]		114,090	121,950	128,250	127,660	116,550
World production [11]		2,030,000	2,190,000	2,350,000	2,600,000 [r]	2,770,000 [e]

[e]Estimated. [r]Revised.

[1]Unless otherwise indicated, data are for portland (including blended) and masonry cements only. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Excludes Puerto Rico.

[3]Includes cement made from imported clinker.

[4]Includes imported cement.

[5]Shipments to final domestic customers. Data are from an annual survey of plants and terminals and may differ from the totals in table 9, which are based on consolidated monthly surveys from companies.

[6]Value at mill or independently reporting terminal of cement shipments to final domestic customers.

[7]Official export data have been corrected to remove an apparent excess of aluminous cement from Laredo, TX, of 943,939 metric tons in 2006 and 653,255 metric tons in 2007.

[8]All forms of hydraulic cement or clinker.

[9]Data may not add to totals shown because of independent rounding.

[10]Production (including that from imported clinker) of portland and masonry cement plus imports of hydraulic cement minus exports of hydraulic cement minus the change in yearend cement stocks.

[11]Total hydraulic cement. May include clinker exports for some countries.

TABLE 2

COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Illinois, metropolitan Chicago	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois, excluding Chicago	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester).
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampass, Leon, Limestone, McCulloch, Reagan, Reeves, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3

PORTLAND CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

District[3]	2006 Active plants	2006 Production[4]	2006 Capacity[2] Finish grinding	2006 Capacity[2] Percentage utilized[5]	2006 Yearend stocks[6]	2007 Active plants	2007 Production[4]	2007 Capacity[2] Finish grinding	2007 Capacity[2] Percentage utilized[5]	2007 Yearend stocks[6]
Maine and New York	5	3,356	4,203	79.8	235	5	3,149	4,165	75.6	307 [7]
Pennsylvania, eastern	7	4,411	5,430 [r, 7]	81.3	277 [7]	7	4,070	5,520 [7]	73.8	304
Pennsylvania, western	3	1,605	1,770 [7]	90.7	117	3	1,591	1,805	88.1	135
Illinois	4	3,108	3,420 [7]	91.0	171 [7]	4	3,116	3,417	91.2	285
Indiana	4	3,025	3,720 [7]	81.3	234	4	2,981	3,740	79.7	254
Michigan	5	5,437	7,328	74.2	422 [7]	5	5,486	7,330 [7]	74.9	292 [7]
Ohio	2	966	1,304	74.1	60	2	916	1,198	76.5	35
Iowa, Nebraska, South Dakota	5	4,558	6,048	75.4	516	5	4,436	6,007	73.8	453
Kansas	4	3,003	3,329	90.2	249	4	2,757	3,230 [7]	85.4	242
Missouri	5	5,240	6,958	75.3	678	5	5,229	6,958	75.1	695
Florida[8]	7	5,876	7,301	80.5	591 [7]	7	5,512	7,301	75.5	520
Georgia, Virginia, West Virginia	4	2,446	3,440 [7]	71.2	280	4	2,294	3,324	69.0	286
Maryland	3	2,651	3,087	85.9	222 [7]	3	2,998	3,132	95.7	310
South Carolina	3	3,315	5,109	64.9	223	3	3,681	5,082	72.4	295 [7]
Alabama	5	5,201	6,036	86.2	403	5	5,061	7,075	71.5	348
Kentucky, Mississippi, Tennessee	4	3,492	3,700 [7]	94.3	348	4	3,420	3,736	91.5	330
Arkansas and Oklahoma	4	2,703	3,260 [7]	83.0	233	4	2,613	3,136	83.3	216
Texas, northern	6	6,467	7,594	85.2	903 [7]	6	6,294	7,600	82.8	682
Texas, southern	6	4,882	5,850 [7]	83.4	411	6	4,627	5,830 [7]	79.3	315
Arizona and New Mexico	3	2,549	3,310 [7]	77.0	163	3	2,633	3,116	84.5	136
Colorado and Wyoming	3	2,579	3,450 [7]	72.8	238	3	2,538	3,542	71.7	173
Idaho, Montana, Nevada, Utah	6	3,043	3,750 [7]	81.2	256	6	3,002	3,753	80.0	251
Alaska and Hawaii	--	--	--	--	97	--	--	--	--	59
California, northern	3	2,454	2,853	86.0	318 [7]	3	2,210	2,853	77.5	233
California, southern	8	8,495	11,047 [r]	76.9 [r]	435 [7]	8	8,623	11,047	78.1	311
Oregon and Washington	4	1,906	2,540	75.1	158 [7]	4	1,908	2,591	73.6	294 [7]
Importers[9]	--	--	--	--	456 [7]	--	--	--	--	413 [7]
Total or average[10]	113	92,768	116,000 [r, 7]	80.6	8,700 [7]	113	91,144	116,000 [7]	78.2	8,170 [7]
Puerto Rico	2	1,546	2,462	62.8	26 [7]	2	1,386	1,898	73.0	52
Grand total or average[10]	115	94,313	118,000 [7]	80.2	8,720 [7]	115	92,530	118,000 [7]	78.2	8,230 [7]

[r]Revised. -- Zero.

[1]Even when presented unrounded, data are thought to be accurate to no more than three significant digits. Includes data for white cement.

[2]Reported grinding capacity is based on fineness needed to produce a plant's normal output mix, including masonry cement, and allowing for downtime for routine maintenance.

[3]District assignation is the location of the reporting facilities, including terminals. Includes independent importers for which district assignations were possible.

[4]Includes cement made from imported clinker.

[5]Calculated relative to portland cement output; utilization percentage would be higher if calculated to include masonry cement output.

[6]Includes imported cement. Includes stocks at mills and terminals and in transit.

[7]Data contains estimates for nonrespondent or incompletely reporting facilities.

[8]Production and grinding capacity data exclude a plant that produced only masonry cement.

[9]Data include only those importers or terminals for which district assignations were not possible.

[10]Data may not add to totals shown because of independent rounding.

TABLE 4

MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

District[4]	2006 Active plants	2006 Production[2] (thousand metric tons)	2006 Stocks at yearend[3] (thousand metric tons)	2007 Active plants	2007 Production[2] (thousand metric tons)	2007 Stocks at yearend[3] (thousand metric tons)
Maine and New York	4	119	20	4	101	20
Pennsylvania	9	384	63 [5]	9	304	61 [5]
Indiana and Ohio	6	529	75	6	462	74
Michigan	4	176	38 [5]	4	149	45
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	W	W	2	W	W
Missouri	2	W	W	1	W	W
Florida	5	900	45	5	524	40
Georgia, Maryland, Virginia, West Virginia	7 [r]	511	63	7	468	59
South Carolina	3	575	48	3	491	34
Alabama	4	526	67	4	450	75
Kentucky, Mississippi, Tennessee	3	W	W	3	W	W
Arkansas and Oklahoma	4	193	21	4	148	20
Texas	7	382	121	8	368	155
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	1	W	W
California, northern	3	92	12	3	76	10
California, southern	4	605	18	4	446	22
Importers[6]	--	--	3 [5]	--	--	3 [5]
Total[7]	75 [r]	5,399	689 [5]	75	4,320	724 [5]

[r]Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Includes masonry, portland-lime, and plastic cements. Even where presented unrounded, data are thought to be accurate to no more than three significant figures.

[2]Includes cement produced from imported clinker.

[3]Includes imported cement.

[4]District assignation is the location of the reporting facilities, including importers for which district assignations were possible.

[5]Data contains estimates for nonrespondents or incompletely reporting facilities.

[6]Data include only those importers or terminals for which district assignations were not possible.

[7]Data may not add to totals shown because of independent rounding.

TABLE 5

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2007, BY DISTRICT[1]

District	Active plants[2] Process used Wet	Active plants[2] Process used Dry	Active plants[2] Process used Both	Active plants[2] Total	Number of kilns[4]	Daily capacity[3, 4] (thousand metric tons)	Average days of routine maintenance[4]	Apparent annual capacity[4, 5] (thousand metric tons)	Production (thousand metric tons)	Percentage of capacity utilized	Yearend stocks[6] (thousand metric tons)
Maine and New York	2	2	--	4	5	10.8 [7]	33.6	3,570 [7]	3,179	88.9 [7]	311
Pennsylvania, eastern	2	4	--	6	10	14.5	26.3	4,883	3,880	79.5	220
Pennsylvania, western	2	1	--	3	7	5.2	15.0 [7]	1,820 [7]	1,591	87.3 [7]	67
Illinois	--	4	--	4	7	9.6	12.2	3,361	2,869	85.4	138
Indiana	1	3 [8]	--	4	8	10.3	27.7	3,455	3,082	89.2	220
Michigan	1	2	--	3	8	14.1	22.6	4,804	4,112	85.6	428 [7]
Ohio	1	1	--	2	3	3.4	21.8	1,153	877	76.1	99
Iowa, Nebraska, South Dakota	--	4	1	5	9	14.1	19.3	4,824	4,191	86.9	352
Kansas	1	3	--	4	9	9.7	27.3	3,289	2,626	79.9	123
Missouri	2	3	--	5	6	16.1	26.5	5,415	4,927	91.0	426 [7]
Florida	--	6	--	6	7	17.7	22.1	6,033	5,229	86.7	442
Georgia, Virginia, West Virginia	1	2	--	3	5	8.3	15.9	2,869	2,336	81.4	181
Maryland	1	2	--	3	4	9.4 [7]	32.8	3,100 [7]	2,829	91.2 [7]	125
South Carolina	--	3	--	3	3	12.3	21.6	4,251	3,512	82.6	241
Alabama	--	5	--	5	5	16.5	25.5	5,586	4,898	87.7	183 [7]
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.5	13.9	3,689	3,317	89.9	251
Arkansas and Oklahoma	2	2	--	4	10	8.0 [7]	18.5	2,770 [7]	2,463	88.9 [7]	103
Texas, northern	2	3	1	6	16	22.6	15.9	7,777	6,031	77.5	613
Texas, southern	--	5	--	5	5	13.0	17.5	4,520	4,143	91.7	302
Arizona and New Mexico	--	3	--	3	7	8.6	21.3	2,940	2,500	85.0	347
Colorado and Wyoming	--	3	--	3	4	8.9	22.7	3,014	2,194	72.8	120
Idaho, Montana, Nevada, Utah	3	3	--	6	8	8.7	24.3	2,978	2,722	91.4	132
California, northern	--	3	--	3	3	8.8	25.9	2,970 [7]	2,217	74.6 [7]	140
California, southern	--	8	--	8	17	29.2	23.5 [7]	9,969	8,661	86.9	905 [7]
Oregon and Washington	1	2	--	3	3	6.4 [7]	38.2	2,070 [7]	1,743	84.3 [7]	78
Total or average[9]	23	80	2	105	173	297.0 [7]	21.8 [7]	101,000 [7]	86,130	85.2 [7]	6,550 [7]
Puerto Rico	--	2	--	2	2	5.5	39.8	1,797	1,336	74.3	123
Grand total or average[9]	23	82	2	107	175	302.0 [7]	22.0 [7]	103,000 [7]	87,466	85.0 [7]	6,670 [7]

-- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes white cement plants. Includes all plants active for at least one day during the year.

[3]Sum of reported daily kiln capacities for each plant in district.

[4]Kilns active at least one day during the year. Excludes idle kilns (full year) that cannot be restarted, fully permitted, in less than 6 months.

[5]Sum of apparent annual kiln capacities: for each kiln, calculated as 365 days minus days reported as shut down for routine maintenance and then multiplied by the reported (unrounded) daily capacity.

[6]Includes imported clinker and clinker stockpiles at grinding plants.

[7]Data contain estimates for nonrespondent or incompletely reporting facilities and have been rounded to no more than three significant digits.

[8]Includes one semidry kiln.

[9]Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED IN PRODUCING CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

Raw materials	2006 Clinker	2006 Cement[3]	2007 Clinker	2007 Cement[3]
Calcareous:				
Limestone (includes aragonite, chalk, coral, marble)	114,000	2,380	112,000	2,150
Cement rock (includes marl)	13,300	52	10,800	6
Cement kiln dust (CKD)[4]	178	364	629	336
Lime[5]	121	21	292	38
Other	22	19	23	--
Aluminous:				
Clay	4,770	--	4,300	--
Shale	3,010	37	3,670	16
Other[6]	637	--	712	--
Ferrous:				
Iron ore	752	--	584	--
Mill scale	754	--	1,080	--
Other[7]	55	--	47	--
Siliceous:				
Sand and calcium silicate	3,620	--	3,940	--
Sandstone, quartzite, soils, other	1,030	--	986	--
Fly ash	2,950	130	3,170	84
Other ash, including bottom ash	1,190	--	1,050	--
Granulated blast furnace slag[8]	207	678	323	540
Other blast furnace slag	324	--	73	--
Steel slag	490	--	547	--
Other slags	145	2	100	8
Natural rock pozzolans[9]	--	15	--	11
Other pozzolans[10]	139	14	98	6
Other:				
Gypsum and anhydrite	--	5,440	--	5,160
Other, n.e.c.[11]	66	92	131	98
Total[12]	148,000	9,240	145,000	8,450
Clinker, imported, raw materials equivalent[13]	--	4,210	--	2,650
Grand total[12]	148,000	13,500	145,000	11,100

-- Zero.

[1]Excludes Puerto Rico.

[2]Data have been rounded to three significant digits to reflect inherent reporting accuracy and the incorporation of estimates for some facilities.

[3]Includes portland, blended, and masonry cements.

[4]Data are underreported.

[5]Data are probably underreported, especially regarding incorporation within masonry cements.

[6]Includes alumina, aluminum dross, bauxite, catalysts, staurolite, and other materials.

[7]Includes iron sludges, pyrite, and other materials.

[8]Includes both ground (GGBFS) and unground material.

[9]Includes pozzolana and burned clays and shales except where reported directly as clay or shale.

[10]Includes diatomite, silica fume, other microcrystalline silica, and other pozzolans, even if not used as such.

[11]Not elsewhere classified. Includes fluorspar.

[12]Data may not add to totals shown because of independent rounding.

[13]Converted as the weight of foreign clinker consumed times 1.7.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE CEMENT INDUSTRY IN THE UNITED STATES, BY PROCESS[1]

Kiln process	Clinker produced[3] Active plants	Clinker produced[3] Quantity (thousand metric tons)	Clinker produced[3] Percentage of total	Conventional fuels consumed[2] Coal[4] (thousand metric tons)	Conventional fuels consumed[2] Petroleum coke (thousand metric tons)	Conventional fuels consumed[2] Oil[5] (thousand liters)	Conventional fuels consumed[2] Natural gas (thousand cubic meters)	Conventional fuels consumed[2] Tires (thousand metric tons)	Waste fuel consumed[2] Solid (thousand metric tons)	Waste fuel consumed[2] Liquid (thousand liters)
2006:										
Wet	23	11,659	13.2	1,530	518	33,700	18,000	90	19	585,000
Dry	79	72,742	82.1	7,340	1,860	46,700	306,000	323	283	360,000
Both	3	4,154	4.7	661	13	--	44,800	5	--	42,600
Total[6]	105	88,555	100.0	9,540	2,390	80,400	369,000	418	302	988,000
2007:										
Wet	23	11,608	13.5	1,470	574	39,200	29,800	90	20	549,000
Dry	80	71,204	82.7	7,320	1,780 [7]	47,800	262,000	355	275	396,000
Both	2	3,318	3.9	529	--	--	38,900	--	--	38,600
Total[6]	105	86,130	100.0	9,310	2,360	87,000	331,000	446	296	984,000

-- Zero

[1] Data exclude Puerto Rico.

[2]All fuel data have been rounded to no more than three significant digits.

[3]Clinker production data are all reported. Although unrounded, data are thought to be accurate to no more than three significant digits.

[4]Essentially all reported to be bituminous.

[5]Distillate and residual fuel oil. Excludes used oils that were reported under liquid wastes.

[6]Data may not add to totals shown because of independent rounding.

[7] Includes a minor quantity (less than 0.03 units) of metallurgical coke.

TABLE 8

ELECTRIC ENERGY USED AT CEMENT PLANTS IN THE UNITED STATES, BY PROCESS[1]

Plant process	Electric energy used[2] Generated at plant Number of plants	Generated at plant Quantity (million kilowatthours)	Purchased Number of plants	Purchased Quantity (million kilowatthours)	Total[3] Number of plants	Total[3] Quantity (million kilowatthours)	Total[3] Percentage	Finished cement produced[4] (thousand metric tons)	Average consumption (kilowatthours per metric ton of cement produced)
2006:									
Integrated plants:									
Wet	1	(5)	23	1,770	23	1,770	13.1	12,741	139
Dry	5	476	79	10,600	79	11,100	82.3	79,014	141
Both[5]	--	--	3	622	3	622	4.6	4,098	152
Total or average[3]	6	476	105	13,000	105	13,500	100.0	95,854	141
Grinding plants[6]	--	--	6	160	6	160	--	1,962	81
Exclusions[7]	--	--	2	XX	2	XX	--	351	XX
2007:									
Integrated plants:									
Wet	1	(5)	23	1,750	23	1,750	13.2	12,446	141
Dry	4	435	80	10,600	80	11,100	83.1	77,702	142
Both	--	--	2	495	2	495	3.7	3,291	150
Total or average[3]	5	436	105	12,900	105	13,300	100.0	93,439	142
Grinding plants[6]	--	--	7	147	7	147	--	1,914	77
Exclusions[7]	--	--	2	XX	2	XX	--	111	XX

XX Not applicable. -- Zero.

[1]Data exclude Puerto Rico.

[2]Electricity data are rounded to no more than three significant digits because they contain estimates.

[3]Data may not add to totals shown because of independent rounding.

[4]Include portland and masonry cements. Data are all reported and have not been rounded.

[5]Less than ½ unit.

[6]Excludes plants that reported production only of masonry cement.

[7]Plants that reported production only of masonry cement.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2006	Portland cement 2007	Masonry cement 2006	Masonry cement 2007
Destination:				
Alabama	1,798	1,771	196	174
Alaska[3]	176	222	--	--
Arizona	4,611	3,822	103	77
Arkansas	1,187	1,074	87	68
California, northern	4,761	4,095	130	104
California, southern	9,549	8,273	530	373
Colorado	2,641	2,411	31	17
Connecticut[3]	814	756	18	15
Delaware[3]	247	233	12	10
District of Columbia[3]	210	177	(4)	1
Florida	11,180	7,886	1,015	616
Georgia	4,484	4,014	394	340
Hawaii[3]	462	441	6	6
Idaho	724	682	1	1
Illinois, excluding Chicago	1,921	1,919	27	19
Illinois, metropolitan Chicago[3]	2,634	2,074	71	53
Indiana	2,173	2,166	84	74
Iowa	1,920	1,803	3	3
Kansas	1,546	1,360	11	11
Kentucky	1,330	1,250	104	88
Louisiana[3]	2,546	2,470	72	72
Maine	334	299	5	4
Maryland	1,614	1,468	95	78
Massachusetts[3]	1,196	1,022	21	17
Michigan	2,505	2,189	101	74
Minnesota[3]	1,902	1,683	15	20
Mississippi	1,176	1,186	80	75
Missouri	2,626	2,376	44	35
Montana	396	404	1	1
Nebraska	1,306	1,222	5	4
Nevada	2,626	2,223	29	23
New Hampshire[3]	336	301	7	7
New Jersey[3]	1,923	1,740	96	74
New Mexico	900	843	8	7
New York, eastern	662	619	18	16
New York, western[3]	798	772	25	21
New York, metropolitan[3]	1,893	1,770	104	90
North Carolina[3]	3,109	2,969	357	337
North Dakota[3]	368	353	2	1
Ohio	3,727	3,357	154	121
Oklahoma	1,543	1,500	69	56
Oregon	1,318	1,240	1	1
Pennsylvania, eastern	2,172	1,977	67	57
Pennsylvania, western	1,107	1,160	54	45
Rhode Island[3]	212	169	3	2
South Carolina	1,851	1,617	177	157
South Dakota	588	463	2	1
Tennessee	2,259	2,214	284	251
Texas, northern	6,499	6,635	170	141
Texas, southern	8,122	8,245	268	239
Utah	1,697	1,683	(4)	(4)
Vermont[3]	158	132	3	3
Virginia	2,639	2,370	188	159
Washington	2,351	2,587	2	1
West Virginia	562	522	26	24

See footnotes at end of table.

TABLE 9—Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2006	Portland cement 2007	Masonry cement 2006	Masonry cement 2007
Destination—Continued:				
Wisconsin	2,171	1,892	22	18
Wyoming	466	460	--	(4)
Total[5]	122,026	110,563	5,401	4,282
Foreign countries[6]	471 r, 7	581	(4)	(4)
Puerto Rico	1,813 r, 7	1,704	--	--
Grand total[5]	124,310 r	112,848	5,401	4,282
Origin:				
United States	91,931 r	90,776	5,354	4,209
Foreign countries[8]	30,821 r	20,580	47 r	73
Puerto Rico	1,558 r	1,492	-- r	--
Total shipments[5]	124,310 r	112,848	5,401	4,282

rRevised. -- Zero.

1Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.

2Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 10–12, and 14–15, which are from annual surveys of individual plants and importers. Includes any revisions to monthly data available through February 27, 2009. Although presented unrounded, data are thought to be accurate to no more than three significant digits.

3Has no cement plants.

4Less than ½ unit.

5Data may not add to totals shown because of independent rounding.

6Includes shipments to U.S. possessions and territories.

7Data for 2006 for foreign countries and for Puerto Rico were inadvertently reversed in the previous edition of this report.

8Imported cement sold to final customers in the United States as reported by domestic producers and other importers. Data do match the imports in tables 17–20.

TABLE 10

SHIPMENTS OF PORTLAND CEMENT FROM MILLS IN THE UNITED STATES, IN BULK AND IN CONTAINERS, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Shipments from plant to terminal		Shipments to final domestic consumer				
			From plant to consumer		From terminal to consumer		Total shipments
	In bulk	In bags[3]	In bulk	In bags[3]	In bulk	In bags[3]	to consumer[4]
2006:							
Railroad	11,600	12	1,740	16	804	1	2,560
Truck	4,700	285	63,500	1,760	52,700	736	119,000
Barge and boat	7,870	--	67	--	558	--	625
Total[4]	24,100	297	65,300	1,780	54,000	737	122,000 [5]
2007:							
Railroad	11,100	19	1,830	--	725	4	2,560
Truck	5,420	210	56,700	1,470	48,400	605	107,000
Barge and boat	9,350	11	211	--	17	--	229
Total[4]	25,900	239	58,800	1,470	49,100	610	110,000 [5]

-- Zero.

1Includes imported cement and cement made from imported clinker. Data exclude Puerto Rico.

2Data are rounded to no more than three significant digits because they include estimates.

3Includes packages, bags, jumbo bags, and supersacks.

4Data may not add to totals shown because of independent rounding.

5Shipments are based on annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 11

PORTLAND CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1]

	2006			2007		
		Value[2]			Value[2]	
District[4, 5]	Quantity[3] (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)	Quantity[3] (thousand metric tons)	Total (thousands)	Average (dollars per metric ton)
Maine and New York	4,420 [6]	$451,000 [6]	102.00 [6]	3,866	$412,000 [6]	106.50 [6]
Pennsylvania, eastern	4,629	463,000 [6]	100.00 [6]	4,222	423,000 [6]	100.00 [6]
Pennsylvania, western	1,520 [6]	147,000 [6]	97.00 [6]	1,458	147,000 [6]	100.50 [6]
Illinois	3,616	358,000 [6]	99.00 [6]	3,301	331,000 [6]	100.50 [6]
Indiana	3,075	271,264	88.23	2,958	260,849	88.18
Michigan and Wisconsin	6,050 [6]	596,000 [6]	99.00 [6]	5,660 [6]	554,000 [6]	98.00 [6]
Ohio	949	94,360	99.47	882	88,935	100.83
Iowa, Nebraska, South Dakota	5,208	518,164	99.49	4,843	508,000 [6]	105.00 [6]
Kansas	2,526	240,854	95.35	2,182	223,403	102.37
Missouri	5,896	562,930	95.47	5,411	533,000 [6]	98.50 [6]
Florida	10,591	1,084,593	102.41	7,693	786,380	102.22
Georgia, Virginia, West Virginia	3,259	324,928	99.69	2,596	273,404	105.33
Maryland	2,960 [6]	264,000 [6]	89.50 [6]	3,207	283,459	88.38
South Carolina	3,723	330,187	88.69	3,710	358,000 [6]	96.50 [6]
Alabama	5,718	515,186	90.10	5,089	489,000 [6]	96.00 [6]
Kentucky, Mississippi, Tennessee	3,305	327,267	99.02	3,197	328,018	102.61
Arkansas and Oklahoma	2,830	262,542	92.77	2,709	259,000 [6]	95.50 [6]
Texas, northern	7,877	746,000 [6]	94.50 [6]	7,359	723,000 [6]	98.00 [6]
Texas, southern	6,543	607,741	92.89	6,953	671,111	96.52
Arizona and New Mexico	4,610	524,592	113.79	4,158	509,493	122.54
Colorado and Wyoming	2,842	281,020	98.87	2,614	280,594	107.36
Idaho, Montana, Nevada, Utah	3,420	361,630	105.74	3,381	372,865	103.18
Alaska and Hawaii	591	82,662	139.81	576	98,284	170.61
California, northern	4,063	434,390	106.91	3,286	354,038	107.74
California, southern	10,964	1,197,612	109.23	9,755	1,080,000 [6]	110.50 [6]
Oregon and Washington	2,690 [6]	252,000 [6]	93.50 [6]	2,779	283,193	99.34
Importers[7]	7,950 [6]	848,000 [6]	106.50 [6]	6,160 [6]	576,000 [6]	93.50 [6]
Total or average[8]	122,000 [6]	12,100,000 [6]	99.50 [6]	110,000 [6]	11,200,000 [6]	101.50 [6]
Puerto Rico	1,820	W	W	1,597	W	W
Grand total[8]	124,000 [6]	W	W	112,000 [6]	W	W

W Withheld to avoid disclosing company proprietary data.

[1]Includes gray and white portland cement produced from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Values represent mill net or ex-plant (free on board plant) valuations of total sales to final customers, including sales from plant distribution terminals. The data are ex-terminal for independent terminals. All varieties of portland cement, and both bag and bulk shipments, are included. Unless otherwise specified, data are presented unrounded but may include cases where value data (only) were missing from survey forms and so were estimated. Accordingly, unrounded value data should be viewed as cement value indicators, accurate to no better than the nearest $0.50 or even $1.00 per metric ton.

[3]Shipments are based on an annual survey of plants and importers; may differ from data in table 9, which are based on consolidated company monthly data.

[4]District is the location of the reporting entity, not necessarily the location of sales (see table 9 for sales data, by State).

[5]Includes shipments by import terminals where district assignments were possible.

[6]Data are rounded (unit values to the nearest $0.50) because they include estimates.

[7]Importers for which district assignations were not possible.

[8]Data may not add to totals because of independent rounding.

TABLE 12

MASONRY CEMENT SHIPPED BY PRODUCERS AND IMPORTERS IN THE UNITED STATES, BY DISTRICT[1, 2]

District[5]	2006 Quantity[4] (thousand metric tons)	2006 Value[3] Total (thousands)	2006 Value[3] Average (dollars per metric ton)	2007 Quantity[4] (thousand metric tons)	2007 Value[3] Total (thousands)	2007 Value[3] Average (dollars per metric ton)
Maine and New York	128 [6]	$15,200 [6]	118.50 [6]	109	$13,500 [6]	124.00 [6]
Pennsylvania	347	47,300 [6]	136.00 [6]	281	37,500 [6]	133.00 [6]
Illinois, Indiana, Ohio	520	70,762	136.14	455	65,359	143.68
Michigan	200 [6]	25,800 [6]	129.00 [6]	142	19,300 [6]	135.50 [6]
Iowa, Nebraska, South Dakota	17	2,055	120.85	24	2,823	115.27
Kansas and Missouri	149	20,257	135.73	123	16,827	136.83
Florida	913	148,507	162.69	525	86,200 [6]	164.00 [6]
Georgia, Maryland, Virginia, West Virginia	427	69,549	162.70	429	76,220	177.77
South Carolina	484	57,986	119.86	444	54,228	122.20
Alabama	538	68,100 [6]	126.50 [6]	470	62,000 [6]	131.50 [6]
Kentucky, Mississippi, Tennessee	137	18,802	137.04	111	16,365	147.71
Arkansas and Oklahoma	179	20,800	116.30	146	17,031	116.28
Texas, northern	202	31,600 [6]	156.50 [6]	179	28,500 [6]	159.50 [6]
Texas, southern	204	24,391	119.78	176	21,751	123.34
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	147	18,820	127.62	104	14,584	140.79
Alaska and Hawaii	4	1,135	264.55	4	1,114	260.45
California, northern; Oregon; Washington	93	11,421	123.44	74	9,464	127.14
California, southern	604	77,900 [6]	129.00 [6]	447	59,408	132.94
Importers[7]	17 [6]	2,730 [6]	169.50 [6]	14 [6]	2,520 [6]	178.50 [6]
Total or average[8]	5,310 [6]	733,000 [6]	138.00 [6]	4,260 [6]	605,000 [6]	142.00 [6]

[1]Shipments are to final customers and include imported cement and cement made from imported clinker. Data exclude Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes gray, white, and colored varieties of masonry, plastic, portland-lime cements, and stucco cements.

[3]Values represent ex-plant (free on board) valuations of total sales to final customers, including sales from distribution terminals. Even where presented unrounded, data should be viewed as cement value indicators, accurate to no better than the nearest $0.50 or even $1.00 per metric ton.

[4]Shipments are based on an annual survey of plants and importers; may differ from data in table 9, which are based on consolidated company monthly data.

[5]District is the location of the reporting entity, not necessarily the location of sales (see table 9 for sales data, by State).

[6]Data are rounded (unit values to the nearest $0.50) because they include estimates.

[7]Importers for which district assignations were not possible.

[8]Data may not add to totals because of independent rounding.

TABLE 13

AVERAGE MILL NET VALUE OF CEMENT IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

Year	Gray portland cement	White portland cement[3]	All portland cement	Prepared masonry cement	All classes of cement
2006	99.00	191.00	99.50	138.00	101.50
2007	101.00	197.00	101.50	142.00	103.00

[1]Excludes Puerto Rico. Values are the average of sales to final customers, free on board the plant or import terminal. Values exclude any onward delivery charges, but include any bagging charges.

[2]Data are rounded to the nearest $0.50 per metric ton because they include estimates.

[3]The unit values for white cement include a component of resales showing significant price markups.

TABLE 14

PORTLAND CEMENT SHIPMENTS IN 2007, BY DISTRICT AND TYPE OF CUSTOMER[1]

(Thousand metric tons)

District[2, 3]	Ready-mixed concrete	Concrete product manufacturers	Contractors	Building material dealers	Oil well, mining, waste stabilization	Government and miscellaneous[4]	Total[5, 6]
Maine and New York	3,030	415	115	256	--	48	3,866
Pennsylvania, eastern	2,530	1,200	143	239	--	114	4,222
Pennsylvania, western	1,030	229	146	22	19	8	1,458
Illinois	2,480	289	165	9	266	92	3,301
Indiana	2,210	474	191	65	7	13	2,958
Michigan and Wisconsin	4,430	495	421	123	48	139	5,660
Ohio	685	146	19	28	2	3	882
Iowa, Nebraska, South Dakota	3,620	555	322	123	76	150	4,843
Kansas	1,650	174	211	59	74	10	2,182
Missouri	4,270	513	511	37	9	70	5,411
Florida	5,510	1,320	458	400	--	13	7,693
Georgia, Virginia, West Virginia	1,890	583	36	80	--	9	2,596
Maryland	2,380	466	169	88	3	100	3,207
South Carolina	2,690	562	124	114	5	218	3,710
Alabama	3,980	675	168	140	16	106	5,089
Kentucky, Mississippi, Tennessee	2,450	460	134	65	26	59	3,197
Arkansas and Oklahoma	1,810	123	471	115	87	99	2,709
Texas, northern	4,700	550	990	78	658	385	7,359
Texas, southern	4,840	648	746	220	486	15	6,953
Arizona and New Mexico	3,060	671	156	242	21	4	4,158
Colorado and Wyoming	1,930	192	144	28	228	89	2,614
Idaho, Montana, Nevada, Utah	2,630	273	96	76	235	73	3,381
Alaska and Hawaii	468	62	--	21	20	4	576
California, northern	2,730	406	76	73	--	2	3,286
California, southern	7,280	1,730	295	347	107	--	9,755
Oregon and Washington	2,120	341	150	122	34	12	2,779
Importers[7]	4,920	483	345	223	65	124	6,160
Total[6]	81,300	14,000	6,800	3,390	2,490	1,960	110,000
Puerto Rico	924	157	65	451	--	--	1,597
Grand total[6]	82,300	14,200 [8]	6,870 [9]	3,840	2,490 [10]	1,960	112,000

-- Zero.

[1]Includes imported cement and cement made from imported clinker. Except for district totals, data have been rounded to three significant digits, but are likely accurate to only two significant digits. District totals are accurate to no more than three significant digits.

[2]District is the location of the reporting entity, not the location of sales (see table 9 for sales data, by State).

[3]Includes shipments by importers for which district assignations were possible.

[4]Includes shipments for which customer types were not specified.

[5]District totals are unrounded except in accord with table 11.

[6]Data may not add to totals shown because of independent rounding.

[7]Shipments by importers for which district assignations were not possible.

[8]Grand total shipments to concrete product manufacturers include brick and block—5,630; precast and prestressed—3,520; pipe—1,690; and other or unspecified—3,340.

[9]Grand total shipments to contractors include airport—100; road paving—3,740; soil cement—1,390; and other or unspecified—6,870.

[10]Grand total shipments include oil well drilling—2,050; mining—271; and waste stabilization—176.

TABLE 15

PORTLAND CEMENT SHIPPED FROM PLANTS IN THE UNITED STATES TO DOMESTIC CUSTOMERS, BY TYPE[1, 2, 3]

(Thousand metric tons)

Type[4]	2006	2007
General use and moderate heat (Types I and II)[5]	94,000 r, 6	86,500
High early strength (Type III)	3,810	3,730
Sulfate resisting (Type V)[5]	17,700	14,400
Block	581	469
Oil well	1,480	1,540
White[7]	1,180	1,020
Blended:		
Portland, natural pozzolans	216	68
Portland, ground granulated blast furnace slag	1,640 r, 6	1,090
Portland, fly ash	306 r	243
Portland, other pozzolans[8]	741 r	756
Total blended[9]	2,900 r, 6	2,160
Expansive and regulated fast setting	42	29
Miscellaneous[10]	59	191
Grand total [9]	122,000	110,000

[r]Revised.

[1]Includes sales of imported cement. Excludes Puerto Rico.

[2]Data are rounded to no more than three significant digits.

[3]Gray portland-type cements unless otherwise specified.

[4]Sold mostly under specifications ASTM C–150, ASTM C–595, and ASTM C–1157. Unless otherwise specified, the sales are of gray cement.

[5]Type II/V hybrid cements are included within Type V.

[6]Revised to include in Type I and II some ASTM C–1157 cement formerly reported as blended cement.

[7]White or colored portland-type cements. Most are Types I and II but may include Types III and V and block cements.

[8]Includes blends with cement kiln dust, silica fume, or other pozzolans. Also includes blends with multiple pozzolans.

[9]Data may not add to totals shown because of independent rounding.

[10]Includes low heat (Type IV), waterproof, and other portland-type cements.

TABLE 16

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

Country	2006		2007	
	Quantity	Value[2]	Quantity	Value[2]
United States:				
Anguilla	(3)	9	2	259
Aruba	(3)	44	1	437
Australia	4	248	3	238
Bahamas	22	2,615	24	3,679
Belize	(3)	9	1	78
Brazil	2	112	(3)	24
British Virgin Islands	1	132	(3)	53
Brunei	--	--	1	57
Canada	601	52,845	729	75,088
Cayman Islands	1	118	1	107
China	3	403	3	564
Colombia	1	216	1	354
Cyprus	1	106	3	212
Dominican Republic	1	180	11	604
Ecuador	1	36	1	66
El Salvador	1	88	1	57
Finland	(3)	9	--	--
France	--	--	1	85
Greece	2	162	2	191
Guatemala	1	113	(3)	9
Hong Kong	3	183	3	224
India	(3)	104	1	80
Ireland	1	119	1	175
Israel	1	53	2	149
Italy	(3)	45	1	45
Jamaica	2	117	4	170
Japan	1	45	(3)	30
Korea, Republic of	3	164	1	61
Mexico	35 [4]	5,126 [4]	32 [4]	5,667 [4]
Netherlands Antilles	1	175	(3)	136
New Zealand	(3)	15	1	57
Oman	(3)	173	2	523
Panama	2	370	11	856
Peru	3	198	1	167
Saudi Arabia	(3)	21	1	144
Singapore	1	258	(3)	290
Spain	1	59	(3)	39
Sweden	1	52	1	81
Taiwan	6	427	3	241
Thailand	1	61	--	--
Tokelau Islands	1	47	--	--
Trinidad and Tobago	1	89	3	362
Turks and Caicos Islands	3	189	1	204
Ukraine	--	--	12	562
United Arab Emirates	4	350	16	753
Venezuela	4	241	(3)	47
Other	4	1,788 r	4	1,073
Total[5]	723 [4]	67,914 [4]	886 [4]	94,298 [4]

See footnotes at end of table.

TABLE 16—Continued

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

Country	2006 Quantity	2006 Value[2]	2007 Quantity	2007 Value[2]
Puerto Rico:				
Antigua and Barbuda	1	137	(3)	15
Aruba	5	326	2	134
Barbados	7	257	--	--
British Virgin Islands	4	568	8	901
Dominica	1	124	--	--
Guadeloupe	14	618	--	--
Guyana	--	--	5	206
Haiti	3	231	1	520
Jamaica	15	738	--	--
Martinique	7	2,594	--	--
Netherlands Antilles	18	805	1	112
St. Vincent and the Grenadines	1	627	--	--
Trinidad and Tobago	1	461	--	--
Turks and Caicos Islands	9	506	5	309
Other	(3)	34 r	10	790
Total[5]	86	8,025	33	2,986
Grand total[5]	809 [4]	75,877 [4]	919 [4]	97,284 [4]

[r]Revised. -- Zero.

[1]Includes portland and masonry cements.

[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

[3]Less than ½ unit.

[4]Official export data have been corrected to remove an apparent excess of aluminous cement exports from Laredo, TX, of 743,939 metric tons and $38.253 million in 2006 and 653,255 metric tons and $28,829 million in 2007.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 17

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Brazil	454	23,133	30,388	579	37,245	47,530
British Virgin Islands[4]	16	1,993	2,559	--	--	--
Bulgaria	295	16,297	19,634	53	3,261	3,862
Canada	5,059	325,217	345,126	5,326	386,922	410,735
China	10,542	469,112	734,103	5,337	243,760	389,869
Colombia[4]	1,862	110,909	139,797	1,552	104,506	134,402
Croatia	29	5,817	6,986	26	7,011	8,490
Denmark	270	20,369	31,185	239	19,441	28,735
Dominican Republic	24	1,295	1,788	12	837	1,116
Egypt	275	16,902	24,485	95	6,469	10,491
France	97	22,805	25,380	111	19,148	20,157
Greece	1,950	91,745	135,493	703	35,516	52,160
India	1	119	143	1	240	342
Indonesia	130	5,045	8,620	--	--	--
Japan	3	1,097	2,403	5	1,954	3,003
Korea, Republic of	2,544	106,553	157,391	2,505	113,076	162,474
Mexico	2,264	142,081	171,928	1,684	113,673	136,115
Netherlands	5	3,701	4,385	4	3,283	3,707
Norway	233	9,849	15,077	122	6,114	6,117
Peru	822	40,108	54,371	326	18,571	30,097
Romania	212	9,444	13,523	--	--	--
Spain	69	7,362	10,043	29	3,032	4,434
Sweden	889	37,760	57,483	457	25,005	39,364
Switzerland	--	--	--	42	2,119	3,327
Taiwan	2,180	93,516	148,997	2,168	98,841	166,729
Thailand	3,798	180,136	268,166	730	33,053	51,794
Turkey	591	30,801	46,815	138	9,366	13,828
United Arab Emirates	2	198	329	(6)	29	47
United Kingdom	7	2,943	3,037	5	2,002	2,462
Venezuela	943	48,907	66,850	218	13,621	18,080
Other	(6)	314	380	1	479	570
Total[5]	35,566	1,825,530	2,526,864	22,468	1,308,574	1,750,033
Puerto Rico:						
Brazil	--	--	--	2	1,380	2,335
China	78	2,891	4,686	40	1,977	3,086
Colombia	12	1,427	1,882	3	400	519
Denmark	27	1,508	2,337	--	--	--
Dominican Republic	--	--	--	18	1,469	1,621
Korea, Republic of	201	9,649	15,716	181	8,140	14,664
Mexico	12	1,281	1,816	16	1,846	2,570
Other	(6)	29	30	(6)	84	92
Total[5]	330	16,785	26,467	261	15,296	24,887
Grand total[5]	35,896	1,842,315	2,553,331	22,729	1,323,870	1,774,920

-- Zero.

[1]Includes portland, masonry, and other hydraulic cements.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Material from British Virgin Islands is thought to be from Colombia.

[5]Data may not add to totals shown because of independent rounding.

[6]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Anchorage, AK:						
Canada	11	526	1,557	10	549	2,094
France	(4)	2	5	--	--	--
Korea, Republic of	120	4,624	8,430	91	4,380	7,947
Total[5]	131	5,152	9,992	101	4,929	10,040
Baltimore, MD:						
Canada	76	4,206	5,527	--	--	--
China	--	--	--	(4)	58	78
Colombia	--	--	--	25	1,818	1,818
Germany	--	--	--	(4)	18	19
India	--	--	--	(4)	9	12
Korea, Republic of	--	--	--	(4)	17	24
Netherlands	(4)	20	24	(4)	213	241
Romania	132	6,058	8,893	--	--	--
Sweden	(4)	176	212	(4)	368	400
Taiwan	35	1,225	1,225	--	--	--
United Kingdom	(4)	82	96	(4)	47	54
Venezuela	18	639	639	--	--	--
Total[5]	262	12,404	16,617	26	2,547	2,646
Boston, MA:						
Canada	29	1,654	2,328	110	6,066	8,697
China	4	132	267	--	--	--
Netherlands	(4)	22	24	--	--	--
Venezuela	42	1,922	2,929	3	212	300
Total[5]	74	3,730	5,547	114	6,278	8,996
Buffalo, NY:						
Canada	828	55,681	59,501	808	62,976	66,036
China	--	--	--	(4)	130	133
Japan	--	--	--	(4)	31	31
United Kingdom	4	1,159	1,196	--	--	--
Total[5]	832	56,841	60,697	809	63,137	66,200
Charleston, SC:						
China	9	327	696	--	--	--
Colombia	245	16,851	20,447	18	978	1,376
Greece	745	33,868	51,026	43	1,964	2,989
Japan	(4)	269	1,033	--	--	--
Netherlands	(4)	33	37	(4)	16	18
South Africa	--	--	--	(4)	13	17
Taiwan	--	--	--	269	10,544	23,836
United Kingdom	1	234	238	--	--	--
Total[5]	998	51,582	73,477	330	13,516	28,236
Chicago, IL:						
Belgium	--	--	--	(4)	18	25
France	(4)	53	56	(4)	--	--
Honduras	--	--	--	(4)	15	17
Japan	(4)	151	181	(4)	149	179
Netherlands	1	826	993	(4)	185	213
Poland	(4)	20	21	(4)	23	25
United Kingdom	(4)	3	5	--	--	--
Total[5]	2	1,053	1,255	(4)	390	458

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Cleveland, OH:						
Canada	931	48,944	51,003	766	59,239	61,272
China	1	19	22	(4)	37	43
Croatia	--	--	--	(4)	43	62
Italy	--	--	--	(4)	14	15
Netherlands	(4)	348	405	(4)	253	285
Turkey	--	--	--	(4)	9	9
Total[5]	932	49,311	51,430	766	59,594	61,687
Columbia-Snake, OR-WA						
Canada	18	870	915	117	6,083	6,550
China	1,011	42,203	61,500	1,077	42,000	65,329
Thailand	3	129	208	(4)	5	7
Total[5]	1,032	43,202	62,623	1,194	48,088	71,887
Dallas, Fort Worth, TX:						
China	(4)	6	8	(4)	13	25
Norway	--	--	--	(4)	4	7
Total[5]	(4)	6	8	(4)	17	31
Detroit, MI:						
Canada	1,213	87,486	89,240	1,020	86,321	87,734
China	--	--	--	(4)	19	24
Croatia	--	--	--	1	288	317
France	--	--	--	(4)	28	28
Germany	--	--	--	(4)	--	--
Japan	(4)	2	2	--	--	--
Netherlands	(4)	358	409	(4)	244	272
South Africa	(4)	27	28	--	--	--
United Kingdom	(4)	159	159	--	--	--
Total[5]	1,214	88,032	89,837	1,021	86,902	88,378
El Paso, TX, Mexico	709	37,617	44,531	612	36,060	41,955
Great Falls, MT:						
Canada	25	1,425	1,495	8	447	466
China	--	--	--	(4)	27	27
Japan	--	--	--	(4)	2	2
Total[5]	25	1,425	1,495	8	476	495
Honolulu, HI:						
China	298	10,566	19,071	194	7,820	13,107
Japan	--	--	--	(4)	24	28
Taiwan	196	7,104	11,797	265	10,583	17,290
Thailand	--	--	--	18	841	1,116
Total[5]	495	17,671	30,868	477	19,267	31,542

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Houston-Galveston, TX:						
Belgium	--	--	--	(4)	3	3
Brazil	--	--	--	117	6,425	8,498
British Virgin Islands[6]	(4)	67	78	(4)	--	--
China	1,718	75,458	127,082	839	34,346	55,857
Colombia[6]	209	15,550	16,800	406	31,171	38,496
Croatia	(4)	6	8	(4)	8	16
Denmark	--	--	--	(4)	16	17
Egypt	49	4,549	6,323	33	2,674	4,607
France	(4)	72	83	(4)	110	123
Germany	(4)	84	110	(4)	81	102
Greece	81	3,591	5,751	--	--	--
India	--	--	--	(4)	6	7
Korea, Republic of	1,009	41,838	68,752	1,378	56,906	87,952
Mexico	--	--	--	39	2,352	3,449
Netherlands	(4)	42	47	(4)	20	24
Peru	--	--	--	31	2,015	2,989
Sweden	(4)	42	47	(4)	65	70
Taiwan	43	1,591	3,096	422	16,367	23,725
Thailand	259	10,001	18,590	84	4,148	9,280
Turkey	--	--	--	(4)	2	3
United Kingdom	1	563	563	(4)	17	20
Total[5]	3,371	153,455	247,330	3,350	156,732	235,239
Laredo, TX:						
Canada	(4)	2	2	(4)	--	--
Mexico	222	23,833	25,147	160	19,258	20,277
Total[5]	222	23,835	25,149	160	19,258	20,277
Los Angeles, CA:						
China	2,015	92,601	140,948	1,506	76,966	124,648
Colombia	(4)	39	54	1	87	128
Croatia	--	--	--	(4)	20	24
Germany	(4)	31	47	(4)	17	20
India	1	113	132	1	140	180
Indonesia	72	2,772	5,067	(4)	--	--
Japan	2	511	926	3	1,054	1,619
Korea, Republic of	(4)	5	5	(4)	--	--
Lithuania	--	--	--	(4)	29	30
Taiwan	41	2,190	3,020	183	9,339	14,159
Thailand	1,289	64,689	97,756	155	8,170	13,631
Turkey	(4)	8	9	(4)	--	--
United Arab Emirates	2	153	261	(4)	--	--
United Kingdom	(4)	77	78	(4)	14	14
Total[5]	3,422	163,188	248,302	1,848	95,836	154,452

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Miami, FL:						
Argentina	(4)	3	4	(4)	3	5
Brazil	12	503	737	23	1,095	2,003
British Virgin Islands[6]	16	1,910	2,459	(4)	--	--
Canada	--	--	--	41	2,165	3,721
China	461	16,996	35,216	20	929	1,527
Colombia[6]	24	1,581	2,192	34	2,900	4,040
Denmark	42	3,061	4,960	23	1,704	2,791
Egypt	48	2,833	4,222	23	1,866	3,189
Greece	219	10,186	14,469	66	3,070	4,157
India	(4)	6	11	(4)	--	--
Mexico	85	8,972	11,268	106	11,147	14,022
Peru	--	--	--	12	463	942
Portugal	(4)	2	3	(4)	25	37
Spain	69	7,362	10,043	27	2,867	4,269
Sweden	882	35,729	54,958	445	22,044	35,937
Switzerland	--	--	--	42	2,119	3,327
Taiwan	66	2,392	4,726	148	4,878	12,245
Thailand	40	1,482	2,867	(4)	--	--
Turkey	186	8,440	12,075	36	1,763	2,733
United Kingdom	(4)	8	9	(4)	3	3
Venezuela	36	2,356	3,203	(4)	--	--
Total[5]	2,186	103,822	163,421	1,046	59,040	94,947
Minneapolis, MN, Canada	179	11,129	12,067	170	14,563	14,961
Mobile, AL:						
China	162	5,878	13,678	(4)	--	--
Greece	162	7,230	11,488	(4)	--	--
Peru	--	--	--	2	166	269
Thailand	168	7,878	13,072	(4)	--	--
Venezuela	29	1,900	2,160	(4)	--	--
Total[5]	521	22,885	40,398	2	166	269
New Orleans, LA:						
China	1,327	72,471	94,281	58	3,374	5,200
Colombia	321	14,871	18,299	146	6,411	8,518
Croatia	29	5,662	6,806	21	5,086	6,337
Germany	--	--	--	(4)	4	4
Korea, Republic of	1,024	42,114	57,984	729	36,155	44,165
Peru	822	40,108	54,371	36	2,235	2,253
Taiwan	464	18,048	33,155	(4)	--	--
Thailand	522	34,059	39,512	(4)	--	--
Turkey	119	9,814	13,915	79	6,170	8,945
United Kingdom	--	--	--	(4)	4	4
Total[5]	4,629	237,149	318,323	1,069	59,438	75,427

See footnotes at end of table.

TABLE 18—Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
New York, NY:						
Canada	--	--	--	153	8,050	8,050
China	143	5,490	9,040	42	1,606	3,768
Colombia	2	561	617	4	907	944
Croatia	(4)	142	162	2	597	686
Denmark	40	3,600	3,988	56	5,521	5,524
France	(4)	3	4	(4)	24	32
Germany	(4)	34	39	(4)	114	139
Greece	448	23,791	32,936	424	22,017	32,386
Japan	--	--	--	(4)	164	387
Mexico	--	--	--	38	3,369	3,369
Netherlands	(4)	264	291	(4)	375	415
Norway	233	9,849	15,077	122	6,111	6,111
Poland	(4)	52	56	(4)	16	17
Sweden	2	1,612	1,945	3	2,084	2,260
Taiwan	86	3,099	5,247	38	1,281	1,281
Thailand	42	1,773	3,807	(4)	--	--
Turkey	122	5,644	9,384	24	1,422	2,139
United Kingdom	(4)	52	52	--	--	--
Venezuela	89	6,012	6,964	26	2,106	2,106
Total[5]	1,207	61,978	89,609	933	55,763	69,614
Nogales, AZ, Mexico	1,080	59,042	76,311	716	40,502	52,046
Norfolk, VA:						
Brazil	--	--	--	127	9,086	10,597
Bulgaria	295	16,297	19,634	53	3,261	3,862
Canada	13	963	963	(4)	--	--
China	242	9,468	16,644	82	6,819	9,279
Colombia	--	--	--	28	1,762	2,138
France	97	22,675	25,232	111	18,978	19,965
Greece	--	--	--	5	252	383
Netherlands	(4)	124	145	(4)	338	386
Romania	80	3,384	4,627	(4)	--	--
South Africa	--	--	--	(4)	3	3
Sweden	(4)	31	34	--	--	--
United Kingdom	(4)	191	225	5	1,885	2,327
Venezuela	7	244	478	(4)	--	--
Total[5]	734	53,378	67,982	411	42,384	48,940
Ogdensburg, NY:						
Canada	418	33,199	33,502	460	46,216	46,678
France	--	--	--	(4)	9	9
Germany	(4)	3	3	(4)	--	--
South Africa	--	--	--	(4)	36	37
Total[5]	418	33,202	33,505	460	46,261	46,724
Pembina, ND, Canada	122	5,934	6,205	150	8,361	8,453
Philadelphia, PA:						
Belgium	(4)	29	31	(4)	14	17
Germany	(4)	15	23	(4)	13	17
Korea, Republic of	143	8,559	8,589	(4)	--	--
Netherlands	2	1,287	1,572	1	858	981
Thailand	460	13,695	16,028	314	12,152	14,558
United Kingdom	(4)	120	123	(4)	10	14
Total[5]	605	23,704	26,364	316	13,047	15,587

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

Customs district and country	2006			2007		
	Quantity	Value		Quantity	Value	
		Customs[2]	C.i.f.[3]		Customs[2]	C.i.f.[3]
United States—Continued:						
Portland, ME, Canada	84	10,307	11,042	105	13,834	14,804
Providence, RI:						
Brazil	--	--	--	26	1,557	2,621
Canada	32	2,119	2,854	89	6,015	8,682
China	55	2,104	4,385	44	1,628	4,268
Colombia	--	--	--	25	1,879	2,311
Peru	--	--	--	218	11,882	20,719
Turkey	164	6,895	11,431	(4)	--	--
Venezuela	400	18,577	26,573	150	8,818	12,266
Total[5]	652	29,695	45,243	553	31,780	50,866
San Diego, CA:						
China	--	--	--	15	861	1,186
Mexico	76	5,250	5,315	14	985	996
Taiwan	604	31,805	44,028	378	21,870	35,682
Thailand	40	2,221	3,215	(4)	--	--
Total[5]	720	39,277	52,559	407	23,715	37,864
San Francisco, CA:						
China	1,611	75,588	111,273	988	43,846	68,389
India	--	--	--	(4)	41	59
Indonesia	39	1,572	2,595	(4)	--	--
Japan	(4)	33	48	(4)	--	--
Netherlands	--	--	--	(4)	42	46
Taiwan	399	17,351	25,230	241	11,760	17,798
Thailand	750	33,936	55,304	157	7,601	12,856
United Arab Emirates	1	45	68	(4)	29	47
United Kingdom	1	266	266	(4)	12	14
Total[5]	2,800	128,793	194,784	1,387	63,332	99,210
Savannah, GA:						
China	1	85	175	(4)	42	57
Colombia	185	12,556	16,238	349	26,355	33,411
Finland	(4)	14	16	(4)	--	--
India	--	--	--	(4)	45	84
Netherlands	(4)	84	94	1	505	561
Romania	(4)	2	3	(4)	--	--
Thailand	--	--	--	(4)	21	46
United Kingdom	(4)	29	29	(4)	11	11
Total[5]	186	12,771	16,555	350	26,979	34,170
Seattle, WA:						
Canada	952	46,055	50,848	1,202	52,581	58,008
China	419	18,251	26,620	365	17,774	28,440
Japan	(4)	129	213	1	529	757
Korea, Republic of	248	9,413	13,631	220	8,693	13,428
Netherlands	(4)	78	92	(4)	93	103
Total[5]	1,619	73,925	91,404	1,788	79,671	100,736
St. Albans, VT, Canada	128	14,718	16,076	117	13,453	14,530
St. Louis, MO:						
Croatia	(4)	7	9	3	969	1,047
Netherlands	(4)	216	253	(4)	141	161
Total[5]	(4)	224	262	3	1,110	1,208

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

Customs district and country	2006 Quantity	2006 Value Customs[2]	2006 Value C.i.f.[3]	2007 Quantity	2007 Value Customs[2]	2007 Value C.i.f.[3]
United States—Continued:						
Tampa, FL:						
Brazil	442	22,630	29,651	286	19,082	23,810
British Virgin Islands[6]	(4)	17	22	(4)	--	--
China	1,053	40,990	72,176	107	5,466	8,484
Colombia[6]	551	29,248	40,165	246	11,642	17,402
Denmark	187	13,709	22,237	160	12,200	20,403
Egypt	179	9,521	13,939	38	1,930	2,695
Greece	295	13,080	19,823	164	8,213	12,244
Korea, Republic of	--	--	--	86	6,924	8,959
Mexico	51	4,440	5,383	(4)	--	--
Peru	--	--	--	27	1,810	2,925
Sweden	5	171	287	9	444	697
Taiwan	244	8,711	17,472	223	12,220	20,712
Thailand	226	10,273	17,807	1	115	299
Venezuela	265	14,173	19,954	38	2,485	3,407
Total[5]	3,499	166,961	258,917	1,385	82,529	122,037
U.S. Virgin Islands:						
Barbados	--	--	--	(4)	18	19
Colombia	--	--	--	8	910	925
Dominican Republic	--	--	--	12	837	1,116
Spain	--	--	--	2	165	165
Venezuela	56	3,083	3,951	(4)	--	--
Total[5]	56	3,083	3,951	22	1,931	2,225
Wilmington, NC:						
China	13	479	1,021	(4)	--	--
Colombia	324	19,650	24,985	263	17,687	22,896
Dominican Republic	24	1,295	1,788	(4)	--	--
Indonesia	18	700	958	(4)	--	--
Mexico	42	2,927	3,973	(4)	--	--
Total[5]	421	25,051	32,726	263	17,687	22,896
U.S. total[5]	35,566	1,825,530	2,526,864	22,468	1,308,574	1,750,033
Puerto Rico (San Juan):						
Brazil	--	--	--	2	1,380	2,335
Canada	(4)	21	22	(4)	--	--
China	78	2,891	4,686	40	1,977	3,086
Colombia	12	1,427	1,882	3	400	519
Denmark	27	1,508	2,337	(4)	--	--
Dominion Republic	--	--	--	18	1,469	1,621
France	(4)	4	4	(4)	--	--
Germany	--	--	--	(4)	68	74
Korea, Republic of	201	9,649	15,716	181	8,140	14,664
Mexico	12	1,281	1,816	16	1,846	2,570
Spain	(4)	4	4	(4)	16	18
Total[5]	330	16,785	26,467	261	15,296	24,887
Grand total[5]	35,896	1,842,315	2,553,331	22,729	1,323,870	1,774,920

-- Zero.

[1]Includes all varieties of hydraulic cement and clicker.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

[5]Data may not add to totals shown because of independent rounding.
[6]Material from the British Virgin Islands is thought to be from Colombia.

Source: U.S. Census Bureau.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

	2006			2007		
					Value	
Country	Quantity	Customs[1]	C.i.f.[2]	Quantity	Customs[1]	C.i.f.[2]
United States:						
Brazil	454	23,133	30,388	578	37,245	47,530
Bulgaria	295	16,297	19,634	53	3,261	3,862
Canada	4,089	243,292	261,558	4,323 [3]	298,595	320,694
China	9,260	397,302	641,665	4,835 [4]	206,564	329,663
Colombia	1,598	90,910	116,940	1,457	95,891	123,916
Egypt	215	11,010	16,540	38	1,930	2,695
Greece	1,950	91,745	135,493	703	35,516	52,160
Indonesia	130	5,045	8,620	--	--	--
Korea, Republic of	2,307	92,336	143,143	2,406	106,272	155,671
Mexico	1,875	97,221	122,203	1,297	68,224	86,086
Norway	233	9,849	15,077	122	6,114	6,117
Peru	431	17,791	28,132	290	16,336	27,844
Romania	212	9,442	13,520	--	--	--
Sweden	886	35,900	55,245	454	22,488	36,634
Taiwan	2,180	93,516	148,997	2,126	97,106	162,964
Thailand	3,255	142,552	223,448	689	28,532	44,603
Turkey	487	22,015	34,587	59	3,193	4,880
Venezuela	795	39,210	55,213	162	9,468	13,176
Other	5	568 [r]	586 [r]	68	4,509	6,029
Total[5]	30,655 [6]	1,439,133	2,070,990	19,662 [6]	1,041,245	1,424,522
Puerto Rico:						
China	78	2,891	4,686	40	1,977	3,086
Denmark	18	661	911	--	--	--
Korea, Republic of	201	9,649	15,716	181	8,140	14,664
Other	2	4	4	2	1,380	2,335
Total[5]	299	13,205	21,317	223	11,497	20,085
Grand total[5]	30,952 [6]	1,452,338	2,092,307	19,885 [6]	1,052,742	1,444,607

[r]Revised. -- Zero.
[1]The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.
[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.
[3]Data for Canada for 2007 do not include approximately 81,000 metric tons, imported into the Columbia-Snake, OR-WA district, that was misregistered by the importer under the white cement tariff code and which has been included in table 20.
[4]Data for China for 2007 do not include approximately 350,000 metric tons, imported into the Los Angeles, CA district, that was misregistered by the importer under the white cement tariff code and which has been included in table 20.
[5]Data may not add to totals shown because of independent rounding.
[6]Total imports do not include gray portland cement that was misregistered by importers under the white cement tariff code and which has been included in table 20.

Source: U.S. Census Bureau.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Country	Quantity	Customs[1]	C.i.f.[2, 3]	Quantity	Customs[1]	C.i.f.[2, 3]
United States:						
British Virgin Islands[4]	16	1,993	2,559	--	--	--
Canada	347	42,832	43,938	407 [5]	45,164	46,399
China	38	3,577	5,752	403 [6]	30,284	50,747
Colombia[4]	25	3,638	4,461	69	6,993	8,559
Denmark	265	19,916	30,732	227	18,211	27,501
Dominican Republic	24	1,295	1,788	--	--	--
Egypt	60	5,893	7,945	57	4,539	7,796
India	1	119	143	1	240	342
Mexico	305	36,126	40,150	269	33,422	37,201
Spain	69	7,362	10,043	27	2,865	4,266
Taiwan	--	--	--	43	1,735	3,765
Thailand	41	4,896	7,441	41	4,521	7,191
Turkey	104	8,779	12,220	79	6,172	8,947
United Arab Emirates	2	198	329	(7)	29	47
Venezuela	4	379	395	--	--	--
Other	1 r	25 r	36 r	1	55	75
Total[8]	1,302 [9]	137,027	167,929	1,622 [9]	154,230	202,836
Puerto Rico:						
Colombia	12	1,427	1,882	3	400	519
Denmark	8	847	1,426	--	--	--
Mexico	12	1,281	1,816	16	1,846	2,570
Other	--	--	--	(7)	23	26
Total[8]	33	3,555	5,124	19	2,269	3,115
Grand total[8]	1,335 [9]	140,582	173,053	1,641 [9]	156,500	205,951

[r]Revised. -- Zero.

[1]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight and other delivery charges to the first port of entry.

[3]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of data for gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[4]Material from British Virgin Islands is thought to be from Colombia.

[5]The official import data for white cement from Canada in 2007 include approximately 81,000 metric tons (t) of gray portland cement, imported into the Columbia-Snake, OR-WA district, that was misregistered by the importer under the white cement tariff code.

[6]Approximately 350,000 tons of the white cement from China in 2007 represents gray portland cement, imported into the Los Angeles, CA district, that was misregistered by the importer under the white cement tariff code.

[7]Less than ½ unit.

[8]Data may not add to totals shown because of independent rounding.

[9]Total imports of white cement include substantial quantities of gray cement that were misregistered by importers under the white cement tariff code.

Source: U.S. Census Bureau.

TABLE 21

U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2006			2007		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Canada	608	36,110	36,471	576	40,021	40,323
China	1,240	67,499	85,729	97	6,483	8,938
Colombia	239	16,361	18,396	24	801	1,106
Croatia	(4)	36	48	--	--	--
France	96	21,697	24,138	109	17,681	18,523
Germany	--	--	--	--	11	13
Korea, Republic of	237	14,213	14,243	99	6,803	6,803
Netherlands	--	--	--	--	8	9
Peru	391	22,317	26,239	36	2,235	2,253
Thailand	502	32,688	37,278	--	--	--
Venezuela	111	5,899	7,824	30	2,047	2,798
Total[5]	3,425	216,821	250,365	972	76,089	80,766
Puerto Rico, Dominican Republic	--	--	--	18	1,446	1,596
Grand total[5]	3,425	216,821	250,365	990	77,535	82,362

-- Zero.

[1]For all types of hydraulic cement.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing in the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2003	2004	2005	2006	2007[e]
Afghanistan[e]	70	70	60	50	50
Albania	578	573	530 [r]	600 [e]	600
Algeria	9,000 [e]	11,000 [e]	11,296	14,702 [r]	15,899 [3]
Angola	700	754	1,315	1,373	1,400
Argentina	5,217	6,254	7,595	8,929	9,602 [3]
Armenia	384	501	605	625 [r]	722 [3]
Australia[e]	8,000	8,000	9,000	9,000	9,000
Austria	3,886	3,976	4,736	4,700 [e]	4,700
Azerbaijan	1,013	1,428	1,538 [r]	1,622 [r]	1,731 [3]
Bahrain	129	153	191	190 [e]	190
Bangladesh[e]	5,000	5,000	5,100	5,100	5,100
Barbados	325	322	320 [e]	320	320
Belarus	2,472	2,731	3,131	3,495	3,820 [3]
Belgium	6,550	6,715	7,594	8,192	8,200
Benin[e]	250	250	250	1,489 [r, 3]	1,550 [3]
Bhutan[e]	160	170	170	180	180
Bolivia	1,138	1,276	1,440	1,636	1,739 [3]
Bosnia and Herzegovina	891	1,045	1,026	1,226	1,300
Brazil	34,010	34,413	36,673	39,540	46,406 [3]
Brunei	236	242	266	270 [e]	270
Bulgaria[e]	2,100	2,100	2,100	2,000	2,000
Burkina Faso[e]	30	30	30	30	30
Burma[4]	572	519	543	570	608 [3]
Cambodia	--	--	--	--	87 [3]
Cameroon	949	1,032	1,000 [e]	1,000	1,000
Canada	13,416	13,863	14,179	14,336 [r]	15,078 [3]
Chile	3,622	3,798	3,999	4,112	4,440 [3]
China	862,080	970,000	1,068,850	1,236,770 [r]	1,354,120 [p, 3]
Colombia	7,337	7,822	9,959	10,038 [5]	11,068 [3, 5]
Congo (Brazzaville)	--	--	100	100 [e]	100
Congo (Kinshasa)	331	403	511	530	550
Costa Rica[e]	1,130 [r]	1,500 [r]	1,400 [r]	1,400 [r, 3]	1,400
Côte d'Ivoire[e]	650	650	650	650	650
Croatia	3,654	3,811	3,481	3,633	3,700
Cuba	1,346	1,401	1,567	1,705	1,805 [3]
Cyprus	1,637	1,689	1,805	1,786	1,873 [3]
Czech Republic	3,502 [r]	3,829	3,978	4,239 [r]	4,889 [3]
Denmark	1,953	2,150	2,120	2,115	2,100
Dominican Republic	2,907	2,654	2,779	2,800 [e]	2,800
Ecuador[e]	3,100	3,000	3,000	3,000	3,000
Egypt	26,639	28,763	32,458 [r]	36,200 [r]	38,400 [3]
El Salvador	1,391	1,265	1,131	1,311	1,350
Eritrea[e]	45	45	45	45	45
Estonia	506	615	726 [r]	750 [r, e]	750
Ethiopia	1,130	1,316	1,569 [r]	1,700 [e]	1,700
Fiji[e]	120	120	143 [3]	143 [r]	145
Finland	1,493 [r]	1,295	1,357	1,685	1,743 [3]
France	19,655	20,962	21,277	22,540 [r]	22,300
French Guiana[e]	60	60	60	60	60
Gabon[e]	260	260	260	260	229 [3]
Georgia[e]	345 [3]	425 [3]	450	450	450
Germany	32,749	31,854	31,009 [r]	33,630 [r]	33,382 [3]
Ghana[e]	1,900	1,900	1,900	1,900	1,900
Greece	14,638	15,039	15,166	15,674	16,667 [3]

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2003	2004	2005	2006	2007[e]
Guadeloupe[e]	230 [3]	230	240 [r]	230	230
Guatemala[e]	2,000	2,200	2,400	2,500	2,500
Guinea[e]	360	360	360	360	360
Haiti[e]	290 [3]	300	300	300	300
Honduras	1,268	1,392	1,384	1,400 [e]	1,400
Hong Kong	1,189	1,039	1,005	1,010 [e]	1,000
Hungary	3,573	3,349	3,371	3,349 [r]	3,350
Iceland	90	100 [r]	132 [r]	141 [r]	90
India[e]	123,000 [3]	130,000	145,000	160,000	170,000
Indonesia	35,500	33,230	33,917	35,000 [e]	36,000
Iran	30,460	32,198	32,650	33,000 [e]	35,000
Iraq[e]	1,901 [3]	2,500	3,000	3,500	3,500
Ireland	3,830	5,000 [e]	5,083	4,981	5,000 [3]
Israel	4,632	4,494	5,093	5,089	5,000
Italy	43,580	45,343	40,284	47,814	47,541 [3]
Jamaica	608	808	845	761	592 [3]
Japan	68,766	67,376	69,629	69,942	67,685 [3]
Jordan	3,515	3,908	4,046	3,967	3,969 [3]
Kazakhstan	2,570	3,662	3,975	4,880 [r]	5,699 [3]
Kenya	1,658	1,789	2,123	2,174 [r]	2,314 [3]
Korea, North[e]	5,540	5,630	5,700	6,160 [r]	6,130
Korea, Republic of	60,725 [r]	56,955 [r]	51,391	53,971 [r]	57,042 [3]
Kuwait	1,863	2,635	2,145	2,200 [e]	2,200
Kyrgyzstan	757	870	900	1,211	1,300
Laos[e]	250	250	250	400 [r]	400
Latvia[e]	295 [3]	284 [3]	280	280	300
Lebanon	3,900 [r]	4,400 [r]	4,600 [r]	4,400 [r]	4,900
Liberia	25 [e]	121	144	155	157 [3]
Libya[e]	3,500 [3]	3,600	3,621 [3]	3,600	3,700
Lithuania	597	753	832	1,065 [r]	1,105 [3]
Luxembourg	714	797	760	800 [e]	780
Macedonia	768	820	800	800 [e]	800
Madagascar[e]	200	170	150	150	270 [3]
Malawi	161	120	166 [r]	188 [r]	185 [3]
Malaysia	17,243	15,690	17,860	18,000 [e]	18,000
Martinique[e]	220	220	220	220	220
Mauritania	200 [e]	300	300 [e]	357 [r]	410 [3]
Mexico	33,593	34,992	37,452	40,362 [r]	40,670 [3]
Moldova	255	440	641	837	800
Mongolia	162	62	112	141	221 [3]
Morocco[e]	10,400	11,000	11,000	11,000	11,000
Mozambique	600	570	560	720	850
Nepal[e, 4]	295	285	290	295	300
Netherlands	2,450	2,380	2,496	2,790	2,700
New Caledonia	100	115	119	133 [r]	122 [3]
New Zealand[e]	1,080	1,110 [3]	1,100	1,100	1,100
Nicaragua	890	521	530	530 [e]	530
Niger[e]	54	54	54	54	54
Nigeria[e]	2,300	2,300	2,400	3,000	6,500
Norway	1,650	1,420	1,613	1,695	1,700
Oman	2,500 [r]	2,621 [r]	2,686 [r]	3,611 [r]	3,880 [3]
Pakistan[e]	13,000	15,000	17,000	20,652 [r, 3]	21,000
Panama	889	1,042	1,050	1,050 [e]	1,100

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2003	2004	2005	2006	2007[e]
Paraguay[e]	520	470	550	600	600
Peru[e]	4,000 [3]	4,590 [3]	4,600	5,000	5,000
Philippines	13,067 [r]	13,346	15,494	12,033	13,048 [3]
Poland	11,653	12,566	12,646	14,688	16,964 [3]
Portugal	8,567	8,843	8,438	8,340	8,500
Qatar[e]	1,400	1,400	1,500 [3]	1,568 [r, 3]	2,500
Réunion[e]	380	380	380	400	400
Romania	5,992	6,239	7,032	8,253 [r]	10,061 [3]
Russia	41,000	45,700	48,500	54,700	59,900 [3]
Rwanda	105 [r]	104	101	103 [r]	103 [3]
Saudi Arabia	24,147	25,380	26,064	27,053	30,369 [3]
Senegal	1,694	2,391	2,623	2,884	3,152 [3]
Serbia	XX [6]	XX [6]	XX [6]	2,565 [r]	2,677 [3]
Serbia and Montenegro	2,075 [6]	2,240 [6]	2,276 [6]	XX [r]	XX
Sierra Leone	169	180	172	234	236 [3]
Singapore[e]	150 [3]	--	--	--	--
Slovakia	3,147	3,158	3,499	3,593	3,718 [3]
Slovenia	1,370	1,186	1,114	1,269	1,270
South Africa, sales[7]	8,973 [r]	10,297 [r]	11,464 [r]	12,658 [r]	13,651 [3]
Spain, including Canary Islands	44,747	45,593 [r]	50,347	54,033	54,500
Sri Lanka[e]	1,164 [3]	1,400	1,500	1,600	1,700
Sudan	272	307	331	202	200
Suriname[e]	65	65	65	65	65
Sweden	2,476	2,588	2,709	2,952	2,950
Switzerland	3,613	3,851	4,022	4,040	4,000
Syria[e]	4,824 [3]	4,757 [3]	4,700	4,700	4,700
Taiwan	18,474	19,050	19,891	19,294	18,957 [3]
Tajikistan	166	194	253	282	300
Tanzania	1,186	1,281	1,366	1,432 [r]	1,513 [3]
Thailand	32,530	35,626	37,872	39,408	35,668 [3]
Togo[e]	800	800	800	800	800
Trinidad and Tobago	766	768	686	883	890
Tunisia	6,038	6,662	6,691	6,932	7,052 [3]
Turkey	35,077	38,796	42,787	47,499	49,553 [3]
Turkmenistan[e]	450	550	650	800	900
Uganda[e]	507 [3]	559 [3]	630	630	650
Ukraine	8,923 [r]	10,635 [r]	12,183	13,732	15,000 [3]
United Arab Emirates[e]	8,000	9,000	9,800 [3]	9,800	12,500
United Kingdom	11,215	11,405	11,216	12,119	11,900
United States, including Puerto Rico[8]	94,329	99,015	100,903	99,712	96,850 [3]
Uruguay[e]	1,050	1,050	1,050	1,050	1,050
Uzbekistan	4,805 [r]	5,068 [r]	5,068	5,000 [e]	5,000
Venezuela[e]	7,700	9,000	10,000	11,000	11,000
Vietnam	24,127	26,153	30,808	32,690	36,400
Yemen	1,541	1,546	1,550 [r]	1,470 [r]	1,728 [3]
Zambia[e]	350	390 [r]	435	650 [r]	650
Zimbabwe[e]	400	500	600	700	400
Total	2,030,000	2,190,000	2,350,000	2,600,000 [r]	2,770,000

[e]Estimated. [p]Preliminary. [r]Revised. XX Not applicable. -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are believed to be accurate to no more than three significant digits. Data are from a variety of sources, including the European Cement Association.

[2]Table includes data available through July 11, 2008. Data may include clinker exports for some countries.

[3]Reported figure.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

[4]Data are for fiscal year ending March 31 of the following year.

[5]Data for 2006 and 2007 are for gray cement only; white cement output was likely to have been and additional 50,000 to 100,000 tons per year.

[6]Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union. Montenegro has no cement plants.

[7]Data have been adjusted to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted, in metric tons, to: 2003—1,189,739 (revised); 2004—1,438,567 (revised); 2005—1,511,716 (revised); 2006—1,599,505 (revised); and 2007—1,664,304.

[8]Portland and masonry cements only.

science for a changing world

2008 Minerals Yearbook

CEMENT [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

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Cement

By Hendrik G. van Oss

Domestic survey tables were prepared by Michelle B. Blackwell, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Portland and masonry cement production in the United States in 2008 was 86.3 million metric tons (Mt), down by 9.6% from that of 2007 (table 1). Consumption of cement as measured by cement sales to domestic final customers fell by nearly 16% to 96.8 Mt (table 9); these sales were 31.1 Mt or about 24% lower than the record high sales of 2005. At 10.7 Mt, imports of cement were only one-half of those of 2007. Despite the large drop in sales volumes, cement prices fell only modestly on average (tables 1, 11–13); sales overall totaled about $10 billion on a mill net valuation basis. Based on typical portland cement mixing ratios in concrete, the delivered value of concrete (excluding mortar) in the United States in 2008 was estimated to be at least $47 billion.

Percentage or other changes expressed in this report compare activity in 2008 with that of 2007 unless specified otherwise. Except where otherwise indicated, activity levels in this report exclude those in Puerto Rico. Except for some trade data, cements covered in this report are limited to those hydraulic varieties broadly classified as portland cement (including blended cement and other varieties listed in table 15) and/or masonry cement (including portland-lime and plastic cements); these are the binding agents in concrete and most mortars. Other hydraulic cements (notably aluminous cement) are included only in the trade data in tables 16–18 and 21 (clinker) and within the world production data in table 22. Excluded are pure (unblended) supplementary cementitious materials (SCM), such as fly ash, other pozzolans, and ground granulated blast furnace slag (GGBFS). Sales data for blended (also called composite) cements listed separately from portland cement are available in the monthly Mineral Industry Surveys reports of the U.S. Geological Survey (USGS).

The bulk of this report is based on data compiled from USGS annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, some of which are independent of U.S. cement manufacturers. For 2008, questionnaires were received from 149 of 152 facilities canvassed, a response rate of 98%, which included all production sites. For 2007, forms were received for 151 of the 153 facilities canvassed, including all production sites. If missing data could not be obtained by followup telephone inquiry, they were estimated based on monthly data or past annual reporting. For both years, the data exclude several importers that have yet to participate in the surveys. To the degree that they are selling independently of the participating companies, sales by the missing importers for 2007 and 2008 are estimated to be equivalent to an additional 1% of the total portland cement sales tonnages shown in this report. Background information on cement and its manufacture and on the USGS cement canvasses is given in van Oss (2005).

Government Programs and Environmental Issues

Environmental issues associated with the cement industry mostly result from the manufacture of the intermediate product called clinker. In clinker manufacture, the burning of large amounts of raw materials and fuels leads, or can lead, to significant emissions of carbon dioxide (CO_2), nitrogen oxides (NOx), sulfur oxides (SOx), mercury and some other metals, volatile organic carbon compounds, and particulates. Increasingly, these emissions are regulated or are being considered for regulation or reregulation. The largest volume emissions are of CO_2. Overall, generation of CO_2 by the U.S. cement industry in 2008 was in the range of 0.89 to 0.93 metric ton (t) of CO_2 per ton of clinker; the high end reflecting fuel combustion emissions derived using “standard” heat values for the fuels consumed (table 7) and the low end reflecting heat values actually reported by the individual plants. Both ends of the range include a standard emissions factor from calcination of limestone of 0.51 t of CO_2 per ton of clinker as detailed by the Intergovernmental Panel on Climate Change (Hanle and others, 2006), but exclude any correction for cement kiln dust (CKD) not recycled to the kiln (for which data are lacking). The calcination component of CO_2 emissions can be reduced in proportion to the calcium oxide contributed by noncarbonate alternative raw materials, such as ferrous slags and coal combustion ashes. This reduction was about 2.7% (nearly 1.1 Mt of CO_2) in 2008 and about 3.0% (1.3 Mt of CO_2) in 2007. Relative reductions can be significantly larger at the subset of individual plants that actually burn these alternative raw materials. Some types of fuels, including alternative or waste fuels, can either directly reduce plant-level emissions or may lead to reductions in reported emissions from combustion because the fuels are considered to be carbon-neutral (certain biofuels) or because there may be credits allowed for their use (certain waste fuels). Plant-level emissions can also be reduced through upgrading to more efficient kiln line technology. Unit (per ton of product) emissions can also be reduced by use of SCM in finished cement and in concrete to reduce the clinker content of these products and allowing the addition of “inert” fillers to boost cement output without simultaneously boosting clinker output. In regard to the latter, both the ASTM International standard for portland cement (ASTM C–150–05) and the similar American Association of State Highway and Transportation Officials (AASHTO) standard M85 were amended to allow for the addition of up to 5% ground limestone in the finish mill.

In June, the U.S. Environmental Protection Agency (EPA) released a study evaluating the potential for increased use in federally funded infrastructure projects of so-called recovered mineral components (such as coal combustion ashes, silica fume, and ferrous slags) to reduce the clinker content of cement or the portland cement content of concrete and so reduce the unit emissions of CO_2 associated with these construction materials (U.S. Environmental Protection Agency, 2008). The study concluded that significant emissions reductions were possible by the use of these alternative materials and recommended mandating their use. The EPA was also formulating new regulations that would mandate reductions in mercury emissions by U.S. cement plants; the new emissions limits were expected to be published in early 2009.

Production

In response to continued sharp declines in sales, domestic production of portland cement fell by 8.6% in 2008 to just 83.3 Mt (table 3). This was the lowest output since 1999. The decline was aggravated by the continued availability of large cement stockpiles and was despite a major curtailment of cement imports (table 1). The size of the production drop was in sharp contrast to the modest (1.8%) decline in 2007; lower sales volumes in that year had been largely accommodated by large reductions in imports. Regionally, production declines in 2008 were experienced in all but two districts. Production capacity for the country increased modestly owing to the startup of a new plant in Colorado and of a new kiln at an existing plant in southern Texas. The 2008 capacities listed in table 3 do not reflect the fact that several plants closed permanently or were idled indefinitely during the year, and that many plants operated a reduced number of kilns during all or part of the year. Instead, these developments are reflected in greatly reduced capacity utilization throughout the country. Masonry cement output fell by nearly 30%, reflecting ongoing weakness in the housing construction sector and a significant drawdown of stockpiles.

With common parents combined under the larger subsidiary's name and with joint ventures apportioned, the 10 leading companies at yearend 2008, in descending order of portland cement production, were Holcim (US) Inc., CEMEX, Inc., Lafarge North America Inc., Lehigh Cement Co., Buzzi Unicem USA Inc. (including Alamo Cement Co.), Ash Grove Cement Co., Texas Industries, Inc. (TXI), Essroc Cement Corp., CalPortland Co., and St. Marys Cement Inc. The listing was unchanged from that of 2007. The U.S. industry continued to be heavily consolidated—the leading 5 cement companies, combined, had 60% of total U.S. portland cement production, and the leading 10 companies accounted for 88% of total production. Of the above named companies, all except Ash Grove and TXI were foreign owned as of yearend, and for the industry overall, about 81% of total cement output was by foreign-owned companies.

Clinker production in 2008 fell by 9.0% to 78.4 Mt (table 5). This was the lowest level since 2000. Production fell in all months but March. Only three districts recorded production increases; one of these had a new plant come online during the year and another commissioned a new kiln. Yearend stocks[1] rose by nearly 8%, possibly as buildup ahead of extended shutdowns of kilns anticipated for 2009. Although the average number of days for routine kiln maintenance was only slightly higher for the country overall, some districts showed significant increases in this metric and, while not revealed in table 5, most districts showed large increases in downtimes for other purposes (including for slow sales); accordingly, the average capacity utilization percentage fell significantly to just 73% from 85% in 2007. The utilization statistic is dependent on the reported breakout of downtime for scheduled routine maintenance and this is not always reported correctly; nevertheless, the drop in 2008 was substantial. Most plants have total downtimes in excess of routine maintenance; thus an overall capacity utilization of 85% or higher is considered to indicate a plant (or district) operating more or less at full practicable capacity.

Nonfuel raw materials consumed to make clinker and cement are listed in table 6. The 2008 ratios among clinker raw materials (as contributors of major oxides) appear to be broadly similar to those in 2007. Direct comparison of ratios among raw materials should be done with caution; tonnage and tonnage ratio changes could reflect widespread raw material substitution, activities at just a few plants, or even errors in reporting.

For fly ash and bottom ash, a comparison can be made between the data in table 6 and those published for sales (by coal-fired electric utilities) of coal combustion products (for cement or as raw feed for clinker) by the American Coal Ash Association (ACAA). For fly ash, table 6 lists consumption of 2.7 Mt of fly ash for clinker and cement, combined, in 2008; the corresponding ACAA number is about 2.9 Mt (American Coal Ash Association, 2009). For bottom ash, consumption was about 0.95 Mt for clinker only ("other ash," table 6), and the ACAA reported 0.55 Mt of bottom ash sales. The difference in the two datasets probably reflects a difference between consumption (table 6)—which is from a mix of ongoing purchases and drawdown of stockpiles—and sales (ACAA data) and the fact that the ACAA data are extrapolated. Of the consumption of gypsum in table 6, at least 0.64 Mt in 2008 was of synthetic gypsum; the differentiation from natural gypsum is not required on the USGS canvass. This was higher than the 0.38 Mt noted by the ACAA; part of the difference could reflect the likelihood that the ACAA data do not include synthetic gypsum produced by the cement plants themselves.

Data for fuel quantities consumed by the cement industry are listed in table 7. As with the nonfuel raw materials, data shifts can reflect activities at just a few plants. In terms of overall mass ratios among fuels (in total) and overall to clinker production, significant changes in 2008 were not evident for coal and

[1]Yearend stockpiles of clinker are an artifact of data collection convenience rather than a reflection of full-year market conditions or production capacity. Generally, if the clinker is not required for immediate cement production, a plant will try to build up its stocks of clinker prior to scheduled extended kiln shutdowns so as to provide continuity of clinker feed to the finish (cement) mill. These shutdowns can happen at any time of the year.

petroleum coke, but showed significant declines for natural gas and fuel oil (likely owing to price increases for these), and increases for tires and solid wastes.

Although not revealed in table 7, overall heat consumption (gross heat basis) in 2008 was about 4.3 billion joules (GJ) per metric ton of clinker, down by 1.5% from that in 2007 and (if significant) likely reflects some idling of less efficient kilns during the year at some plants. Wet plants were significantly unchanged at an average of about 6.5 GJ per ton of clinker, as were dry kiln plants at 4.0 GJ per ton of clinker. As in past years, the largest share of heat energy used in 2008 was from coal (about 65%) and petroleum coke (21%).

The average unit electricity consumption increased in 2008 (table 8); this most likely reflects increases in the total amount of downtime at a majority of plants. Modern dry process plants have for many years reported higher average electricity consumption per ton of cement product than many wet process plants because of a complex array of blowers and fans associated with the modern kiln lines, but the difference has essentially vanished in recent years, largely owing to relatively high electricity consumption levels at the remaining wet plants.

There were no significant ownership changes in the U.S. cement industry in 2008. In January, Holcim took over U.S. operational and sales management of its Canadian subsidiary, St. Lawrence Cement Group, and St. Lawrence took over management of the Holcim operations in Canada. In particular, this affected two integrated plants in the United States (Catskill, NY, and Hagerstown, MD).

Two new cement plants were completed during 2008. In February, GCC Rio Grande began producing clinker and then cement at its new 0.9-million-metric-ton-per-year (Mt/yr) plant at Pueblo, CO. Towards yearend, a new company, American Cement Co., LLC, finished construction of its new cement plant at Sumterville, FL. The company was a joint venture between Oldcastle Materials, Inc., and New Jersey-based Trap Rock Industries, Inc. Plant capacity was about 1.0 Mt/yr (Cohrs, 2008), and the facility was expected to begin cement production in early 2009.

Poor sales during the year and prospects for more of the same in 2009 led to a number of plants, or at least their production facilities, being permanently closed or put into idle status indefinitely. For some plants, environmental issues, especially those involving emissions, were a contributing factor to the shutdowns. In many of these cases, however, the facilities continued to be used as storage, packaging, and transshipment terminals.

Buzzi Unicem closed its granulated slag-grinding and cement-lending plant in New Orleans, LA, in June, permanently ended production at its 0.4-Mt/yr cement plant at Independence, KS, in September, and idled its 0.6-Mt/yr cement plant at Oglesby, IL, in November. Towards yearend, CEMEX closed the smaller of its two cement plants at Brooksville, FL, preferring to rely on the more modern Brooksville-South facility that it had purchased in 2007 and that was being enlarged. At yearend, CEMEX idled indefinitely its 0.9-Mt/yr plant at Davenport, CA, after the facility had been cited for hexavalent chromium content in its fugitive dust. Essroc closed the 0.4-Mt/yr kiln at its plant at Frederick, MD, in November, and the plant's finish mill was expected to be shut down in early 2009 when the remaining clinker supply had run out. The Frederick closure, albeit somewhat advanced in timing, had been expected given diminishing limestone reserves and because the company was undertaking a major expansion project at its nearby Martinsburg, WV, cement plant. At yearend, St. Marys indefinitely idled its 0.6-Mt/yr plant at Dixon, IL. In March, TXI shut the remaining white clinker kiln at its Crestmore, CA, plant because of hexavalent chromium in the dust; the other white clinker kiln there was shut down in December 2007. However, grinding of gray clinker brought in from TXI's Oro Grande, CA, plant continued until yearend, at which point the gray cement finish mill was idled. With the closure of the Crestmore plant, Lehigh's York, PA, and Waco, TX, plants became the only white cement plants remaining in operation in the United States.

In November, Holcim announced that, in response to low sales levels, the company was planning to close its Dundee, MI, and Clarksville, MO, plants by early 2009 (Holcim, Ltd., 2008). The Dundee plant operated two wet kilns, and Clarksville, a single wet kiln. The two plants had a combined capacity of approximately 2.2 Mt/yr of clinker. Clarksville's kiln was notable in that, at nearly 232 meters (m) length and about 8.5 m in diameter, it was thought to be the largest in the world. In terms of net capacity, the Clarksville closure was to be more than offset by Holcim's plans to open, at about the same time, a new 4-Mt/yr-capacity plant in St. Genevieve County, MO. The new plant's capacity was to be based on a single precalciner kiln, giving it the largest capacity kiln in the world.

Upgrade or expansion projects of varying complexity were underway at a number of plants, although some projects were being postponed entirely or extended owing to projected slow sales conditions. A few projects were completed in 2008. In September, CEMEX first fired the new 1.1-Mt/yr precalciner kiln at its Balcones, TX, plant. In November, CEMEX completed the new 0.9-Mt/yr precalciner kiln at its Brooksville-South, FL, plant (CEMEX USA, 2008).

In January, TXI Riverside Cement Co. fired the new 1.4 Mt/yr precalciner kiln at its Oro Grande, CA, plant; construction of the new kiln had been completed in December 2007. The new kiln line replaced the plant's existing seven long dry kilns, of total capacity of approximately 1.2 Mt/yr, which were shut down in March (Arment and others, 2008).

In August, Buzzi Unicem commissioned a new 190-metric-ton-per-hour finish mill at its Festus, MO, cement plant. The mill was to supplement the existing finish mills in anticipation of commissioning a new approximately 2-Mt/yr, precalciner kiln in 2009 (Keim, 2008). Also in August, Continental Cement Co. fired up the new 1.0-Mt/yr precalciner kiln at its Hannibal, MO, plant (Maxwell-Cook, 2008, p. 90.). The plant permanently shut down its wet kiln in October.

In April, Carolinas Cement Co., LLC (a subsidiary of Titan America, LLC) announced plans to build a new cement plant at Castle Hayne, NC. The plant, targeted to come online in late 2011 or 2012, was to have a clinker capacity of about 2.0 Mt per-year (Mt/yr) (Environmental Quality Management, Inc., 2008).

Consumption

The consumption data used by the cement industry for market analysis are monthly cement shipments (sales) tonnages to final domestic customers, by State; these data are published monthly by the USGS and have been summarized in table 9. Although the national sales totals in table 9 are similar to the shipments totals in tables 11, 12, and 14, only the table 9 breakout tonnages represent State-level consumption. The regional breakouts in tables 11, 12, and 14 simply pertain to the locations of the reporting entities (chiefly the production sites), not the locations of consumption. It is very common for shipments to cross State lines.

The U.S. cement market throughout 2008 continued a steady decline begun in early-to-mid 2006 and largely related to the continued combined effects of the decline in new home construction, a tight loan market, and declines in State property tax revenues. Declines (relative to 2007) were experienced in all months during the year. Overall, domestic portland cement consumption in 2008 fell by about 15% to 93.8 Mt (table 9), the lowest level since 1997. Only Kansas, Louisiana, North Dakota, Oklahoma, and Wyoming registered overall consumption increases during the year. Combined, consumption of portland cement in the three traditionally leading consuming States (California, Florida, and Texas), were down by about 16% in 2008. Masonry cement consumption fell by nearly 29% to just 3.0 Mt, the lowest level since 1993.

Sales by some importers that did not participate in the USGS monthly and annual surveys were not included in the portland cement consumption data in this report. An estimate of these missing importers' sales can be made by comparing official (U.S. Census Bureau) trade data (tables 17 and 21) with the import origins of sales (table 9). The official cement imports were about 1.5 Mt higher than the foreign origin tonnages in 2008 and 1.2 Mt higher than those in 2007. After accounting for these differences for cement varieties that are in the trade tables but not covered by the USGS canvasses (chiefly aluminous cement) and for apparent drawdown of stocks (which cannot fully distinguish between imported and domestic cement), it becomes evident that the annual tables are missing 1.0 to 1.2 Mt of sales for 2007 and 2008. It is possible to estimate the missing import tonnages for only a few regions. In Texas, company-specific cement tax data published by the Texas Comptroller of Public Accounts indicate that the USGS sales data for Texas overall (table 9) understate the consumption by approximately 0.28 Mt in 2007 and 0.33 Mt in 2008, mostly representing material imported from Colombia. At other locations, USGS data appear to be missing an additional 0.2 to 0.3 Mt of Colombian cement. The USGS consumption data are also missing imports into the Philadelphia, PA, customs district (table 18), amounting to 0.31 Mt in 2007 and 0.19 Mt in 2008.

As the binder in concrete, cement consumption levels within a given category of construction will broadly reflect levels of construction spending, although significant time lags may exist between the onset or cutoff of spending and changes in the consumption of cement. In terms of 1996 constant dollars, overall construction spending in 2008 fell by 7.5% to $657 billion (Portland Cement Association, 2010). Within this spending, the residential construction sector was dominant at $231 billion, down by about 25%; the decline continued a trend begun in 2006. The largest component of the 2008 decline was in new, single-family housing, which was down by nearly 37% to $120 billion. The private nonresidential construction sector, in contrast, was up by 8.6% overall to $177 billion, continuing a trend begun in 2006 and, apparently, continuing to reflect lag effects of the very strong housing sector in 2005 and early 2006. Public sector construction was up by just 2.8% to about $186 billion. The increase was owing largely to higher expenditures for buildings (up by 6.1% to $76.3 billion); the road construction sector declined slightly to $47.4 billion.

Portland cement sales broken out by customer type are listed in table 14. Sales to ready-mixed concrete producers accounted for about 72% of total shipments, but the true tonnage for this type of concrete was larger because some of it was recorded under other customer categories, such as road paving contractors. As listed, the sales to ready-mixed customers declined by 17%, a somewhat higher percentage drop than that for overall portland cement sales. The decrease in residential construction funding noted earlier is at least qualitatively reflected in a 12% decline in sales tonnages to brick and block manufacturers (table 14) as well as the large drop in masonry cement sales (table 12). As in 2007, the 8.5% decline in 2008 sales to precast and prestressed concrete contractors was not in accord with the overall increase in spending levels for private nonresidential construction and for public sector construction. Sales to road paving contractors were up by 5% (compared with revised data for 2007), despite the slight decline in road construction expenditures. Sales to mining companies fell by nearly 13%, which was in accord with reduced mineral commodity prices in 2008, but the volumes may be underreported. Cement sales for oil and gas well drilling increased by 22%.

A breakout of the sales of different types of portland cement is given in table 15. As in past years, sales were dominated by Types I and II cements and sulfate-resistant varieties of cement (Type V and Type II/V hybrids reported as Type V). Although the sales of the largest category (Types I and II) fell proportionately to the 15% decline in overall portland sales, those of Type V fell by 18% and reflected the severe construction falloff in California and other Southwestern States. Sales of oil-well cements fell by 4.5% but reflected only a component of total sales to "oil well drillers" (table 14); relatively shallow oil and gas drilling can use standard types of portland cement.

Blended cement sales declined, but by a smaller percentage than for portland cement sales overall; this may indicate some growth in the market share of blended cement. Sales of blended cements that contained fly ash increased by about 57%, apparently at the expense of blends containing GGBFS. Availability of GGBFS was somewhat uncertain during the year, owing in part to the closure of a major slag-grinding facility at midyear.

Data on the mill net values for shipments to final customers by plants and import terminals (terminal nets) are provided in tables 11 to 13. Despite significantly reduced sales tonnages, the average mill net values of portland and masonry cement declined only slightly in 2008.

Foreign Trade

Trade data from the U.S. Census Bureau are presented in tables 16–21. Exports were again very small compared with imports, and Canada continued to be by far the dominant recipient of the exports. Overall, exports of hydraulic cement and clinker fell by about 7% to 0.82 Mt; 2007 data have been corrected to remove an apparent excess (0.65 Mt) of aluminous cement exports to Mexico through Laredo, TX (table 16). Imports of cement and clinker in 2007 fell by about 49% to just 11.4 Mt (tables 1, 17, 18); this followed a nearly 37% drop in 2007. Imports in 2008 were the lowest since 1994 and represented a decline of 24.2 Mt from the record level of 2006. The dominant component of imports was gray portland cement, imports of which fell by 51% to 9.6 Mt (table 19). Overall, imports from Asian countries (especially China, Taiwan, and Thailand) were down well in excess of the overall average, while overland imports from Canada and Mexico declined less severely.

Official imports of clinker fell by 36% to just 0.6 Mt (table 21), the lowest level since 1982. The clinker data continued to be incomplete, however, with regard to overland imports from Canada; the tonnages listed were insufficient to supply the grinding plants in Michigan and Washington (all of which imported their clinker from Canada). The unreported Canadian clinker appeared mostly to be coming in by truck, at a value of less than $2,000 (customs value) per truckload; such shipments are classified as “informal entries” and data on them are not routinely transmitted by the U.S. Customs Service to the U.S. Census Bureau for recordation into the official trade data (reproduced in tables 17–21). This problem presumably does not exist for imports by rail or by ship because these shipments are larger. Clinker imports from Canada were estimated to be higher than those reported in tables 1 and 21 by about 0.6 Mt in 2007 and about 0.7 Mt in 2008.

With the falloff of imports, especially from Asia, many of the once-busiest import locations have fallen from prominence, and overland import locations have become relatively dominant. For cement and clinker combined, the 10 busiest customs districts of entry in 2008, in descending order, were Houston-Galveston, TX; Seattle, WA; Detroit, MI; Columbia-Snake, OR and WA; Buffalo, NY; Los Angeles, CA; Cleveland, OH; San Francisco, CA; Ogdensburg, NY; and El Paso, TX (table 18). These leading districts accounted for about 67% of the total imports for the year.

World Review

World hydraulic cement production data are listed in table 22. The data are intended to include all forms of hydraulic cement; however, the data for the United States are for portland plus masonry cement only, and data for some other countries also may be incomplete. For some countries, the production data may include exports of clinker.

World cement output in 2008 was an estimated 2.84 billion metric tons (Gt), up by only about 1%; this was a significantly lower growth rate than that in 2007 (7.7%). Production was from more than 150 countries. China was again the world’s leading producer by far, with an output of nearly 1.4 Gt or about 49% of the world total. The remaining top 20 producers (a grouping that happens to correspond in 2008 with a production threshold of 20 Mt or more), in descending order, were India, the United States, Japan, the Republic of Korea, Russia, Brazil, Turkey, Mexico, Iran, Italy, Spain, Egypt, Pakistan, Indonesia and Vietnam (tied), Thailand, Germany, Saudi Arabia, and France. Cumulatively, the top 5 countries had about 62% of total world output, the top 10 countries, about 71%, and the top 20 countries, about 84%.

Regionally, Asia contributed about 67% of world production, included 8 of the 20 leading producing countries, and continued to experience the greatest growth rate of all regions. Western Europe had about 8% of total output; the Middle East (including Turkey), about 6%; North America, about 5%; Africa, about 4%; Central America and South America, combined, about 4%; the Commonwealth of Independent States, about 3%; and Eastern Europe, about 2%.

Outlook

There was little expectation of much increase in overall spending levels in the construction sector in 2009. Portland cement consumption was expected to continue to decline, but the rate of decline was expected to be lower because of anticipated Government economic stimulus spending. Lower revenues to the States from property taxes were expected to continue to hamper State contributions to construction projects funded jointly by the State and Federal Governments. An overall year-over-year increase in cement consumption was not expected until 2010 at the earliest, and a return to levels approaching the record years of 2005 and 2006 was not expected for at least 5 more years. Imports were expected to decline further, but such declines were not expected to be able to significantly shield domestic producers from the potential need to reduce output. Further plant closures or indefinite idlings were expected in 2009, especially at plants that were either very small or operated energy-inefficient (especially wet) kiln technology. It was unclear how many of the indefinitely idled facilities in 2008 would ever reopen. New, lower limits on mercury emissions were expected to be released by the EPA in 2009 and were of concern to the industry. Mercury enters the kilns from both the fuels and the raw materials and, as with CO_2, the emissions are not easily technologically controlled. Some form of mandatory accounting of CO_2 emissions was expected to be implemented in the near future. There was concern that popular strategies for reducing unit emissions of CO_2, such as incorporating SCM into the finished cement or concrete or by burning alternative raw materials and fuels, might be constrained by restrictions on mercury emissions. Some of the SCM, especially fly ash, typically have elevated concentrations of this metal.

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TABLE 1

SALIENT CEMENT STATISTICS FOR THE UNITED STATES[1, 2]

(Thousand metric tons unless otherwise specified)

		2004	2005	2006	2007	2008
Production:						
Cement[3]		97,434	99,319	98,167	95,464	86,310
Clinker		86,658	87,405	88,555	86,130	78,382
Shipments from mills and terminals:[3, 4, 5]						
Quantity		120,000	128,000	127,000	114,000	96,700
Value[6]	(thousands dollars)	9,520,000	11,700,000	12,900,000	11,900,000 [r]	9,990,000
Average value[6]	(dollars per metric ton)	79.50	91.00	101.50	104.00 [r]	103.50
Stocks, yearend		6,740	7,450	9,380	8,890 [r]	8,360
Exports		749	766	723 [7]	886 [7]	823
Imports:[8]						
Cement		25,396	30,403	32,141	21,496	10,744
Clinker		1,630	2,858	3,425	972	621
Total[9]		27,026	33,261	35,566	22,468	11,365
Consumption, apparent[10]		121,950	128,250	127,660	116,550	96,760
World production [11]		2,190,000	2,350,000	2,610,000 [r]	2,810,000 [r]	2,840,000

[r]Revised.

[1]Unless otherwise indicated, data are for portland (including blended) and masonry cements only. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Excludes Puerto Rico.

[3]Includes cement made from imported clinker.

[4]Includes imported cement.

[5]Shipments to final domestic customers. Data are from an annual survey of plants and terminals and may differ from the totals in table 9, which are based on consolidated monthly surveys from companies.

[6]Value free on board mill or independently reporting terminal.

[7]Official export data have been corrected to remove an apparent excess of aluminous cement from Laredo, TX, of 943,939 metric tons in 2006 and 653,255 metric tons in 2007.

[8]All forms of hydraulic cement or clinker.

[9]Data may not add to totals shown because of independent rounding.

[10]Production (including that from imported clinker) of cement plus imports of hydraulic cement minus exports of hydraulic cement minus the change in yearend cement stocks.

[11]Total hydraulic cement. May include clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Illinois, metropolitan Chicago	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois, excluding Chicago	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, excepting those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reagan, Reeves, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3

PORTLAND AND BLENDED CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

	2007					2008				
			Capacity[2]					Capacity[2]		
District[3]	Number of plants	Production[4]	Grinding	Percentage utilized[5]	Yearend stocks[6]	Number of plants	Production[4]	Grinding	Percentage utilized[5]	Yearend stocks[6]
Maine and New York	5	3,149	4,165	75.6	307 [7]	5	3,061	4,204	72.8	234 [7]
Pennsylvania, eastern	7	4,070	5,520 [7]	73.8	304	7	3,826	5,140 [7]	74.5	285
Pennsylvania, western	3	1,591	1,805	88.1	135	3	1,327	1,805	73.5	140
Illinois	4	3,116	3,417	91.2	285	4	2,655	3,390	78.3	268
Indiana	4	2,981	3,740	79.7	254	4	2,587	3,653	70.8	237
Michigan	5	5,486	7,330 [7]	74.9	292 [7]	5	4,928	7,332	67.2	287
Ohio	2	916	1,198	76.5	35	2	762	1,166	65.4	64
Iowa, Nebraska, South Dakota	5	4,436	6,007	73.8	453	5	3,987	5,840 [7]	68.3	458
Kansas	4	2,757	3,230 [7]	85.4	242	4	2,396	3,230 [7]	74.2	247
Missouri	5	5,229	6,958	75.1	695	5	4,651	7,230	64.3	532
Florida[8]	7	5,512	7,301	75.5	520	7	4,979	7,301	68.2	389 [7]
Georgia, Maryland, Virginia, West Virginia	7	5,292	6,456	82.0	596	7	5,057	6,780 [7]	74.6	595 [7]
South Carolina	3	3,681	5,082	72.4	295 [7]	3	2,925	5,085	57.5	137 [7]
Alabama	5	5,061	7,075	71.5	348	5	4,635	7,074	65.5	242
Kentucky, Mississippi, Tennessee	4	3,420	3,736	91.5	330	4	3,045	3,702	82.3	282
Arkansas and Oklahoma	4	2,613	3,136	83.3	216	4	2,623	3,130 [7]	83.9	198
Texas, northern	6	6,294	7,600	82.8	682	6	6,303	7,618	82.7	1,324
Texas, southern	6	4,627	5,830 [7]	79.3	315	6	4,778	6,330 [7]	75.5	260 [7]
Arizona and New Mexico	3	2,633	3,116	84.5	136	3	2,097	3,116	67.3	102
Colorado and Wyoming	3	2,538	3,542	71.7	173	4	2,610	4,449	58.7	173
Idaho, Montana, Nevada, Utah	6	3,002	3,753	80.0	251	6	2,727	3,728	73.1	221 [7]
Alaska and Hawaii	--	--	--	--	59	--	--	--	--	82
California, northern	3	2,210	2,853	77.5	233	3	1,678	2,853	58.8	188
California, southern	8	8,623	11,047	78.1	311	8	8,201	10,855	75.6	310 [7]
Oregon and Washington	4	1,908	2,591	73.6	294 [7]	4	1,443	2,435	59.3	248 [7]
Importers[9]	--	--	--	--	413 [7]	--	--	--	--	310 [7]
Total[10]	113	91,144	116,000 [7]	78.2	8,170 [7]	114	83,283	117,000 [7]	70.9	7,810 [7]
Puerto Rico	2	1,386	1,898	73.0	52	2	1,301	1,898	68.5	44
Grand total[10]	115	92,530	118,000 [7]	78.2	8,230 [7]	116	84,584	119,000 [7]	70.9	7,860 [7]

-- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits. Includes data for white cement.

[2]Grinding capacity is based on fineness needed to produce a plant's normal output mix, including masonry cement, and allowing for downtime for routine maintenance.

[3]District assignation is the location of the reporting facilities. Specific districts include importers for which district assignations were possible.

[4]Includes cement made from imported clinker.

[5]Calculated relative to portland cement output; utilization would be higher if calculated to include output of masonry cement.

[6]Includes imported cement. Includes stocks at mills, terminals, and in transit.

[7]Data contain estimates for nonrespondent or incompletely reporting facilities and have been rounded to no more than three significant digits.

[8]Production and capacity data exclude a plant that produced only masonry cement.

TABLE 3—Continued

PORTLAND AND BLENDED CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

[9]Data include only those importers or terminals for which district assignations were not possible.

[10]Data may not add to totals shown because of independent rounding.

TABLE 4

MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

District[2]	2007 Number of plants	2007 Production[3]	2007 Yearend stocks[4]	2008 Number of plants	2008 Production[3]	2008 Yearend stocks[4]
Maine and New York	4	101	20	4	69	17
Pennsylvania	9	304	61 [5]	9	254	56
Indiana and Ohio	6	462	74	6	332	73
Michigan	4	149	45	4	99	34
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	W	W	2	W	W
Missouri	1	W	W	1	W	W
Florida	5	524	40	5	310	65
Georgia, Maryland, Virginia, West Virginia	7	468	59	6	367	53
South Carolina	3	491	34	3	323	31
Alabama	4	450	75	4	303	63
Kentucky, Mississippi, Tennessee	3	W	W	3	W	W
Arkansas and Oklahoma	4	148	20	4	125	18
Texas	8	368	155	7	274	20
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	1	W	W
California, northern	3	76	10	3	59	19
California, southern	4	446	22	5	278	23
Importers[6]	--	--	3 [5]	--	--	3 [5]
Total[7]	75	4,320	724 [5]	74	3,027	549 [5]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Includes masonry, portland-lime, plastic, and stucco cements. Even where presented unrounded, data are thought to be accurate to no more than three significant figures.

[2]District assignation is the location of the reporting facilities. Specific districts include importers for which district assignations were possible.

[3]Includes cement produced from imported clinker.

[4]Includes imported cement.

[5]Data contain estimates for nonrespondents or incompletely reporting facilities.

[6]Data include only those importers or terminals for which district assignations were not possible.

[7]Data may not add to totals shown because of independent rounding.

TABLE 5

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2008, BY DISTRICT[1]

(Data on capacity, production, and stocks are in thousand metric tons)

District	Number of active plants[2]: Process used: Wet	Dry	Both[3]	Total	Number of kilns[4]	Daily capacity[4, 5]	Average days of routine maintenance[6]	Apparent annual capacity[4, 7]	Production	Percentage of capacity utilized	Yearend stocks[8]
Maine and New York	2	2	--	4	5	11.2 [9]	34.4	3,700 [9]	2,753	74.5	220
Pennsylvania, eastern	2	4	--	6	10	14.6 [9]	22.4	4,990 [9]	3,660	73.3	310
Pennsylvania, western	2	1	--	3	7	5.0	24.9	1,700	1,387	81.6	133
Illinois	--	4 [10]	--	4	7	9.6	25.9 [9]	3,270 [9]	2,404	73.6	179
Indiana	1	3	--	4	8	10.2	22.0 [9]	3,470 [9]	2,667	76.8	285
Michigan	1	2	--	3	8	14.1	32.6	4,649	3,546	76.3	376
Ohio	1	1	--	2	3	3.3	29.9	1,136	746	65.7	94
Iowa, Nebraska, South Dakota	--	4	1	5	9	14.3	20.6	4,859	3,676	75.7	339
Kansas	1	3	--	4	9	9.4	29.1 [9]	3,197 [9]	2,306	72.1	107
Missouri	1	3	1	5	7	19.1	24.7	6,527	4,464	68.4	355
Florida	--	6	--	6	8	20.2	21.0	6,892	4,749	68.9	352
Georgia, Maryland, Virginia, West Virginia	2	4	--	6	9	17.8	23.1	6,017	4,833	80.3	282
South Carolina	--	3	--	3	3	12.3	22.3	4,246	2,899	68.3	319
Alabama	--	5	--	5	5	16.9	27.6	5,714	4,521	79.1	276
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.5	17.5	3,663	2,955	80.7	128
Arkansas and Oklahoma	2	2	--	4	10	8.0 [9]	24.2	2,730 [9]	2,447	89.5	83 #
Texas, northern	2	3	1	6	16	22.2	14.1 [9]	7,720 [9]	6,055	78.4	727
Texas, southern	--	5	--	5	6	16.3	15.7	5,708	4,386	76.8	405
Arizona and New Mexico	--	3	--	3	7	8.6	24.0	2,974	1,981	66.6	387
Colorado and Wyoming	--	4	--	4	5	11.5	17.0 [9]	3,967	2,548	64.2	269
Idaho, Montana, Nevada, Utah	3	3	--	6	8	8.3	22.7	2,823	2,587	91.7	244
California, northern	--	3	--	3	3	8.8	17.0	3,040 [9]	1,631	53.7	175
California, southern	--	8	--	8	18	36.1	17.4	11,916	7,942	66.7	970
Oregon and Washington	1	2	--	3	3	6.0	30.8	2,019	1,239	61.3	56
Total[11]	22	81	3	106	178	314.0 [9]	22.5 [9]	107,000 [9]	78,382	73.3	7,070 #
Puerto Rico	--	2	--	2	2	5.5	51.5	1,727	1,217	70.5	87
Grand total[11]	22	83	3	108	180	320.0 [9]	22.8 [9]	109,000 [9]	79,599	73.3	7,160 [9]

-- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes white cement plants. Includes all plants that produced clinker for at least one day during the year.

[3]Plants that can operate both wet and dry kilns, whether or not both types were active during the year.

[4]Includes kilns active for at least one day during the year. For kilns idle all year, excludes those that cannot be restarted, fully permitted, in less than 6 months.

[5]Sum of reported kiln capacities for each plant in a district.

[6]Total days of routine maintence (summed for all kilns) divided by the number of kilns.

[7]Sum of apparent annual capacities for each kiln. For each kiln, the statistic is calculated as 366 days (leap year) minus days reported for routine maintenance and then multiplied by the reported, unrounded, daily capacity.

[8]Includes imported clinker and clinker stockpiles at grinding plants.

TABLE 5—Continued

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2008, BY DISTRICT[1]

[9]Data contain estimates for nonrespondents and incompletely reporting facilities and have been rounded to no more than three significant digits.

[10]Includes one semiwet kiln.

[11]Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED TO PRODUCE CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

Materials	2007 Clinker	2007 Cement[3]	2008 Clinker	2008 Cement[3]
Calcareous:				
Limestone (aragonite, chalk, coral, marble)	112,000	2,150	101,000	1,920
Cement rock (includes marl)	10,800	6	10,900	50
Cement kiln dust (CKD)[4]	629	336	425	304
Lime[4]	292	38	248	15
Other	23	--	41	--
Aluminous:				
Clay	4,300	--	3,780	--
Shale and schist	3,670	16	3,290	20
Other[5]	712	--	849	--
Ferrous:				
Iron ore	584	--	609	--
Mill scale	1,080	--	702	--
Other[6]	47	--	65	--
Siliceous:			--	--
Sand, calcium silicates	3,940	--	3,970	--
Sandstone, quartzite, soils, nonpozzolanic rocks	986	--	693	--
Fly ash	2,940 r	84	2,620	83
Other ash, including bottom ash	1,050	--	948	--
Granulated blast furnace slag[7]	323	540	81	328
Other blast furnace slag	290 r	--	262	--
Steel slag	547	--	428	--
Other slag	113 r	8	67	30
Natural rock pozzolans[8]	--	11	--	9
Other pozzolans[9]	98	6	79	3
Other:				
Gypsum and anhydrite	--	5,160	--	4,640
Other[10]	131	98	115	90
Total[11]	145,000	8,450	131,000	7,470
Clinker, imported, raw materials equivalent[12]	--	2,650	--	1,810
Grand total[11]	145,000	11,100	131,000	9,280

rRevised. -- Zero.

1Excludes Puerto Rico.

2Data have been rounded to three significant digits to reflect inherent reporting accuracy and the incorporation of estimates for some facilities.

3Includes portland, blended, and masonry cements.

4Data are probably underreported.

5Includes alumina, aluminum dross, bauxite, spent catalysts, and other aluminous materials.

6Includes iron sludges, pyrite, and other ferrous materials.

7Includes both ground (GGBFS) and unground material.

8Includes pozzolana and burned clays or shales (except where directly reported as clay or shale).

9Includes diatomite, silica fume, other microcrystalline silica, and other pozzolans, even if not used as such.

10Includes fluorspar and all other materials not listed earlier.

11Data may not add to totals shown because of independent rounding.

12Converted as the weight of foreign clinker consumed times 1.7.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE U.S. CEMENT INDUSTRY, BY KILN PROCESS[1]

	Clinker production[2]			Conventional fuels[3]				Waste fuels[3]		
Kiln process	Number of plants	Quantity (thousand metric tons)	Percentage of total	Coal[4] (thousand metric tons)	Petcoke (thousand metric tons)	Oil[5] (thousand liters)	Natural gas[6] (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
2007:										
Wet	23	11,608	13.5	1,470	574	39,200	29,800	90	20	549,000
Dry	80	71,204	82.7	7,210 r	1,780 [7]	47,800	275,000 r	355	275	396,000
Both[8]	2	3,318	3.9	529	--	--	38,900	--	--	38,600
Total[9]	105	86,130	100.0	9,200 r	2,360 [7]	87,000	344,000 r	446	296	984,000
2008:										
Wet	22	9,930	12.7	1,230	518	24,300	23,200	91	10	370,000
Dry	81	64,664	82.5	6,440	1,610	28,000	218,000	341	335	354,000
Both[8]	3	3,788	4.8	561	--	--	38,900	6	9	67,200
Total[9]	106	78,382	100.0	8,240	2,130	52,300	280,000	438	354	791,000

rRevised. -- Zero.

[1]Data exclude Puerto Rico.

[2]Clinker production data are all reported. Although unrounded, data are thought to be accurate to no more than three significant digits.

[3]All fuel data have been rounded to no more than three significant digits.

[4]Essentially all reported to be bituminous.

[5]Distilliate and residual fuel oils. Excludes used oils that were reported under liquid wastes.

[6]Includes landfill gas.

[7]Includes a minor quantity (less than 0.03 units) reported as metallurgical coke (from coal).

[8]Plants that can operate both wet and dry kilns, whether or not both types were active during the year.

[9]Data may not add to totals shown because of independent rounding.

TABLE 8

ELECTRICITY CONSUMED BY U.S. CEMENT PLANTS, BY KILN PROCESS[1]

Plant process	Electricity consumed[2] Generated: Number of plants	Generated: Quantity (million kilowatthours)	Purchased: Number of plants	Purchased: Quantity (million kilowatthours)	Total[3]: Number of plants	Total[3]: Quantity (million kilowatthours)	Total[3]: Percentage of total	Cement produced[4] (thousand metric tons)	Average consumption (kilowatthours per ton of cement produced)
2007:									
Integrated plants:									
Wet	1	(5)	23	1,750	23	1,750	13.2	12,446	141
Dry	4	435	81 r, 5	10,600	81 r, 5	11,100	83.1	77,702	142
Both[6]	--	--	2	495	2	495	3.7	3,291	150
Total or average[3]	5	436	106 r, 5	12,900	106 r, 5	13,300	100.0	93,439	142
Grinding plants[7]	--	--	6 r	147	6 r	147	--	1,756 r	84 r
Exclusions[8]	--	--	3 r	XX	3 r	XX	--	269 r	XX
2008:									
Integrated plants:									
Wet	--	--	22	1,530	22	1,530	12.4	10,598	145
Dry	3	236	83 9	9,960	83 9	10,200	82.9	70,279	145
Both[6]	--	--	3	563	3	563	4.6	3,736	151
Total or average[3]	3	236	108 9	12,100	108 9	12,300	100.0	84,612	145
Grinding plants[7]	--	--	5	130	5	130	--	1,481	88
Exclusions[8]	--	--	3	XX	3	XX	--	216	XX

[r]Revised. XX Not applicable. -- Zero.

[1]Data exclude Puerto Rico.

[2]Electricity data are rounded to no more than three significant digits because they contain estimates.

[3]Data may not add to totals shown because of independent rounding.

[4]Portland and masonry cement. Data are all reported and are unrounded.

[5]Includes one grinding plant whose data were included with an integrated plant.

[6]Plants that can operate both wet and dry kilns, whether or not both types were active during the year.

[7]Plants that did not produce clinker but ground clinker from outside sources. Excludes plants that only made masonry cement or just reground one type of portland cement into another.

[8]Plants whose production of portland cement was by simply regrinding of one type into another, or which reported production only of masonry cement, or which also reported a significant component of grinding excess granulated blast furnace slag.

[9]Includes two grinding plants whose data were included with the integrated plants.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2007	Portland cement 2008	Masonry cement 2007	Masonry cement 2008
Destination:				
Alabama	1,771	1,559	174	122
Alaska[3]	222	148	--	--
Arizona	3,822	2,778	77	44
Arkansas	1,074	902	68	49
California, northern	4,095	3,179	104	73
California, southern	8,273	6,189	373	238
Colorado	2,411	2,156	17	14
Connecticut[3]	756	640	15	12
Delaware[3]	233	217	10	7
District of Columbia[3]	177	168	1	(4)
Florida	7,886	5,875	616	351
Georgia	4,014	3,112	340	235
Hawaii[3]	441	397	6	4
Idaho	682	507	1	1
Illinois, excluding Chicago	1,919	1,656	19	13
Illinois, metropolitan Chicago[3]	2,074	1,636	53	31
Indiana	2,166	1,719	74	56
Iowa	1,803	1,658	3	2
Kansas	1,360	1,430	11	10
Kentucky	1,250	1,085	88	68
Louisiana[3]	2,470	2,477	72	62
Maine	299	239	4	3
Maryland	1,468	1,223	78	59
Massachusetts[3]	1,022	919	17	15
Michigan	2,189	1,858	74	59
Minnesota[3]	1,683	1,374	20	13
Mississippi	1,186	1,063	75	59
Missouri	2,376	2,079	35	26
Montana	404	349	1	1
Nebraska	1,222	1,134	4	3
Nevada	2,223	1,651	23	15
New Hampshire[3]	301	269	7	4
New Jersey[3]	1,740	1,594	74	59
New Mexico	843	709	7	9
New York, eastern	619	573	16	13
New York, western[3]	772	748	21	23
New York, metropolitan[3]	1,770	1,637	90	73
North Carolina[3]	2,969	2,343	337	229
North Dakota[3]	353	391	1	1
Ohio	3,357	2,817	121	99
Oklahoma	1,500	1,570	56	54
Oregon	1,240	923	1	1
Pennsylvania, eastern	1,977	1,722	57	48
Pennsylvania, western	1,160	1,082	45	42
Rhode Island[3]	169	139	2	2
South Carolina	1,617	1,242	157	103
South Dakota	463	453	1	1
Tennessee	2,214	1,692	251	164
Texas, northern	6,635	6,580	141	123
Texas, southern	8,245	7,668	239	198
Utah	1,683	1,313	(4)	(4)

See footnotes at end of table.

TABLE 9—Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2007	Portland cement 2008	Masonry cement 2007	Masonry cement 2008
Destination—Continued:				
Vermont[3]	132	116	3	3
Virginia	2,370	2,019	159	118
Washington	2,587	2,044	1	1
West Virginia	522	504	24	21
Wisconsin[3]	1,892	1,729	18	13
Wyoming	460	497	(4)	(4)
Total[5]	110,563	93,751	4,282	3,047
Foreign countries[6]	581	564	(4)	(4)
Puerto Rico	1,704	1,397	--	--
Grand total[5]	112,848	95,710	4,282	3,047
Origin:				
United States	90,776	83,178	4,209	2,995
Foreign countries[7]	20,580	11,197	73	52
Puerto Rico	1,492	1,335	--	--
Total shipments[5]	112,848	95,710	4,282	3,047

-- Zero.

[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.

[2]Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 10–12, and 14–15, which are from annual surveys of individual plants and importers. Although presented unrounded, data are thought to be accurate to no more than three significant digits.

[3]Has no cement plants.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Includes shipments to U.S. possessions and territories.

[7]Imported cement sold to final customers in the United States as reported by domestic producers and other importers. Data do not match the imports in tables 17–20.

TABLE 10

SHIPMENTS OF PORTLAND CEMENT IN THE UNITED STATES, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Plant to terminal		Plant to customer		Terminal to customer		Total to
	In bulk	In bags[3]	In bulk	In bags[3]	In bulk	In bags[3]	customers
2007:							
Railroad	11,100	19	1,830	--	725	4	2,560
Truck	5,420	210	56,700	1,470	48,400	605	107,000
Barge and boat	9,350	11	211	--	17	--	229
Total[4]	25,900	239	58,800	1,470	49,100	610	110,000 [5]
2008:							
Railroad	10,700	108	1,870	3	438	2	2,310
Truck	5,350	308	49,000	1,310	39,900	644	90,900
Barge and boat	7,230	3	323	43	37	--	403
Total[4]	23,300	419	51,200	1,360	40,400	647	93,600 [5]

-- Zero.

[1]Includes imported cement and cement made from imported clinker. Data exclude Puerto Rico. Data are for domestic sales only.

[2]Data are rounded to no more than three significant digits because they contain estimates.

[3]Includes packages, bags, and supersacks.

[4]Data may not add to totals shown because of independent rounding.

[5]Shipments are based on an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 11

PORTLAND CEMENT SHIPPED IN THE UNITED STATES, BY DISTRICT[1]

District[4]	2007 Quantity[3] (thousand metric tons)	2007 Value[2] Total (thousands)	2007 Value[2] Average (per metric ton)	2008 Quantity[3] (thousand metric tons)	2008 Value[2] Total (thousands)	2008 Value[2] Average (per metric ton)
Maine and New York	3,866	$412,000 [5]	$106.50 [5]	3,820 [5]	$403,000 [5]	$105.50 [5]
Pennsylvania, eastern	4,222	423,000 [5]	100.00 [5]	3,838	382,000 [5]	99.50 [5]
Pennsylvania, western	1,458	147,000 [5]	100.50 [5]	1,248	121,000 [5]	97.00 [5]
Illinois	3,301	331,000 [5]	100.50 [5]	2,810	279,000 [5]	99.00 [5]
Indiana	2,958	260,849	88.18	2,346	205,153	87.46
Michigan	5,660 [5]	554,000 [5]	98.00 [5]	4,986	508,000 [5]	102.00 [5]
Ohio	882	88,935	100.83	733	71,200	97.20
Iowa, Nebraska, South Dakota	4,843	508,000 [5]	105.00 [5]	4,366	453,124	103.79
Kansas	2,182	223,403	102.37	2,115	217,519	102.85
Missouri	5,411	533,000 [5]	98.50 [5]	5,058	490,008	96.89
Florida	7,693	786,380	102.22	5,763	599,000 [5]	104.00 [5]
Georgia, Virginia, West Virginia	2,596	273,404	105.33	2,299	243,026	105.71
Maryland	3,207	283,459	88.38	2,957	240,275	81.25
South Carolina	3,710	358,000 [5]	96.50 [5]	2,756	267,411	97.02
Alabama	5,089	489,000 [5]	96.00 [5]	4,444	432,000 [5]	97.00 [5]
Kentucky, Mississippi, Tennessee	3,197	328,018	102.61	2,673	268,412	100.43
Arkansas and Oklahoma	2,709	259,000 [5]	95.50 [5]	2,643	262,806	99.44
Texas, northern	7,359	723,000 [5]	98.00 [5]	7,316	733,000 [5]	100.00 [5]
Texas, southern	6,953	671,111	96.52	6,417	645,641	100.61
Arizona and New Mexico	4,158	509,493	122.54	3,106	391,316	125.97
Colorado and Wyoming	2,614	280,594	107.36	2,554	273,303	107.02
Idaho, Montana, Nevada, Utah	3,381	372,865	103.18	2,589	260,250	100.53
Alaska and Hawaii	576	98,284	170.61	497	86,882	174.79
California, northern	3,286	354,038	107.74	2,481	256,000 [5]	103.00 [5]
California, southern	9,755	1,080,000 [5]	110.50 [5]	7,540	784,938	104.10
Oregon and Washington	2,779	283,193	99.34	2,196	212,013	96.53
Importers[6]	6,160 [5]	686,000 [r, 5]	111.50 [r, 5]	4,060 [5]	478,000 [5]	117.50 [5]
Total or average[7]	110,000 [5, 8]	11,300,000 [r, 5]	102.50 [r, 5]	93,600 [5, 8]	9,560,000 [5]	102.00 [5]
Puerto Rico	1,597	W	W	1,381	W	W
Grand total[7]	112,000 [5, 8]	W	W	95,000 [5, 8]	W	W

[r]Revised. W Withheld to avoid disclosing company proprietary data.

[1]Includes gray and white portland cement. Includes cement made from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Values are mill net or ex-plant (free on board) valuations of total sales to final customers, including sales from plants external distribution terminals. The data are ex-terminal for independently reporting terminals. Data include all varieties of portland cement and both bulk and bag shipments. Unless otherwise specified, data are presented unrounded. Unrounded or not, unit value data should be viewed as value indicators, good to no better than the nearest $0.50 or $1.00 per metric ton.

[3]Tonnages are those by reporting entities in the district but may include shipments into other districts. They differ from the data in table 9, which are the actual reported sales into the specific States.

[4]District is the location of the reporting entities, not necessarily the location of sales (see table 9 for sales data, by State). Specific districts include shipments by importers where district assignations were possible.

[5]Data are rounded (unit values to the nearest $0.50) because they include estimates.

[6]Importers for which district assignations were not possible.

[7]Data may not add to totals shown because of independent rounding.

[8]Shipments are based on an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 12

MASONRY CEMENT SHIPPED IN THE UNITED STATES, BY DISTRICT[1, 2]

	2007			2008		
		Value[3]			Value[3]	
District[5]	Quantity[4] (thousand metric tons)	Total (thousands)	Average (per metric ton)	Quantity[4] (thousand metric tons)	Total (thousands)	Average (per metric ton)
Maine and New York	109	$13,500 [6]	$124.00 [6]	82	$10,100 [6]	$124.50 [6]
Pennsylvania	281	37,500 [6]	133.00 [6]	241	32,300 [6]	134.00 [6]
Illinois, Indiana, Ohio	455	65,359	143.68	335	47,725	142.55
Michigan	142	19,300 [6]	135.50 [6]	136	16,400 [6]	121.00 [6]
Iowa, Nebraska, South Dakota	24	2,823	115.27	19	2,161	114.53
Kansas and Missouri	123	16,827	136.83	84	13,427	159.64
Florida	525	86,200 [6]	164.00 [6]	282	42,800 [6]	151.50 [6]
Georgia, Maryland, Virginia, West Virginia	429	76,220	177.77	320	57,900 [6]	180.50 [6]
South Carolina	444	54,228	122.20	305	39,409	129.07
Alabama	470	62,000 [6]	131.50 [6]	353	44,247	125.38
Kentucky, Mississippi, Tennessee	111	16,365	147.71	80	11,784	146.57
Arkansas and Oklahoma	146	17,031	116.28	125	15,070	120.65
Texas, northern	179	28,500 [6]	159.50 [6]	155	26,100 [6]	168.00 [6]
Texas, southern	176	21,751	123.34	146	18,300 [6]	125.50 [6]
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	104	14,584	140.79	67	9,259	137.47
Alaska and Hawaii	4	1,114	260.45	3	946	279.55
California, northern; Oregon; Washington	74	9,464	127.14	51	6,511	128.31
California, southern	447	59,408	132.94	279	36,213	129.87
Importers[7]	14 [6]	2,520 [6]	178.50 [6]	10 [6]	1,950 [6]	196.00 [6]
Total or average[8]	4,260 [6, 9]	605,000 [6]	142.00 [6]	3,070 [6, 9]	433,000 [6]	140.50 [6]

[1]Shipments are those by cement companies to final customers and include imported cement and cement made from imported clinker.
Sales are those by cement plants and exclude masonry cement made by portland cement customers from purchased portland cement and which was then resold and/or consumed. Data exclude Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Data include true masonry, plastic, portland-lime, and stucco cements.

[3]Values are mill net or ex-plant (free on board) valuations of total sales to final customers, including sales from plants external distribution terminals. The data are ex-terminal for independently reporting terminals. Data include both bulk and bag shipments.
Unless otherwise specified, data are presented unrounded. Unrounded or not, unit value data should be viewed as value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[4]Tonnages are those by reporting entities in the district but may include shipments into other districts. They differ from the data in table 9, which are the actual reported sales into the specific States.

[5]District is the location of the reporting entities, not necessarily the location of sales (see table 9 for sales data, by State). Specific districts include importers for which district assignations were possible.

[6]Data are rounded (unit values to the nearest $0.50) because they include estimates.

[7]Importers for which district assignations were not possible.

[8]Data may not add to totals because of independent rounding.

[9]Shipments are based on an annual survey of plants and importers; may differ from data in table 9, which are based on consolidated monthly data.

TABLE 13

AVERAGE MILL NET VALUE OF CEMENT SOLD IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

	Portland cement			Masonry	All
Year	Gray	White[3]	Total	cement	cement
2007	101.50 [r]	197.00	102.50 [r]	142.00	104.00 [r]
2008	101.00	221.50	102.00	141.00	103.50

[r]Revised.

[1]Values are average of sales to final customers, free on board the plant or independently reporting terminal. Values include any bagging charges, but exclude delivery charges to customers or to extermінal terminals. Data exclude Puerto Rico.

[2]Data are rounded to the nearest $0.50 per metric ton because they contain estimates.

[3]Data for white cement include a component of resale’s showing significant price markups.

TABLE 14

PORTLAND CEMENT SHIPMENTS IN 2008, BY DISTRICT AND TYPE OF CUSTOMER[1]

(Thousand metric tons)

District[2]	Ready-mixed concrete	Concrete product manufacturers	Contractors	Building material dealers	Oil well, mining, waste stabilization	Government and other[3]	Total[4, 5]
Maine and New York	2,930	419	147	252	--	78	3,820
Pennsylvania, eastern	2,310	1,040	148	219	--	118	3,838
Pennsylvania, western	878	191	117	18	18	25	1,248
Illinois	1,910	287	205	7	281	120	2,810
Indiana	1,850	322	81	44	9	44	2,346
Michigan and Wisconsin	3,780	534	440	131	57	46	4,986
Ohio	572	98	44	17	2	--	733
Iowa, Nebraska, South Dakota	3,380	483	271	36	84	113	4,366
Kansas	1,620	192	159	58	76	8	2,115
Missouri	4,010	378	477	46	11	136	5,058
Florida	3,970	1,190	368	212	--	26	5,763
Georgia, Virginia, West Virginia	1,670	496	48	79	1	5	2,299
Maryland	2,260	390	130	69	3	107	2,957
South Carolina	1,970	291	203	103	3	192	2,756
Alabama	3,360	570	274	123	19	99	4,444
Kentucky, Mississippi, Tennessee	2,030	289	178	65	35	76	2,673
Arkansas and Oklahoma	1,780	124	471	121	125	24	2,643
Texas, northern	4,270	484	1,040	102	939	486	7,316
Texas, southern	4,160	687	726	206	623	19	6,417
Arizona and New Mexico	2,260	462	202	158	24	4	3,106
Colorado and Wyoming	1,800	198	200	12	252	90	2,554
Idaho, Montana, Nevada, Utah	1,920	200	104	57	237	75	2,589
Alaska and Hawaii	440	53	--	--	--	4	497
California, northern	1,940	269	148	116	--	5	2,481
California, southern	5,740	1,260	228	212	103	1	7,540
Oregon and Washington	1,700	275	83	106	30	4	2,196
Importers[6]	2,910	536	307	129	57	121	4,060
Total[5]	67,400	11,700	6,800	2,700	2,990	2,030	93,600
Puerto Rico	779	132	33	436	--	--	1,381
Grand total[5]	68,200	11,900 [7]	6,830 [8]	3,130	2,990 [9]	2,030	95,000

-- Zero.

[1]Includes imported cement and cement made from imported clinker. Except for district totals, data have been rounded to three significant digits, but are likely accurate to only two significant digits. District totals are likely accurate to no more than three significant digits.

[2]District is the location of the reporting entity, not the location of sales (see table 9 for sales data, by State). Specific districts include shipments by importers for which district assignations were possible.

[3]Includes shipments to miscellaneous customer types and for which customer types were not specified.

[4]District totals are unrounded except in accord with table 11.

[5]Data may not add to totals shown because of independent rounding.

[6]Shipments by importers for which district assignations were not possible.

[7]Grand total shipments to concrete product manufacturers include, in thousand metric tons, brick and block—4,690; precast and prestressed—3,220; pipe—1,120; and other or unspecified—2,830.

[8]Grand total shipments to contractors include, in thousand metric tons, airport—121; road paving—3,750; soil cement—1,350; and other or unspecified—1,610.

[9]Grand total shipments include, in thousand metric tons, oil well drilling—2,510; mining—236; and waste stabilization—244.

TABLE 15
PORTLAND CEMENT SHIPMENTS IN THE UNITED STATES,
BY TYPE OF CEMENT[1, 2, 3]

(Thousand metric tons)

Type[4]	2007	2008
General use and moderate heat (Types I and II)[5]	86,600 r, 6	73,600
High early strength (Type III)	3,760 r, 6	3,450
Sulfate resisting (Type V)[5]	14,400	11,800
Block	469	509
Oil well	1,540	1,470
White[7]	1,020	823
Blended:[8]		
Portland, natural pozzolans	68	38
Portland, ground granulated blast furnace slag	1,090	981
Portland, fly ash	243	381
Portland, other pozzolans[9]	756	563
Total blended[10]	2,160	1,960
Expansive and regulated fast setting	29	36
Miscellaneous[11]	18 r, 6	(12)
Grand total[10]	110,000	93,600

[r]Revised.

[1]Includes sales of imported cement. Excludes Puerto Rico.

[2]Data are rounded to no more than three significant digits.

[3]Gray portland-type cements unless otherwise specified.

[4]Sold mostly under specifications ASTM C–150, ASTM C–595, and ASTM C–1157.

[5]Type II/V and similar hybrids are included within Type V.

[6]Revised to include in Type I and II some ASTM C–1157 general use cement that contained no pozzolans but which was formerly reported as blended cement or miscellaneous portland cement.

[7]White or colored portland-type cements. Most are Types I or II but may include Types III and V and block cements.

[8]Cements sold under ASTM C–590 and those under ASTM C–1157 that contain pozzolans.

[9]Includes blends with cement kiln dust, silica fume, or other pozzolans, and blends containing multiple pozzolans.

[10]Data may not add to totals shown because of independent rounding.

[11]Includes low heat (Type IV), waterproof, and other portland-type cements.

[12]Less than 500 metric tons.

TABLE 16

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

Country	2007		2008	
	Quantity	Value[2]	Quantity	Value[2]
United States:				
Angola	--	--	1	183
Anguilla	2	259	1	42
Aruba	1	437	1	352
Australia	3	238	(3)	127
Bahamas	24	3,679	28	3,853
Belize	1	78	1	224
Brazil	(3)	24	1	136
British Virgin Islands	(3)	53	(3)	190
Brunei	1	57	--	--
Canada	729	75,088	711	82,814
Cayman Islands	1	107	3	293
China	3	564	1	354
Colombia	1	354	1	675
Cook Island	--	--	(3)	7
Cyprus	3	212	(3)	171
Denmark	--	--	(3)	22
Dominican Republic	11	604	3	322
Ecuador	1	66	(3)	107
El Salvador	1	57	(3)	17
Estonia	--	--	(3)	28
Fiji	--	--	(3)	338
France	1	85	--	--
Gabon	--	--	(3)	5
Ghana	--	--	(3)	5
Greece	2	191	7	352
Guatemala	(3)	9	(3)	90
Hong Kong	3	224	(3)	98
India	1	80	(3)	141
Indonesia	--	--	(3)	6
Ireland	1	175	(3)	101
Israel	2	149	(3)	107
Italy	1	45	(3)	110
Jamaica	4	170	(3)	25
Japan	(3)	30	(3)	26
Korea, Republic of	1	61	(3)	169
Mexico	32 [4]	5,667 [4]	23	4,540
Netherlands Antilles	(3)	136	1	187
New Zealand	1	57	(3)	95
Niger	--	--	2	114
Oman	2	523	(3)	139
Panama	11	856	3	413
Paraguay	--	--	(3)	4
Peru	1	167	1	255
Saudi Arabia	1	144	1	259
Singapore	(3)	290	(3)	140
Spain	(3)	39	(3)	33
Sri Lanka	--	--	(3)	9
Sweden	1	81	1	90
Taiwan	3	241	1	366
Thailand	--	--	(3)	5
Trinidad and Tobago	3	362	(3)	101
Turks and Caicos Islands	1	204	1	267
Ukraine	12	562	(3)	3

See footnotes at end of table.

TABLE 16—Continued

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

Country	2007		2008	
	Quantity	Value[2]	Quantity	Value[2]
United States—Continued:				
United Arab Emirates	16	753	(3)	226
Venezuela	(3)	47	(3)	225
Other	4	1,073	30	3,501
Total[4]	886 [4]	94,298 [4]	823	102,466
Puerto Rico:				
Antigua and Barbuda	(3)	15	--	--
Aruba	2	134	--	--
British Virgin Islands	8	901	13	1,778
Dominica	--	--	(3)	4
Guyana	5	206	--	--
Haiti	1	520	--	--
Netherlands Antilles	1	112	1	332
Trinidad and Tobago	--	--	(3)	69
Turks and Caicos Islands	5	309	8	545
Other	10	790	12	904
Total[5]	33	2,986	34	3,631
Grand total[5]	919 [4]	97,284 [4]	858	106,097

-- Zero.

[1]Includes portland and masonry cements.

[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

[3]Less than ½ unit.

[4]Official export data have been corrected to remove an apparent excess of aluminous cement exports from Laredo, TX, of 653,255 metric tons and $28,829 million in 2007.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 17
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Brazil	579	37,245	47,530	36	2,780	3,225
Bulgaria	53	3,261	3,862	--	--	--
Canada	5,326	386,922	410,735	4,104	338,225	356,325
China	5,337	243,760	389,869	2,020	103,055	164,401
Colombia	1,552	104,506	134,402	964	67,117	90,608
Croatia	26	7,011	8,490	34	10,048	13,061
Denmark	239	19,441	28,735	99	9,768	14,898
Dominican Republic	12	837	1,116	11	786	1,082
Egypt	95	6,469	10,491	57	4,873	7,331
France	111	19,148	20,157	108	22,266	24,999
Greece	703	35,516	52,160	213	11,717	18,514
India	1	240	342	1	98	153
Japan	5	1,954	3,003	6	773	1,038
Korea, Republic of	2,505	113,076	162,474	1,229	50,550	85,899
Mexico	1,684	113,673	136,115	1,071	84,714	99,673
Netherlands	4	3,283	3,707	4	3,894	4,800
Norway	122	6,114	6,117	20	897	897
Peru	326	18,571	30,097	92	4,727	7,509
Spain	29	3,032	4,434	1	4	4
Sweden	457	25,005	39,364	261	13,192	24,583
Switzerland	42	2,119	3,327	--	--	--
Taiwan	2,168	98,841	166,729	855	36,424	55,867
Thailand	730	33,053	51,794	77	5,165	7,909
Turkey	138	9,366	13,828	96	5,257	12,201
United Arab Emirates	(4)	29	47	--	--	--
United Kingdom	5	2,002	2,462	4	1,712	2,076
Venezuela	218	13,621	18,080	--	--	--
Other	1	479	570	1	845	1,155
Total[5]	22,468	1,308,574	1,750,033	11,365	778,888	998,208
Puerto Rico:						
Brazil	2	1,380	2,335	--	--	--
China	40	1,977	3,086	78	3,270	5,701
Colombia	3	400	519	4	529	665
Dominican Republic	18	1,469	1,621	--	--	--
Korea, Republic of	181	8,140	14,664	54	3,861	5,812
Mexico	16	1,846	2,570	17	1,981	2,808
Other	(4)	84	92	(4)	39	51
Total[5]	261	15,296	24,887	153	9,681	15,037
Grand total[5]	22,729	1,323,870	1,774,920	11,519	788,569	1,013,244

-- Zero.

[1]Includes portland, masonry, and other hydraulic cements.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

TABLE 18

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

Customs district and country	2007 Quantity	2007 Value Customs[2]	2007 Value C.i.f.[3]	2008 Quantity	2008 Value Customs[2]	2008 Value C.i.f.[3]
United States:						
Anchorage, AK:						
Canada	10	549	2,094	7	419	1,479
China	--	--	--	1	98	106
Japan	--	--	--	5	187	282
Korea, Republic of	91	4,380	7,947	102	4,471	8,689
Total[4]	101	4,929	10,040	114	5,175	10,556
Baltimore, MD:						
China	(5)	58	78	--	--	--
Colombia	25	1,818	1,818	--	--	--
Germany	(5)	18	19	(5)	13	15
India	(5)	9	12	--	--	--
Korea, Republic of	(5)	17	24	--	--	--
Netherlands	(5)	213	241	(5)	229	259
Sweden	(5)	368	400	--	--	--
United Kingdom	(5)	47	54	--	--	--
Total[4]	26	2,547	2,646	(5)	242	274
Boston, MA:						
Canada	110	6,066	8,697	45	2,537	4,584
Venezuela	3	212	300	--	--	--
Total[4]	114	6,278	8,996	45	2,537	4,584
Buffalo, NY:						
Canada	808	62,976	66,036	707	57,564	60,681
China	1 r	130	133	--	--	--
France	--	--	--	(5)	60	61
Germany	--	--	--	(5)	3	3
Japan	(5)	31	31	--	--	--
Total[4]	809	63,137	66,200	708	57,627	60,744
Charleston, SC:						
Colombia	18	978	1,376	--	--	--
Greece	43	1,964	2,989	--	--	--
Netherlands	(5)	16	18	--	--	--
South Africa	(5)	13	17	--	--	--
Taiwan	269	10,544	23,836	--	--	--
Total[4]	330	13,516	28,236	--	--	--
Chicago, IL:						
Belgium	(5)	18	25	--	--	--
Croatia	--	--	--	(5)	38	53
Denmark	--	--	--	(5)	15	16
France	--	--	--	(5)	3	25
Germany	--	--	--	(5)	2	3
Honduras	(5)	15	17	--	--	--
Japan	(5)	149	179	(5)	220	259
Netherlands	(5)	185	213	(5)	231	296
Poland	(5)	23	25	(5)	41	44
Total[4]	(5)	390	458	1	551	696

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Cleveland, OH:						
Canada	766	59,239	61,272	485	40,608	41,506
China	(5)	37	43	(5)	13	17
Croatia	(5)	43	62	1	261	354
Italy	(5)	14	15	--	--	--
Netherlands	(5)	253	285	(5)	37	57
Turkey	(5)	9	9	--	--	--
Total[4]	766	59,594	61,687	485	40,919	41,935
Columbia-Snake, OR-WA						
Canada	117	6,083	6,550	135	8,012	8,756
China	1,077	42,000	65,329	653	26,857	44,713
Thailand	(5)	5	7	(5)	2	4
Total[4]	1,194	48,088	71,887	788	34,872	53,473
Dallas, Fort Worth, TX:						
China	(5)	13	25	--	--	--
Italy	--	--	--	(5)	3	4
Norway	(5)	4	7	--	--	--
Total[4]	(5)	17	31	(5)	3	4
Detroit, MI:						
Canada	1,020	86,321	87,734	837	76,193	77,285
China	(5)	19	24	--	--	--
Croatia	1	288	317	--	--	--
France	(5)	28	28	--	--	--
Germany	(5)	3 r	3 r	(5)	5	5
Netherlands	(5)	244	272	(5)	260	356
Total[4]	1,021	86,902	88,378	838	76,457	77,645
El Paso, TX, Mexico	612	36,060	41,955	384	31,680	35,277
Great Falls, MT:						
Canada	8	447	466	9	9	503
China	(5)	27	27	(5)	(5)	32
Germany	--	--	--	(5)	(5)	21
Japan	(5)	2	2	--	--	--
Total[4]	8	476	495	9	9	556
Honolulu, HI:						
China	194	7,820	13,107	10	705	1,597
Japan	(5)	24	28	--	--	--
Taiwan	265	10,583	17,290	373	16,848	25,388
Thailand	18	841	1,116	(5)	3	6
Total[4]	477	19,267	31,542	383	17,556	26,991
Houston-Galveston, TX:						
Algeria	--	--	--	1	94	122
Belgium	(5)	3	3	--	--	--
Brazil	117	6,425	8,498	--	--	--
China	839	34,346	55,857	93	4,219	6,940
Colombia	406	31,171	38,496	403	30,692	39,484
Croatia	(5)	8	16	(5)	11	12
Denmark	(5)	16	17	--	--	--
Egypt	33	2,674	4,607	22	1,892	2,774

See footnotes at end of table.

TABLE 18—Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Houston-Galveston, TX—Continued:						
France	(5)	110	123	(5)	69	79
Germany	(5)	81	102	(5)	109	133
India	(5)	6	7	--	--	--
Korea, Republic of	1,378	56,906	87,952	799	31,413	51,352
Mexico	39	2,352	3,449	108	6,076	8,957
Netherlands	(5)	20	24	--	--	--
Peru	31	2,015	2,989	--	--	--
Sweden	(5)	65	70	--	--	--
Taiwan	422	16,367	23,725	449	16,972	27,229
Thailand	84	4,148	9,280	--	--	--
Turkey	(5)	2	3	1	58	89
United Kingdom	(5)	17	20	--	--	--
Total[4]	3,350	156,732	235,239	1,876	91,605	137,171
Laredo, TX, Mexico	160	19,258	20,277	133	15,994	16,939
Los Angeles, CA:						
Algeria	--	--	--	2	179	328
China	1,506	76,966	124,648	505	23,241	42,027
Colombia	1	87	128	(5)	28	43
Croatia	(5)	20	24	(5)	109	180
Egypt	--	--	--	11	964	1,667
Germany	(5)	17	20	(5)	188	206
India	1	140	180	--	--	--
Japan	3	1,054	1,619	(5)	36	51
Lithuania	(5)	29	30	(5)	13	13
Taiwan	183	9,339	14,159	--	--	--
Thailand	155	8,170	13,631	19	2,285	3,521
United Kingdom	(5)	14	14	(5)	12	12
Total[4]	1,848	95,836	154,452	538	27,055	48,048
Miami, FL:						
Algeria	--	--	--	1	43	70
Argentina	(5)	3	5	--	--	--
Brazil	23	1,095	2,003	--	--	--
Canada	41	2,165	3,721	--	--	--
China	20	929	1,527	(5)	23	36
Colombia	34	2,900	4,040	11	1,464	1,837
Denmark	23	1,704	2,791	3	414	529
Egypt	23	1,866	3,189	23	1,971	2,811
Greece	66	3,070	4,157	--	--	--
Italy	--	--	--	(5)	2	2
Mexico	106	11,147	14,022	98	9,869	12,580
Peru	12	463	942	--	--	--
Portugal	(5)	25	37	--	--	--
Spain	27	2,867	4,269	--	--	--

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Miami, FL—Continued:						
Sweden	445	22,044	35,937	239	10,596	20,770
Switzerland	42	2,119	3,327	--	--	--
Taiwan	148	4,878	12,245	--	--	--
Turkey	36	1,763	2,733	--	--	--
United Kingdom	(5)	3	3	--	--	--
Total[4]	1,046	59,040	94,947	375	24,382	38,636
Minneapolis, MN:						
Canada	170	14,563	14,961	154	17,524	17,541
Denmark	--	--	--	(5)	6	6
United Kingdom	--	--	--	(5)	11	11
Total[4]	170	14,563	14,961	154	17,541	17,558
Mobile, AL, Peru	2	166	269	--	--	--
New Orleans, LA:						
China	58	3,374	5,200	26	5,076	6,461
Colombia	146	6,411	8,518	--	--	--
Croatia	21	5,086	6,337	27	7,929	9,887
Germany	(5)	4	4	--	--	--
Korea, Republic of	729	36,155	44,165	45	1,506	2,412
Peru	36	2,235	2,253	62	3,205	4,652
Turkey	79	6,170	8,945	95	5,199	12,112
United Kingdom	(5)	4	4	--	--	--
Total[4]	1,069	59,438	75,427	256	22,915	35,525
New York, NY:						
Canada	153	8,050	8,050	--	--	--
China	42	1,606	3,768	--	--	--
Colombia	4	907	944	16	777	1,650
Croatia	2	597	686	(5)	9	11
Denmark	56	5,521	5,524	38	4,440	6,564
France	(5)	24	32	--	--	--
Germany	(5)	114	139	(5)	14	19
Greece	424	22,017	32,386	213	11,717	18,514
Japan	(5)	164	387	--	--	--
Mexico	38	3,369	3,369	--	--	--
Netherlands	(5)	375	415	(5)	336	398
Norway	122	6,111	6,111	20	897	897
Poland	(5)	16	17	--	--	--
Sweden	3	2,084	2,260	3	1,670	1,856
Taiwan	38	1,281	1,281	--	--	--
Turkey	24	1,422	2,139	--	--	--
United Kingdom	--	--	--	(5)	41	72
Venezuela	26	2,106	2,106	--	--	--
Total[4]	933	55,763	69,614	291	19,902	29,982
Nogales, AZ, Mexico	716	40,502	52,046	348	21,095	25,919
Norfolk, VA:						
Brazil	127	9,086	10,597	--	--	--
Bulgaria	53	3,261	3,862	--	--	--

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Norfolk, VA—Continued:						
Canada	(5)	--	--	113	8,044	8,940
China	82	6,819	9,279	(5)	9	11
Colombia	28	1,762	2,138	--	--	--
France	111	18,978	19,965	108	22,121	24,818
Germany	--	--	--	(5)	14	17
Greece	5	252	383	--	--	--
Netherlands	(5)	338	386	(5)	353	464
South Africa	(5)	3	3	--	--	--
Sweden	--	--	--	(5)	79	89
United Kingdom	5	1,885	2,327	4	1,647	1,980
Total[4]	411	42,384	48,940	225	32,267	36,319
Ogdensburg, NY:						
Canada	460	46,216	46,678	399	41,749	42,237
France	(5)	9	9	--	--	--
South Africa	(5)	36	37	--	--	--
Total[4]	460	46,261	46,724	399	41,749	42,237
Pembina, ND						
Canada	150	8,361	8,453	173	10,174	10,293
France	--	--	--	(5)	5	5
Total[4]	150	8,361	8,453	173	10,179	10,298
Philadelphia, PA:						
Belgium	(5)	14	17	(5)	6	7
China	--	--	--	(5)	33	33
Germany	(5)	13	17	(5)	104	143
Korea, Republic of	--	--	--	137	5,032	11,590
Netherlands	1	858	981	1	1,275	1,463
Thailand	314	12,152	14,558	48	1,629	2,379
United Kingdom	(5)	10	14	--	--	--
Total[4]	316	13,047	15,587	187	8,079	15,616
Portland, ME, Canada	105	13,834	14,804	75	9,765	10,410
Providence, RI:						
Brazil	26	1,557	2,621	--	--	--
Canada	89	6,015	8,682	80	4,572	8,488
China	44	1,628	4,268	--	--	--
Colombia	25	1,879	2,311	48	2,502	3,909
Peru	218	11,882	20,719	29	1,522	2,857
Venezuela	150	8,818	12,266	--	--	--
Total[4]	553	31,780	50,866	158	8,596	15,253
San Diego, CA:						
China	15	861	1,186	--	--	--
Mexico	14	985	996	--	--	--
Taiwan	378	21,870	35,682	13	515	517
Total[4]	407	23,715	37,864	13	515	517
San Francisco, CA:						
China	988	43,846	68,389	370	16,786	27,248
Egypt	--	--	--	1	46	79
France	--	--	--	(4)	9	12

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
San Francisco, CA—Continued:						
India	(5)	41	59	1	98	153
Netherlands	(5)	42	46	(5)	18	37
Taiwan	241	11,760	17,798	20	1,036	1,679
Thailand	157	7,601	12,856	9	1,150	1,806
United Arab Emirates	(5)	29	47	--	--	--
United Kingdom	(5)	12	14	--	--	--
Total[4]	1,387	63,332	99,210	400	19,143	31,013
Savannah, GA:						
China	(5)	42	57	(4)	10	12
Colombia	349	26,355	33,411	258	17,005	23,652
India	(5)	45	84	--	--	--
Netherlands	1	505	561	1	537	713
Thailand	(5)	21	46	1	96	194
United Kingdom	(5)	11	11	--	--	--
Total[4]	350	26,979	34,170	259	17,649	24,570
Seattle, WA:						
Canada	1,202	52,581	58,008	757	45,848	48,079
China	365	17,774	28,440	362	25,961	35,167
Japan	1	529	757	1	331	447
Korea, Republic of	220	8,693	13,428	123	6,170	9,308
Netherlands	(5)	93	103	(5)	188	257
Taiwan	--	--	--	(5)	1,053	1,055
Total[4]	1,788	79,671	100,736	1,243	79,551	94,312
St. Albans, VT, Canada	117	13,453	14,530	126	14,748	15,543
St. Louis, MO:						
Croatia	3	969	1,047	6	1,690	2,564
Netherlands	(5)	141	161	(5)	430	500
Total[4]	3	1,110	1,208	6	2,120	3,064
Tampa, FL:						
Brazil	286	19,082	23,810	36	2,780	3,225
China	107	5,466	8,484	--	--	--
Colombia	246	11,642	17,402	39	2,103	2,865
Denmark	160	12,200	20,403	58	4,893	7,782
Egypt	38	1,930	2,695	--	--	--
Greece	164	8,213	12,244	--	--	--
Korea, Republic of	86	6,924	8,959	24	1,958	2,548
Peru	27	1,810	2,925	--	--	--
Spain	--	--	--	(5)	4	4
Sweden	9	444	697	19	847	1,868
Taiwan	223	12,220	20,712	--	--	--
Thailand	1	115	299	--	--	--
Venezuela	38	2,485	3,407	--	--	--
Total[4]	1,385	82,529	122,037	175	12,584	18,292
U.S. Virgin Islands:						
Barbados	(5)	18	19	--	--	--
Colombia	8	910	925	2	213	219
Dominican Republic	12	837	1,116	11	786	1,082
Spain	2	165	165	--	--	--
Total[4]	22	1,931	2,225	13	998	1,300

See footnotes at end of table.

TABLE 18—Continued

U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Wilmington, NC, Colombia	263	17,687	22,896	186	12,333	16,952
U.S. total[4]	22,468	1,308,574	1,750,033	11,365	778,888	998,208
Puerto Rico (San Juan):						
Brazil	2	1,380	2,335	--	--	--
China	40	1,977	3,086	78	3,270	5,701
Colombia	3	400	519	4	529	665
Denmark	(5)	--	--	--	--	--
Dominican Republic	18	1,469	1,621	--	--	--
Germany	(5)	68	74	--	--	--
Korea, Republic of	181	8,140	14,664	54	3,861	5,812
Mexico	16	1,846	2,570	17	1,981	2,808
Peru	--	--	--	(5)	14	18
Spain	(5)	16	18	(5)	25	33
Total[4]	261	15,296	24,887	153	9,681	15,037
Grand total[4]	22,729	1,323,870	1,774,920	11,519	788,569	1,013,244

[r]Revised. -- Zero.

[1]Includes all varieties of hydraulic cement and clicker.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Data may not add to totals shown because of independent rounding.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

Country	2007			2008		
	Quantity	Value		Quantity	Value	
		Customs[1]	C.i.f.[2]		Customs[1]	C.i.f.[2]
United States:						
Brazil	578	37,245	47,530	36	2,780	3,225
Bulgaria	53	3,261	3,862	--	--	--
Canada	4,323	298,595	320,694	3,294	259,073	275,818
China	4,835	206,564	329,663	1,906	81,907	137,987
Colombia	1,457	95,891	123,916	891	60,180	81,614
Egypt	38	1,930	2,695	--	--	--
Greece	703	35,516	52,160	213	11,717	18,514
Korea, Republic of	2,406	106,272	155,671	1,227	50,410	85,539
Mexico	1,297	68,224	86,086	744	45,002	55,076
Norway	122	6,114	6,117	20	897	897
Peru	290	16,336	27,844	92	4,727	7,509
Sweden	454	22,488	36,634	257	11,443	22,638
Taiwan	2,126	97,106	162,964	855	35,371	54,813
Thailand	689	28,532	44,603	48	1,629	2,379
Turkey	59	3,193	4,880	--	--	--
Venezuela	162	9,468	13,176	--	--	--
Other	68	4,509	6,029	17	1,170	1,619
Total[3, 4]	19,662	1,041,245	1,424,522	9,599	566,307	747,629
Puerto Rico:						
China	40	1,977	3,086	78	3,270	5,701
Korea, Republic of	181	8,140	14,664	54	3,861	5,812
Spain	--	--	--	(5)	6	8
Other	2	1,380	2,335	--	--	--
Total[3, 4]	223	11,497	20,085	132	7,137	11,521
Grand total[3, 4]	19,885	1,052,742	1,444,607	9,731	573,443	759,150

-- Zero.

[1]The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[3]Data may not add to totals shown because of independent rounding.

[4]Total imports do not include gray portland cement that was misregistered by importers under the white cement tariff code and which has been included in table 20.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 20
U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

Country	2007 Quantity	2007 Value Customs[1]	2007 Value C.i.f.[2, 3]	2008 Quantity	2008 Value Customs[1]	2008 Value C.i.f.[2, 3]
United States:						
Canada	407	45,164	46,399	296	40,213	41,086
China	403	30,284	50,747	88	15,869	19,697
Colombia	69	6,993	8,559	58	6,491	8,276
Denmark	227	18,211	27,501	99	9,747	14,875
Egypt	57	4,539	7,796	55	4,724	7,087
India	1	240	342	1	98	153
Mexico	269	33,422	37,201	237	29,222	32,871
Spain	27	2,865	4,266	--	--	--
Taiwan	43	1,735	3,765	(4)	1,053	1,055
Thailand	41	4,521	7,191	29	3,536	5,530
Turkey	79	6,172	8,947	96	5,257	12,201
United Arab Emirates	(4)	29	47	--	--	--
Other	1	55	75	6	459	884
Total[5]	1,622 [6]	154,230	202,836	964 [6]	116,669	143,715
Puerto Rico:						
Colombia	3	400	519	4	529	665
Mexico	16	1,846	2,570	17	1,981	2,808
Peru	--	--	--	(4)	14	18
Other	(4)	23	26	--	--	--
Total[5]	19	2,269	3,115	21	2,525	3,491
Grand total[5]	1,641 [6]	156,500	205,951	985 [6]	119,194	147,206

-- Zero.

[1]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[3]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of data for gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Total imports of white cement include substantial quantities of gray cement that were misregistered by importers under the white cement tariff code.

Source: U.S. Census Bureau.

TABLE 21

U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2007			2008		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Canada	576	40,021	40,323	477	35,048	35,310
China	97	6,483	8,938	19	3,414	4,285
Colombia	24	801	1,106	16	446	718
Croatia	--	--	--	(4)	11	23
Egypt	--	--	--	2	149	244
France	109	17,681	18,523	107	20,976	23,550
Germany	(4) r	11	13	--	--	--
Korea, Republic of	99	6,803	6,803	--	--	--
Netherlands	(4) r	8	9	(4)	9	11
Peru	36	2,235	2,253	--	--	--
Venezuela	30	2,047	2,798	--	--	--
Total[5]	972	76,089	80,766	621	60,054	64,141
Puerto Rico, Dominican Republic	18	1,446	1,596	--	--	--
Grand total[5]	990	77,535	82,362	621	60,054	64,141

[r]Revised. -- Zero.

[1]For all types of hydraulic cement.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing in the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2004	2005	2006	2007	2008[e]
Afghanistan[e]	70	60	50	50	50
Albania	573	489 [r]	525 [r]	889 [r]	890
Algeria	11,000 [e]	12,800 [r]	14,702	15,886 [r]	17,397 [3]
Angola	754	1,315	1,373	1,400 [e]	1,400
Argentina	6,254	7,595	8,929	9,602	9,703 [3]
Armenia	501	605	625	722	770
Australia[e]	8,000	9,000	9,000	9,000	8,500
Austria	4,356 [r]	4,560 [r]	4,852 [r]	5,203 [r]	5,309 [3]
Azerbaijan	1,428	1,538	1,622	1,731	1,800
Bahrain	400 [r]	400 [r]	400 [r]	400 [r]	370
Bangladesh[e]	5,000	5,100	5,100	5,100	5,000
Barbados	322	341 [r]	338 [r]	294 [r]	300
Belarus	2,731	3,131	3,495	3,820	4,219 [3]
Belgium	6,715	7,594	8,192	8,200 [e]	8,200
Benin[e]	250	250	1,489 [3]	1,550 [3]	1,600
Bhutan[e]	170	170	180	180	170
Bolivia	1,276	1,440	1,636	1,739	1,700
Bosnia and Herzegovina	1,045	1,026	1,226	1,283 [r]	1,406 [3]
Brazil	34,413	36,673	39,540	46,406	51,865 [3]
Brunei	242	266	240 [r, e]	200 [r, e]	200
Bulgaria	2,939 [r]	3,618 [r]	4,093 [r]	4,413 [r]	4,400
Burkina Faso[e]	30	30	30	30	30
Burma[4]	519	543	570	608	676 [3]
Cambodia	--	--	--	87	87
Cameroon	1,032	1,000 [e]	1,000	1,000 [e]	1,000
Canada	13,863	14,179	14,336	15,078	13,672 [p, 3]
Chile	3,798	3,999	4,112	4,440	4,622 [3]
China	970,000	1,068,850	1,236,770	1,361,170 [r]	1,388,380 [p, 3]
Colombia	7,822	9,959	10,038 [5]	11,068 [5]	10,456 [3, 5]
Congo (Brazzaville)	--	100	100 [e]	100 [e]	110
Congo (Kinshasa)	403	511	530	520 [r, e]	520
Costa Rica[e]	1,500	1,400	1,400 [3]	1,400	1,400
Côte d'Ivoire[e]	650	650	650	650	650
Croatia	3,811	3,481	3,598 [r]	3,524 [r]	3,500
Cuba	1,401	1,567	1,705	1,805	1,800
Cyprus	1,689	1,805	1,786	1,873	1,870
Czech Republic	3,829	3,978	4,239	4,899	4,805 [3]
Denmark	2,150	2,120	2,115	2,100 [e]	2,100
Dominican Republic	2,654	2,779	3,777 [r]	4,100 [r, e]	4,000
Ecuador[e]	3,470 [r]	3,690 [r]	4,110 [r]	4,420 [r]	4,000
Egypt	28,763	32,458	36,200	38,400	40,000
El Salvador	1,265	1,131	1,311	1,300 [r, e]	1,300
Eritrea[e]	45	45	45	45	45
Estonia	615	726	849 [r]	937 [r]	808 [3]
Ethiopia	1,316	1,569	1,676 [r]	1,800 [r, e]	1,820
Fiji[e]	120	143 [3]	143	145	143
Finland	1,295	1,357	1,685	1,743	1,745 [3]
France	20,962	21,277	22,540	22,300 [e]	21,700 [3]

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2004	2005	2006	2007	2008[e]
French Guiana[e]	60	60	60	60	62
Gabon[e]	260	260	260	229 [3]	230
Georgia[e]	425 [3]	450	450	450	450
Germany	31,854	31,009	33,630	33,382	33,581 [3]
Ghana[e]	1,900	1,900	1,900	1,900	1,900
Greece	15,039	15,166	15,674	16,667	16,500
Guadeloupe[e]	230	240	230	230	230
Guatemala[e]	2,200	2,400	2,500	2,500	2,500
Guinea[e]	360	360	360	360	360
Haiti[e]	300	300	300	300	300
Honduras	1,392	1,384	1,800 [r, e]	1,800 [r, e]	1,800
Hong Kong	1,039	1,005	1,010 [e]	1,000 [e]	1,000
Hungary	3,580 [r]	3,371	3,724 [r]	3,552 [r]	3,544 [3]
Iceland	100	132	141	90 [e]	100
India[e]	130,000	145,000	160,000	170,000	177,000
Indonesia	33,230	33,917	35,000 [e]	36,000 [e]	37,000
Iran	32,198	32,650	35,300 [r, e]	40,000 [r, e]	44,400 [3]
Iraq[e]	2,500	3,000	3,500	4,500 [r]	5,500
Ireland	5,000 [e]	5,083	4,981	5,000 [e]	5,000
Israel	4,494	5,093	5,089	5,000 [e]	5,000
Italy	45,343	40,284	47,814	47,542 [r]	43,030 [3]
Jamaica	808	845	761	592	600
Japan	67,376	69,629	69,942	67,685	62,810 [3]
Jordan	3,908	4,046	3,967	4,051 [r]	4,284 [3]
Kazakhstan	3,662	3,975	4,880	5,699	5,223 [3]
Kenya	1,789	2,123	2,174	2,546 [r]	3,135 [3]
Korea, North[e]	5,630	5,700	6,160	6,130	6,130
Korea, Republic of	56,955	51,391	53,971	57,042	53,900 [3]
Kosovo[6]	450 [e]	450	450 [e]	470	590 [3]
Kuwait	2,635	2,145	2,200 [e]	2,200 [e]	2,200
Kyrgyzstan	870	900	1,211	1,300 [e]	1,300
Laos[e]	250	250	400	400	400
Latvia[e]	284 [3]	280	280	300	310
Lebanon	4,400	4,600	4,400	4,900 [e]	5,000
Liberia	121	144	155	157	160
Libya[e]	3,600	3,621 [3]	5,300 [r]	5,206 [r, 3]	6,000
Lithuania	753	832	1,065	1,105	1,100
Luxembourg	797	760	800 [e]	780 [e]	780
Macedonia	752 [r]	827 [r]	867 [r]	902 [r]	862 [3]
Madagascar[e]	170	150	150	270 [3]	270
Malawi	120	166	188	185	240
Malaysia	15,690	17,860	18,400 [r, e]	19,480 [r]	19,500
Martinique[e]	220	220	220	220	220
Mauritania	300	300 [e]	374 [r]	410	322 [3]
Mexico	34,992	37,452	40,362	40,670	47,609 [3]
Moldova	440	641	837	800 [e]	750
Mongolia	62	112	141	180 [r]	180
Morocco[e]	11,000	11,000	11,000	11,000	11,000

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2004	2005	2006	2007	2008[e]
Mozambique[e]	550 [r]	490 [r]	600 [r]	800 [r]	730
Nepal[e, 4]	285	290	295	300	285
Netherlands	2,380	2,496	2,790	2,700 [e]	2,700
New Caledonia	115	119	133	134 [r, e]	134
New Zealand[e]	1,110 [3]	1,100	1,120 [r, 3]	1,100	1,100
Nicaragua	521	530	530 [e]	530 [e]	530
Niger[e]	54	54	54	54	54
Nigeria[e]	2,300	2,700 [r]	3,300 [r]	4,700 [r]	5,000
Norway	1,420	1,613	1,695	1,700 [e]	1,700
Oman	2,621	2,686	3,611	3,880	4,000
Pakistan[e]	15,000	17,000	20,652 [3]	30,000 [r]	39,000
Panama	1,042	1,050	1,050 [e]	1,050 [r, e]	1,050
Paraguay[e]	470	550	600	600	600
Peru	4,604 [r]	5,107 [r]	5,782 [r]	6,231 [r]	6,922 [3]
Philippines	13,346	15,494	12,033	13,048	13,000
Poland	12,566	12,646	14,688	17,120 [r]	17,207 [3]
Portugal	8,843	8,438	8,340	12,631 [r]	10,000
Qatar	1,400	1,500	1,568	2,500 [e]	3,500
Réunion[e]	380	380	400	400	400
Romania	6,239	7,032	8,253	10,061	10,703 [3]
Russia	45,700	48,500	54,700	59,900	53,600 [3]
Rwanda	104	101	103	103	100
Saudi Arabia	25,380	26,064	27,056 [r]	30,369	31,823 [3]
Senegal	2,391	2,623	2,884	3,152	3,200
Serbia[7]	2,240 [r, 8]	2,276 [r, 8]	2,565	2,677	2,843 [3]
Serbia and Montenegro	-- [r, 8]	-- [r, 8]	-- [r]	-- [r]	--
Sierra Leone	180	172	234	236	236
Slovakia	3,158	3,499	3,593	3,718	4,157 [3]
Slovenia	1,186	1,114	1,269	1,300 [r, e]	1,300
South Africa, sales[9]	10,297	11,464	12,658	13,651	13,341 [3]
Spain, including Canary Islands	45,593	50,347	54,033	54,720 [r]	42,088 [3]
Sri Lanka[e]	1,400	1,500	1,600	1,700	1,800
Sudan	307	331	202	326 [r]	330
Suriname[e]	65	65	65	65	65
Sweden	2,588	2,709	2,952	2,950	2,900
Switzerland	3,851	4,022	4,040	4,000 [e]	4,000
Syria	4,757	4,700 [e]	4,804 [r]	5,104 [r]	5,336 [3]
Taiwan	19,050	19,891	19,294	18,957	17,330 [3]
Tajikistan	194	253	282	313 [r]	300
Tanzania	1,281	1,366	1,432	1,513	1,600
Thailand	35,626	37,872	39,408	35,668	35,600
Togo[e]	800	800	800	800	800
Trinidad and Tobago	768	686	883	890 [e]	800
Tunisia	6,662	6,691	6,932	7,052	7,559 [3]
Turkey	38,796	42,787	47,499	49,553	51,432 [3]
Turkmenistan[e]	550	650	800	900	900
Uganda[e]	559 [3]	630	630	650	650
Ukraine	10,635	12,183	13,732	15,000	14,918 [3]

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2004	2005	2006	2007	2008[e]
United Arab Emirates[e]	9,000	9,800 [3]	12,600 [r]	14,000 [r]	16,000
United Kingdom	11,405	11,216	12,119	11,900 [e]	11,900
United States, including Puerto Rico[10]	99,015	100,903	99,712	96,850	87,610 [3]
Uruguay[e]	620 [r]	620 [r]	620 [r]	620 [r]	620
Uzbekistan	5,068	5,068	5,700 [r, e]	6,500 [r]	6,600
Venezuela[e]	5,000 [r]	5,800 [r]	7,200 [r]	9,000 [r]	9,000
Vietnam	26,153	30,808	32,690	36,400 [e]	37,000
Yemen	1,546	1,550	1,470	1,728	3,000
Zambia[e]	390	435	650	650	700
Zimbabwe[e]	500	600	700	400	400
Total	2,190,000	2,350,000	2,610,000 [r]	2,810,000 [r]	2,840,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are thought to be accurate to no more than three significant digits. Data are from a variety of sources, including the European Cement Association.

[2]Table includes data available through July 9, 2009. Data may include clinker exports for some countries.

[3]Reported figure.

[4]Data are for fiscal year ending March 31 of the following year.

[5]Data for 2006–08 are for gray cement only; white cement output was likely to have been an additional 50,000 to 100,000 metric tons per year.

[6]Not included in Serbia data.

[7]Excludes Kosovo data.

[8]Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union. Montenegro has no cement plants.

[9]Data have been adjusted to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted, in metric tons, to: 2004—1,438,567; 2005—1,511,716; 2006—1,599,505; 2007—1,664,304; and 2008—1,395,124.

[10]Portland and masonry cements only.

USGS
science for a changing world

2009 Minerals Yearbook

CEMENT [ADVANCE RELEASE]

U.S. Department of the Interior
U.S. Geological Survey

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CEMENT

By Hendrik G. van Oss

Domestic survey tables were prepared by Michelle B. Blackwell, statistical assistant, and the world production table was prepared by Glenn J. Wallace, international data coordinator.

Combined production of portland and masonry cement in the United States in 2009 was 63.9 million metric tons (Mt). This was a 25.9% decline from production in 2008, a 35.6% decrease from the record output in 2005 (table 1), and the lowest level of output since 1983. Consumption of portland and masonry cement as measured by sales to domestic final customers decreased in 2009 by 26.7% to 71.0 Mt (table 9), also the lowest level since 1983 and nearly 57 Mt or 44.5% lower than the 2005 record. In contrast, the decline in sales prices (mill net valuation basis) in 2009 was comparatively modest (tables 1, 11–13). Overall, the value of cement sales totaled $7.0 billion, down by about 30% from that of 2008. Based on typical portland cement mixing ratios in concrete, the delivered value of concrete (excluding mortar) in the United States was estimated to be at least $47 billion in 2009.

Percentage or other changes expressed in this report compare activity in 2009 with that of 2008 unless specified otherwise. Except where otherwise indicated, activity levels in this report exclude those in Puerto Rico. Cements covered in this report are mainly limited to those hydraulic varieties broadly classified as portland cement (including blended cement and other varieties listed in table 15) and/or masonry cement (including portland-lime and plastic cements); these are the binding agents in concrete and most mortars. A few other types of hydraulic cements and/or clinker (notably aluminous cement) are included in some of the trade data (tables 16–18 and 21) and within the world production data (table 22). Except where incorporated as components within finished portland (blended) or masonry cements, this report's tables exclude supplementary cementitious materials (SCM), such as fly ash, other pozzolans, and ground granulated blast furnace slag (GGBFS). Sales data for blended (also called composite) cements listed separately from portland cement are available in the monthly Mineral Industry Surveys reports of the U.S. Geological Survey (USGS).

The bulk of this report is based on data compiled from USGS annual questionnaires sent to cement and clinker manufacturing plants and associated distribution facilities and import terminals, and some terminals that are independent of U.S. cement manufacturers. For 2009, questionnaires were received from 152 of 156 facilities canvassed, a response rate of 97%, which included all of the production sites. For 2008, questionnaires were received from 149 of 152 facilities canvassed, a response rate of 98%, including all of the production sites. If missing data could not be obtained by followup telephone inquiries, they were estimated based on monthly data or past annual reporting. For both years, the data exclude several importers that have yet to participate in the surveys. To the degree that they are independent of the participating companies, sales by the missing importers for 2008 and 2009 are estimated to be equivalent to an additional 1% of the total portland cement sales tonnages shown in this report. Background information on cement and its manufacture and on the USGS cement canvasses can be found in van Oss (2005).

Government Programs and Environmental Issues

A number of ongoing Government programs provide funding and direction for public sector construction and were thus of importance to cement consumption levels. In 2009, stimulus program spending allotments, including those related to the American Recovery and Reinvestment Act (ARRA) of 2009, were being compared to individual State spending of the appropriated monies as a means to predict increases in cement demand. By late 2009, it was evident that very little of the stimulus spending during the year had been for cement (concrete) but it was anticipated that the concrete industry would significantly benefit from ARRA funding in 2010 (Sullivan, 2010).

Environmental issues associated with the cement industry mostly result from the manufacture of the intermediate product called clinker. In clinker manufacture, the burning of large amounts of raw materials and fuels leads to significant emissions of carbon dioxide (CO_2), and can yield significant emissions of nitrogen oxides (NOx), sulfur oxides (SOx), mercury and some other metals, volatile organic carbon compounds, and particulates. Increasingly, these emissions are regulated or are being considered for regulation or reregulation. The largest volume emissions are of CO_2; the cement industry is one of the leading industrial emitters of this greenhouse gas (GHG). Overall, generation of CO_2 by the U.S. cement industry in 2009 was calculated to be in the range of 0.87 to 0.92 metric ton (t) of CO_2 per ton of clinker produced; the high end incorporates fuel combustion emissions calculated using "standard" heat values for the fuels consumed (table 7), and the low end incorporates heat values actually reported by the individual plants. Both ratios include a standard emissions factor from calcination of limestone of 0.51 t of CO_2 per ton of clinker as detailed by the Intergovernmental Panel on Climate Change (Hanle and others, 2006), but exclude any correction for cement kiln dust (CKD) not recycled to the kiln (for which data are lacking). However, the standard calcination component of CO_2 emissions can be reduced in the calculation in proportion to the calcium oxide contributed by noncarbonate alternative raw materials such as ferrous slags and coal combustion ashes. This incorporation would allow a reduction of calcination-related emissions of about 2.4% (0.7 Mt of CO_2) in 2009 and 2.7% (nearly 1.1 Mt of CO_2) in 2008; relative reductions can be significantly larger for the subset of individual plants that actually burn these alternative raw materials. Certain fuels, including alternative or waste fuels, can either directly reduce plant-level CO_2 emissions or may lead to reductions in reported emissions from combustion because the fuels are considered to be carbon-neutral (certain biofuels) or because credits may be allowed for their use (certain waste fuels). Plant-level emissions can be reduced through upgrading to more fuel-efficient kiln line technology. Unit emissions can also be reduced by use of SCM in finished cement and in concrete to reduce the clinker content of these products and/or by allowing the addition of "inert" fillers to boost cement output without simultaneously boosting clinker output.

In past years, the U.S. Environmental Protection Agency (EPA) used methods similar to those used above to calculate and report overall U.S. levels of GHG emissions by various industries; for cement, these methods made use of national-level clinker production data published by the USGS. However, to more accurately determine U.S. emissions of GHG, in October, the EPA released a final rule for mandatory site/plant-specific reporting of GHG emissions (to begin in 2010) (U.S. Environmental Protection Agency, 2009b). For the cement industry's CO_2 emissions, relevant calculation procedures for fuel combustion are covered under Part 98, subpart C (p. 56397–56411) and, for calcination and related process emissions, in subpart H (p. 56420–56422).

In May, the EPA proposed new, very low, limits on individual plant emissions of mercury, total hydrocarbons, particulate matter, and hydrochloric acid within a set of national emissions standards for hazardous air pollutants (NESHAP) for the U.S. cement industry (U.S. Environmental Protection Agency, 2009a). It was unclear how many U.S. cement plants would be able to comply with the new NESHAP limits for all four listed pollutants. The new standards for mercury were set so stringent (for existing plants, 43 pounds of mercury per million short tons of clinker produced; and for new plants, 14 pounds of mercury per million short tons of clinker produced) as to possibly preclude, absent the installation of mercury scrubbers, which could be very expensive, the use at many plants of their normal raw materials and of coal as a fuel. The NESHAP could end the use of fly ash as an alternative raw material for clinker manufacture; fly ash commonly has a high mercury content and this content was expected to increase as coal-fired powerplants installed their own scrubbers. The mercury-scrubbing technology most commonly discussed makes use of activated carbon, and this mercury-laden carbon (at a powerplant) would report to the fly ash. A discussion of the cement NESHAP is provided by O'Hare (2009).

The EPA was evaluating changing the regulatory classification of coal combustion byproducts, particularly fly ash, under conditions of long-term or permanent storage (disposal) and for various usage purposes. Concern in the construction sector was that if fly ash were to be reclassified as a hazardous waste, even under restricted circumstances, the material would be stigmatized and demand for it would decrease or cease altogether (Goss, 2010).

Production

Continued declining sales of cement, together with an apparent drawdown of cement stockpiles, and despite a major decline in cement imports, led to a 25.6% decrease in portland cement production in 2009 to just 62.0 Mt (table 3). This was the lowest production since 1983 and was nearly 32 Mt less than the record output in 2005. Production fell in all districts except Indiana. Yearend stocks of portland cement fell by 28%. Owing to two plants coming online during the year (Florida and Missouri) and of some new mills at existing plants, overall grinding capacity increased by about 6%. The capacities and plant counts listed in table 3 for 2009 are, however, somewhat uncertain because of difficulties differentiating between plants reported as "idle" (or "indefinitely idle") and those that were permanently "closed." At least in terms of sales, some such plants continued to operate as distribution terminals. Likewise, plants that closed their kilns in late 2008 may have continued to grind remaining clinker stocks until they were exhausted in early 2009 after which the finish mills were closed as well. The USGS policy has been to count as active all plants having production for at least 1 day during the year, but this policy may not be realistic for plants idle all year and which offered few prospects of ever reopening. Thus, in a few locations, a decision was made for the 2009 tally to exclude plants that were "idle" throughout 2009–10 and for which a formal closure announcement was made in 2010. In one district, an ultimately closed plant was retained in the 2009 count because it made a small quantity of masonry cement early in the year, thus still having active grinding capacity. Another plant, seemingly closed, retained the possibility of restarting its finish mill. One plant in Florida that had been announced as closed in late 2008 was retained in the 2009 count despite no production during the year because its status was confirmed as idled, rather than closed.

For masonry cement, a stagnant housing construction sector during the year led to a decline in cement production of 35% to just 2.0 Mt, the lowest level since at least 1954.

With common parents combined under the larger subsidiary's name and with joint ventures apportioned, the 10 leading companies at yearend 2009, in descending order of portland cement production, were Holcim (US) Inc., CEMEX, Inc., Lafarge North America Inc., Lehigh Cement Co., Buzzi Unicem USA Inc. (including Alamo Cement Co.), Ash Grove Cement Co., Texas Industries, Inc. (TXI), Essroc Cement Corp., CalPortland Co., and St. Marys Cement Inc. The listing was unchanged from that of 2008. The U.S. industry continued to be heavily consolidated—the leading 5 cement companies, combined, contributed 59% of total U.S. portland cement production, and the leading 10 companies accounted for 81% of total production. Of the above named companies, all except Ash Grove and TXI were foreign owned as of yearend, and for the industry overall, about 77% of total cement output was by foreign-owned companies.

Clinker output in 2009 fell by 28.4% to 56.1 Mt (tables 1, 5). This was the lowest level since 1982. Production fell in all months, and for the year overall in all districts. Owing to a new plant coming online, the commencement of production from a plant that was completed at yearend 2008, and upgrades at some existing plants, apparent annual capacity increased by 6.5%; this was despite the removal in the 2009 total of plants or kilns closed during 2008. Utilization of clinker production capacity was only about 49% in 2009, well down from the 73% of the previous year and the presumed "full practicable" capacity utilization of 85% or more experienced during years of high cement sales volumes. The performance in 2009 reflected a combination of permanent kiln or plant closures and long-term idling of “extra” kilns at multikiln plants. However, the utilization statistic is dependent on the reported downtime for routine maintenance. Many plants reported much longer than normal downtimes for this purpose in 2009; where this was obvious, corrections were made after consultation with the plants to remove the extra downtime (a result of slow sales) from the statistic. Yearend clinker stockpiles decreased by nearly 30%, likely reflecting yet more kiln idlings late in the year.

Nonfuel raw materials consumed to make clinker and cement are listed in table 6. Ratios among clinker raw materials consumed in 2009 appear to be broadly similar to those in 2008. For fly ash and bottom ash, the data are similar to those published by the American Coal Ash Association (ACAA) for sales for use in making clinker and cement (combined), namely 2.210 Mt of fly ash and 0.654 Mt of bottom ash (American Coal Ash Association, 2010; Goss, 2010). The ACAA also noted sales of 0.382 Mt of synthetic gypsum to the cement industry; this is less than the 0.47 Mt or more of this material included within the “Gypsum and anhydrite” data in table 6, but could reflect the fact that the ACAA does not survey the cement plants’ own manufacture of this material.

Data on fuel consumption by the cement industry are listed in table 7. Data shifts can reflect activities at just a few plants. In terms of overall mass ratios among fuels in total and relative to clinker production, significant changes in 2009 were evident for several fuels but in part reflected closure and full-year idling of several wet kilns and some less efficient long dry kilns during the year. A much smaller percentage of clinker was contributed by wet kilns in 2009, for example. The significant increase in the consumption of natural gas reflects a combination of the incorporation of large amounts of landfill gas at two plants, and a shift from gas as a warm up fuel to a major use fuel reported at two facilities. Some of the other apparent shifts reflect upgrades, including conversions from wet to dry kiln technology at some plants.

Although not revealed in table 7, overall heat consumption (gross heat basis) in 2009 was about 3.9 billion joules (GJ) per metric ton of clinker, down by about 9% from that in 2008. The reduction reflected the closure or idling of wet kilns and less efficient dry kilns during the year. Heat energy consumption at the remaining operational wet kilns averaged 6.0 GJ per ton of clinker, down by nearly 8%. Dry kilns averaged 3.6 GJ per ton of clinker, down by 10%. Thus, efficiency apparently improved despite much longer and perhaps more frequent than normal total downtimes (for all reasons) on the operational kilns. It is possible that further reductions in unit energy consumption will be realized if and when the industry resumes more normal operating schedules. As in past years, coal supplied the largest share of the heat consumed (60%, down by about 7%), followed by petroleum coke (about 21%, unchanged), and waste fuels (13%, up by 22%). As noted above, natural gas, including landfill gas, use increased markedly; it contributed about 5% of total heat in 2009, up by 74%.

The average unit electricity consumption increased again in 2009 (table 8); this most likely reflects operational disruptions (idlings and closures, repairs, plant upgrades) at many plants, and a greater reliance on dry plants. Dry plants, commonly, have higher unit electricity consumption than do wet plants.

There were no significant ownership changes in the U.S. cement industry in 2009. Two new plants were brought into production during the year. American Cement Co., LLC began operations early in the year at its 1.0-million-metric-ton-per-year (Mt/yr) plant at Sumterville, FL; plant construction had been completed at yearend 2008. Initial cement production was from purchased clinker, but the plant started its own clinker production in May. American Cement was a joint venture between Oldcastle Materials, Inc. and New Jersey-based Trap Rock Industries, Inc. In July, Holcim fired the 4.0-Mt/yr precalciner kiln at its new plant in St. Genevieve County, MO; this kiln was said to have the largest annual capacity of any in the world and was expected, at full output levels, to put Missouri at or near the forefront of U.S. clinker production.

The litany of plant closures and long-term or indefinite idlings of plants that began in 2008 continued in 2009, although many of the facilities continued to operate as storage, packaging, and transshipment terminals for cement sourced elsewhere. At the end of January, Ash Grove indefinitely idled the wet kilns at its Inkom, ID, plant, but the facility continued to produce cement from clinker stockpiles and from clinker brought in from another Ash Grove plant. CalPortland idled the long dry kilns at its Colton, CA, plant during the course of the year but continued to make cement from clinker brought in from the company’s Mojave, CA, facility. CEMEX confirmed that its Brooksville “North” plant in Florida was on indefinite idle status in 2009, and had not been closed as had been reported in 2008. Essroc closed the wet kilns at its Bessemer, PA, plant at the end of April and shut the finish mill there at the end of September. At the end of April, Holcim shut its wet plants at Dundee, MI, and Clarksville, MO; the Clarksville plant’s kiln was the longest in the world. At the same time, the company indefinitely idled its wet plant at Artesia, MS, and in September, indefinitely idled its dry plant at Mason City, IA. In addition to these plant closures and/or indefinite idlings, many multikiln plants had one or more kilns idle for all or part of the year.

Major kiln line upgrades were completed at three cement plants in 2009. In August, Buzzi Unicem fired the new 1.2 Mt/yr precalciner kiln at its River (also known as the Festus or Selma plant), at Festus, MO; the new kiln replaced the existing pair of long dry kilns (Buzzi Unicem, 2009). Also in November, Keystone Cement Co. fired its new precalciner kiln line at Bath, PA; the new 1.2-Mt/yr line replaced the plant’s pair of wet kilns, which were shut down at the same time. In August, Essroc closed the three wet kilns at its Martinsburg, WV, plant and in November fired the plant’s new 2.0-Mt/yr precalciner kiln that had been under construction.

Some ongoing upgrade projects were cancelled or postponed in light of poor cement sales. An example was the January announcement by TXI that it was postponing further work on the expansion project at its cement plant at Hunter, TX (Texas Industries, 2009); the project was expected to resume once market conditions improved.

Consumption

Cement consumption data for the United States were surveyed and reported monthly by the USGS in terms of sales to final customers and are summarized in table 9. Although the national sales totals in table 9 are similar to the shipments totals in tables 11, 12, and 14, only the table 9 breakout tonnages represent State-level consumption. The regional breakouts in tables 11, 12, and 14 simply pertain to the locations of the reporting entities (chiefly the production sites), not the locations of consumption. It is very common for shipments to cross State lines.

The U.S. cement market in 2009 continued a decline that began in early to mid-2006; this reflected ongoing stagnation in several construction sectors, particularly in housing, a tight loan market, and continued declines in State property tax revenues. Decreases in sales of cement were experienced in all months during the year. Total sales of portland cement to domestic final customers fell by 26.5% to 68.9 Mt, the lowest level since 1983. Sales declined in all districts; those into the three traditionally leading consuming States (California, Florida, and Texas) were down by about 32% in 2009. Although sensitive to the accuracy of the population data, per capita consumption of portland cement was just 220 kg in 2009, the lowest level since 1947; the amount in 2008 was 413 kg. Masonry cement consumption decreased by 31.0% to 2.1 Mt, the lowest level since 1949.

Sales by some importers that did not participate in the USGS monthly and annual surveys were not included in the portland cement consumption data in this report. An estimate of these missing importers' sales can be made by comparing official (U.S. Census Bureau) trade data (tables 17 and 21) with the import origins of sales (table 9). The official cement imports were about 0.3 Mt higher than the foreign origin tonnages in 2009 and 1.5 Mt higher than those in 2008; however, the discrepancy in 2009 appears to be too small based on known missing data for cement from the Republic of Korea into the Philadelphia, PA, customs district (0.139 Mt), and of much of the material from Colombia into the Houston, TX, and Wilmington, NC, districts (0.369 Mt). It appears that part of the reason for the difference in 2009 is that the table 9 import origins of sales data include a large component of drawdown of stocks, as suggested by the large yearend stockpile decline for importers listed in table 3. Adjusting for both years for cement varieties that are in the trade tables but not covered by the USGS canvasses (chiefly aluminous cement) and for apparent drawdown of stocks, which cannot fully distinguish between imported and domestic cement, it becomes evident that the annual tables are missing about 0.5 Mt of cement sales in 2009 and about 1 Mt in 2008.

As the binder in concrete, cement consumption levels within a given category of construction will broadly reflect levels of construction spending, although significant time lags may exist between the onset or cutoff of spending and changes in the consumption of cement. In terms of 1996 constant dollars, overall construction spending in 2009 fell by 15% to $552 billion (Portland Cement Association, 2011). Within this spending, public sector construction was the largest share, at $184 billion, down by 0.8% only. Residential construction, which had been the dominant sector in 2008, fell in 2009 by 25% to $168 billion. Nonresidential construction spending was $133 billion, down by 21%.

Portland cement sales broken out by customer type are listed in table 14. Sales to ready-mixed concrete producers accounted for about 71% of total shipments, but the true tonnage for this type of concrete was larger because some of it was recorded under other customer categories, such as road paving contractors. As listed, the sales to ready-mixed customers declined by 27%, in line with the decrease in overall portland cement sales. The decline in residential construction spending noted above is in line with the 34% decline in sales tonnages of cement for brick and block; and the decline in nonresidential private and public sector spending noted is in line with reduced sales of cement for precast–prestressed concrete products (down by 28%), and for road paving (down by 22%). Sales of cement for oil well and gas well drilling fell by 45%, in line with sharply reduced oil and gas prices and drilling activities in 2009.

Sales of different types of portland cement are broken out in table 15. As in past years, sales were dominated by Types I and II cements and sulfate-resistant varieties of cement (Type V and Type II/V hybrids reported as Type V). Sales of these cements fell more or less proportionately to overall portland cement sales. Oil well cement sales fell by 42%, a result similar to that in table 14 noted above. White cement sales fell by 30%. As in past years, the white cement sales tonnage was significantly less than the imports of white cement (table 20) and would seemingly preclude any need for domestic production of the material. The discrepancy is partly explained by the use of some imported white cement for masonry cement (sales not included in table 15), and by the fact that some imported white cement is blended with domestically produced white cement.

Blended cement sales in table 15 fell by about 34% to 1.3 Mt, but this tonnage is significantly less than the blended cement sales reported for 2009 in the monthly reports of the USGS (1.6 Mt). It is unclear why this difference exists, except that there could be inconsistent reporting between the monthly and annual surveys of cement sold under the general performance standard ASTM C–1157, which at one time applied only to blended cements but which now applies to hydraulic cements in general.

Data on the mill net values for shipments to final customers by plants and import terminals (terminal nets) are provided in tables 11 to 13. Despite the large drop in sales tonnages, unit prices for portland and masonry cement declined relatively modestly.

Foreign Trade

Trade data from the U.S. Census Bureau are presented in tables 16–21. Although at the highest tonnage level since 1948, exports of cement and clinker continued to be small compared with imports. Canada remained by far the dominant destination of the exports, taking about 76% of the total in 2009.

Total imports of cement and clinker in 2009 fell by 40.5% to 6.8 Mt (table 17), the lowest total since 1992 and a decline of 28.8 Mt from the record level of 2006. The dominant share of imports was gray portland cement, imports of which fell by nearly 44% to 5.4 Mt (table 19). Canada continued to be the dominant source of U.S. imports. The tonnage of portland cement imported from Canada in 2009 fell by nearly 20%, but this was a small relative decline compared with those of most other countries. The relative regional sourcing of imports has changed dramatically in recent years. For example, Canada's share of the U.S. cement and clinker import market was 50% in 2009, much higher than the 14% share it held in 2006. By comparison, Asia, which had accounted for 19.5 Mt or 54% of total imports in 2006, supplied just 1.8 Mt or 26% of the imports in 2009. China alone supplied nearly 30% of total U.S. imports in 2006 but accounted for only 9% of the imports in 2009.

Official imports of clinker fell by 10.5% to 0.56 Mt (table 21). The clinker data are incomplete, however, with regard to overland imports from Canada; the tonnages listed are insufficient to have fully supplied the grinding plants in Michigan and Washington, all of which imported their clinker from Canada. The unreported Canadian clinker appeared mostly to be coming in by truck, at a value of less than $2,000 (customs value) per truckload; such shipments are classified as "informal entries" and data on them are not routinely transmitted by the U.S. Customs Service to the U.S. Census Bureau for recordation into the official trade data (reproduced in tables 17–21). This problem presumably does not exist for imports by rail or by ship because these shipments are larger. Clinker imports from Canada were estimated to be higher than those reported in tables 1 and 21 by about 0.7 Mt in 2008 and by about 0.2 Mt in 2009.

With the decline in imports, especially from Asia, several of the once-busiest import locations have fallen from prominence, and overland import locations have become relatively dominant. For cement and clinker combined, the 10 busiest customs districts of entry in 2009 were, in descending order of tonnage, Detroit, MI; Houston-Galveston, TX; Seattle, WA; Buffalo, NY; Cleveland, OH; Columbia-Snake, OR and WA; Honolulu, HI; El Paso, TX; Ogdensburg, NY; and Savannah, GA (table 18). These leading districts accounted for about 71% of the total imports for the year.

World Review

World hydraulic cement production data are listed in table 22. The data are intended to include all forms of hydraulic cement; however, the data for the United States are for portland and masonry cement only, and data for some other countries also may be incomplete. For some countries, the production data may include exports of clinker.

World cement output in 2009 was an estimated 3.04 billion metric tons (Gt), up by 6.7%. Production was from more than 150 countries. China was again the world's leading producer by far, with an output of 1.63 Gt or nearly 54% of the world total. The remaining top 20 producers were, in descending order of tonnage, India, the United States, Japan, Turkey, Brazil, the Republic of Korea, Iran, Vietnam, Egypt, Russia, Indonesia and Saudi Arabia (tied), Italy, Mexico, Pakistan, Thailand, Germany, Spain, and Malaysia. Cumulatively, the top 5 countries had about 66% of total world output, the top 10 countries, about 74%, and the top 20 countries, about 85%.

Regionally, Asia and the Pacific contributed about 71% of world production, included 9 of the 20 leading producing countries, and continued to experience the greatest growth rate of all regions. The Middle East (including Turkey), had 6.8% of world output; Western Europe, 6.1%; Africa, 4.3%; Central America and South America, combined, 3.8%; North America (including Mexico), 3.7%; the Commonwealth of Independent States, 2.5%; and Eastern Europe, 1.5%.

Outlook

A modest increase in concrete construction in 2010 was expected, based on projected beneficial downstream effects of stimulus funding on the general economy and the housing construction sector in particular, and on expected access to ARRA funding. Relatively little ARRA funding had gone to public sector construction projects involving concrete in 2009 and many States still had significant fractions of their respective ARRA allotments as yet unspent at yearend 2009. However, low revenues to the States from property taxes were expected to continue to hamper State contributions to construction projects funded jointly by State governments and the Federal Government. It was recognized that a return to cement consumption levels approaching those of the peak 2005–06 period was many years away. Of great concern to the cement industry was the proposed portland cement NESHAP, which would impose very low, stringent, limits on mercury and certain other emissions by cement plants. The NESHAP would be difficult to comply with owing to high cost of emissions control equipment and potential problems of sufficient control equipment availability within the 3-year NESHAP compliance window. According to some industry analysts, a large number of plants—representing perhaps 25% of U.S. production capacity—might have to close as a result of the NESHAP, forcing the concrete industry to increasingly rely on imported cement. Further, should fly ash become stigmatized as a result of an EPA reclassification of it as a hazardous material, the construction sector might lose this material as an alternative raw material or SCM, and thus hamper efforts to reduce the GHG "footprint" associated with concrete construction.

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TABLE 1
SALIENT CEMENT STATISTICS FOR THE UNITED STATES[1, 2]

(Thousand metric tons unless otherwise specified)

		2005	2006	2007	2008	2009
Production:						
Cement[3]		99,319	98,167	95,464	86,310	63,929
Clinker		87,405	88,555	86,130	78,382	56,116
Shipments from mills and terminals:[3, 4, 5]						
Quantity		128,000	127,000	114,000	96,700	71,100
Value[6]	(thousands dollars)	11,700,000	12,900,000	11,900,000	9,990,000	7,020,000
Average value[6]	(dollars per metric ton)	91.00	101.50	104.00	103.50	99.00
Stocks, yearend:						
Cement		7,450	9,380	8,890	8,360	6,080
Clinker		3,520	5,370	6,550	7,070	5,130
Exports		766	723 [7]	886 [7]	823	884
Imports:[8]						
Cement		30,403	32,141	21,496	10,744	6,211
Clinker		2,858	3,425	972	621	556
Total[9]		33,261	35,566	22,468	11,365	6,767
Consumption, apparent[10]		128,250	127,660	116,550	96,760	71,530
World production[e, 11]		2,350,000	2,610,000	2,810,000	2,850,000 [r]	3,040,000

[e]Estimated. [r]Revised.
[1]Unless otherwise indicated, data are for portland (including blended) and masonry cements only. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.
[2]Excludes Puerto Rico.
[3]Includes cement made from imported clinker.
[4]Includes imported cement.
[5]Shipments to final domestic customers. Data are from an annual survey of plants and terminals and may differ from the totals in table 9, which are based on consolidated monthly surveys from companies.
[6]Value free on board mill or independently reporting terminal.
[7]Official export data have been corrected to remove an apparent excess of aluminous cement from Laredo, TX, of 943,939 metric tons in 2006 and 653,255 metric tons in 2007.
[8]All forms of hydraulic cement or clinker.
[9]Data may not add to totals shown because of independent rounding.
[10]Production (including that from imported clinker) of cement plus imports of hydraulic cement minus exports of hydraulic cement minus the change in yearend cement stocks.
[11]Total hydraulic cement. May include clinker exports for some countries.

TABLE 2
COUNTY BASIS OF SUBDIVISION OF STATES IN CEMENT TABLES

State subdivision	Defining counties
California, northern	Alpine, Fresno, Kings, Madera, Mariposa, Monterey, Tulare, Tuolumne, and all counties farther north.
California, southern	Inyo, Kern, Mono, San Luis Obispo, and all counties farther south.
Illinois, metropolitan Chicago	Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will Counties in Illinois.
Illinois, excluding Chicago	All counties other than those in metropolitan Chicago.
New York, eastern	Delaware, Franklin, Hamilton, Herkimer, Otsego, and all counties farther east and south, except those within Metropolitan New York.
New York, western	Broome, Chenango, Lewis, Madison, Oneida, St. Lawrence, and all counties farther west.
New York, metropolitan	New York City (Bronx, Kings, New York, Queens, and Richmond), Nassau, Rockland, Suffolk, and Westchester.
Pennsylvania, eastern	Adams, Cumberland, Juniata, Lycoming, Mifflin, Perry, Tioga, Union, and all counties farther east.
Pennsylvania, western	Centre, Clinton, Franklin, Huntingdon, Potter, and all counties farther west.
Texas, northern	Angelina, Bell, Concho, Crane, Culberson, El Paso, Falls, Houston, Hudspeth, Irion, Lampasas, Leon, Limestone, McCulloch, Reagan, Reeves, Sabine, San Augustine, San Saba, Tom Green, Trinity, Upton, Ward, and all counties farther north.
Texas, southern	Brazos, Burnet, Crockett, Jasper, Jeff Davis, Llano, Madison, Mason, Menard, Milam, Newton, Pecos, Polk, Robertson, San Jacinto, Schleicher, Tyler, Walker, Williamson, and all counties farther south.

TABLE 3

PORTLAND AND BLENDED CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

	2008					2009				
District[2]	Number of plants	Production	Grinding capacity[3]	Percentage utilized[4]	Yearend stocks[5]	Number of plants	Production	Grinding capacity[3]	Percentage utilized[4]	Yearend stocks[5]
Maine and New York	5	3,061	4,204	72.8	234 [6]	5	2,118	4,341	48.8	219 [6]
Pennsylvania, eastern	7	3,826	5,140 [6]	74.5	285	7	3,064	5,420 [6]	56.5	247
Pennsylvania, western	3	1,327	1,805	73.5	140	3	678	1,805	37.6	103
Illinois	4	2,655	3,390	78.3	268	3	1,487	3,390	43.9	237
Indiana	4	2,587	3,653	70.8	237	4	2,685	3,740 [6]	71.7	188
Michigan	5	4,928	7,332	67.2	287	5	3,548	6,983	50.8	163
Ohio	2	762	1,166	65.4	64	2	550	1,166	47.2	25
Iowa, Nebraska, South Dakota	5	3,987	5,840 [6]	68.3	458	5	2,991	5,840 [6]	51.2	266
Kansas	4	2,396	3,230 [6]	74.2	247	3	1,669	2,940 [6]	56.8	166
Missouri	5	4,651	7,230	64.3	532	6	4,418	13,035	33.9	622
Florida[7]	7	4,979	7,301	68.2	389 [6]	7	3,145	7,610 [6]	41.3	260
Georgia, Maryland, Virginia, West Virginia	7	5,057	6,780 [6]	74.6	595 [6]	6	3,859	7,180 [6]	53.7	334
South Carolina	3	2,925	5,085	57.5	137 [6]	3	1,868	5,085	36.7	77
Alabama	5	4,635	7,074	65.5	242	5	3,416	7,292	46.8	231 [6]
Kentucky, Mississippi, Tennessee	4	3,045	3,702	82.3	282	4	1,958	3,702	52.9	147
Arkansas and Oklahoma	4	2,623	3,130 [6]	83.9	198	4	2,067	3,127	66.1	182
Texas, northern	6	6,303	7,618	82.7	1,324	6	3,833	7,580 [6]	50.5	609
Texas, southern	6	4,778	6,330 [6]	75.5	260 [6]	6	4,519	6,505	69.5	226 [6]
Arizona and New Mexico	3	2,097	3,116	67.3	102	3	1,464	3,116	47.0	91
Colorado and Wyoming	4	2,610	4,449	58.7	173	4	2,165	4,517	47.9	149
Idaho, Montana, Nevada, Utah	6	2,727	3,728	73.1	221 [6]	6	2,050	3,728	55.0	156
Alaska and Hawaii	--	--	--	--	82	--	--	--	--	55
California, northern	3	1,678	2,853	58.8	188	W [8]	W [8]	W [8]	W [8]	W [8]
California, southern	8	8,201	10,855	75.6	310 [6]	11 [8]	7,153 [8]	13,600 [6,8]	52.7 [8]	417 [6,8]
Oregon and Washington	4	1,443	2,435	59.3	248 [6]	4	1,254	2,435	51.4	275 [6]
Importers[9]	--	--	--	--	310 [6]	--	--	--	--	182 [6]
Total[10]	114	83,283	117,000 [6]	70.9	7,810 [6]	112	61,961	124,000 [6]	49.9	5,620 [6]
Puerto Rico	2	1,301	1,898	68.5	44	2	936	1,780	52.6	47 [6]
Grand total[10]	116	84,584	119,000 [6]	70.9	7,860 [6]	114	62,897	126,000 [6]	50.0	5,670 [6]

See footnotes at end of table.

TABLE 3—Continued

PORTLAND AND BLENDED CEMENT PRODUCTION, CAPACITY, AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits. Includes data for white cement. Includes cement made from imported clinker.

[2]District assignation is the location of the reporting facilities. Specific districts include importers for which district assignations were possible.

[3]Grinding capacity is based on fineness needed to produce a plant's normal output mix, including masonry cement, and allowing for downtime for routine maintenance.

[4]Calculated relative to portland cement output; utilization would be higher if calculated to include output of masonry cement.

[5]Includes imported cement. Includes stocks at mills, terminals, and in transit.

[6]Data contain estimates for nonrespondent or incompletely reporting facilities and have been rounded to no more than three significant digits.

[7]Production and capacity data exclude a plant that produced only masonry cement.

[8]Data for Northern California for 2009 are included with those for Southern California.

[9]Data include only those importers or terminals for which district assignations were not possible.

[10]Data may not add to totals shown because of independent rounding.

TABLE 4

MASONRY CEMENT PRODUCTION AND STOCKS IN THE UNITED STATES, BY DISTRICT[1]

(Thousand metric tons unless otherwise specified)

	2008			2009		
District[2]	Number of active plants	Production[3]	Yearend stocks[4]	Number of active plants	Production[3]	Yearend stocks[4]
Maine and New York	4	69	17	4	41	12
Pennsylvania	9	254	56	9	176	46
Indiana and Ohio	6	332	73	6	244	52
Michigan	4	99	34	4	80	28
Iowa, Nebraska, South Dakota	2	W	W	2	W	W
Kansas	2	W	W	2	W	W
Missouri	1	W	W	1	W	W
Florida	5	310	65	6	123	38
Georgia, Maryland, Virginia, West Virginia	6	367	53	6	250	42
South Carolina	3	323	31	3	174	16
Alabama	4	303	63	4	208	61
Kentucky, Mississippi, Tennessee	3	W	W	3	W	W
Arkansas and Oklahoma	4	125	18	3	97	21
Texas	7	274	20	8	202	22
Arizona and New Mexico	3	W	W	3	W	W
Colorado and Wyoming	2	W	W	2	W	W
Idaho, Montana, Nevada, Utah	1	W	W	--	W	W
California, northern	3	59	19	W [5]	W [5]	W [5]
California, southern	5	278	23	7	236	45 [6]
Importers[7]	--	--	3 [6]	--	--	3 [6]
Total[8]	74	3,027	549 [6]	73	1,968	456 [6]

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

[1]Includes masonry, portland-lime, plastic, and stucco cements. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]District assignation is the location of the reporting facilities. Specific districts include importers for which district assignations were possible.

[3]Includes cement produced from imported clinker.

[4]Includes imported cement.

[5]Data for 2009 for Northern California is included with those for Southern California.

[6]Data contain estimates for nonrespondent or incompletely reporting facilities.

[7]Data include only those importers or terminals for which district assignations were not possible.

[8]Data may not add totals shown because of independent rounding.

TABLE 5

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2009, BY DISTRICT[1]

District	Number of active plants[2] Process used: Wet	Dry	Both[3]	Total	Number of kilns[4]	Daily capacity[4, 5] (thousand metric tons)	Average days of routine maintenance[6]	Apparent annual capacity[4, 7] (thousand metric tons)	Production (thousand metric tons)	Percentage of capacity utilized	Yearend stocks (thousand metric tons)
Maine and New York	2	2	--	4	5	11.3	26.8	3,817	1,856	48.6	100
Pennsylvania	3	5	1	9	18	22.8	13.9 [8]	8,000 [8]	3,523	44.2	271
Illinois	--	3	--	3	6	7.7	7.5	2,728	1,311	48.1	134 [8]
Indiana	1	3 [9]	--	4	8	10.2	25.8	3,430	2,578	75.2	198
Michigan	1	2	--	3	8	14.1	18.6	4,796	2,587	53.9	132
Ohio	1	1	--	2	3	3.3	25.8	1,159	467	40.3	23
Iowa, Nebraska, South Dakota	--	4	1	5	9	14.1	17.9 [8]	4,850 [8]	2,614	53.9	230
Kansas	1	2	--	3	5	8.2	18.5	2,746	1,682	61.3	63
Missouri	1	5	--	6	8	36.3	25.6 [8]	12,400 [8]	4,123	33.3	434
Florida	--	7	--	7	8	23.8	18.1 [8]	8,350 [8]	2,984	35.7	338
Georgia, Maryland, Virginia, West Virginia	--	4	1	5	8	22.1	19.3 [8]	7,570 [8]	3,611	47.7	261
South Carolina	--	3	--	3	3	12.3	26.6	4,185	1,770	42.3	325
Alabama	--	5	--	5	5	16.9	31.0	5,670 [8]	3,240	57.1	196
Kentucky, Mississippi, Tennessee	1	3	--	4	4	10.5	17.5	3,635	1,773	48.8	47
Arkansas and Oklahoma	2	2	--	4	10	8.1	20.5	2,796	1,775	63.5	66
Texas, northern	2	4 [10]	-- [10]	6	12	19.0	18.6	6,586	3,480	52.8	649
Texas, southern	--	5	--	5	6	16.2	15.7	5,648	4,128	73.1	366
Arizona and New Mexico	--	3	--	3	7	8.6	11.6	3,022	1,125	37.2	136
Colorado and Wyoming	--	4	--	4	5	11.5	26.8	3,907	1,992	51.0	228
Idaho, Montana, Nevada, Utah	3	3	--	6	8	8.5	20.3	2,876	1,671	58.1	154 [8]
California	--	9	--	9	11	40.4	26.0	13,667	6,612	48.4	717
Oregon and Washington	1	2	--	3	3	6.0	34.4	2,019	1,213	60.1	64
Total[11]	19	81	3	103	160	332.1	20.1 [8]	114,000 [8]	56,116	49.3	5,130 [8]
Puerto Rico	--	2	--	2	2	5.3	42.5	1,731	802	46.3	75
Grand total[11]	19	83	3	105	162	337.4	20.4 [8]	116,000 [8]	56,918	49.3	5,210 [8]

See footnotes at end of table.

TABLE 5—Continued

CLINKER CAPACITY AND PRODUCTION IN THE UNITED STATES IN 2009, BY DISTRICT[1]

-- Zero.

[1]Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Includes white cement plants. Includes all plants that produced clinker for at least one day during the year.

[3]Plants that can operate both wet and dry kilns, whether or not both types were active during the year.

[4]Includes kilns active for at least one day during the year. For kilns idle all year, excludes those that cannot be restarted, fully permitted, in less than 6 months.

[5]Sum of reported kiln capacities for each plant in a district.

[6]Total days of routine maintenance (summed for all kilns) divided by the number of kilns.

[7]Sum of apparent annual capacities for each kiln. For each kiln, the statistic is calculated as 366 days (leap year) minus days reported for routine maintenance and then multiplied by the unrounded daily capacity.

[8]Data contain estimates for nonrespondents and incompletely reporting facilities and have been rounded to no more than three significant digits.

[9]Includes one semiwet kiln.

[10]Includes as a dry operation one plant, formerly operating both wet and dry kilns, whose wet kilns were idle all year (2009) and which, in 2010, were declared permanently closed.

[11]Data may not add to totals shown because of independent rounding.

TABLE 6

RAW MATERIALS USED TO PRODUCE CLINKER AND CEMENT IN THE UNITED STATES[1, 2]

(Thousand metric tons)

Materials	2008 Clinker	2008 Cement[3]	2009 Clinker	2009 Cement[3]
Calcareous:				
Limestone (aragonite, chalk, coral, marble)	101,000	1,920	73,600	1,510
Cement rock (includes marl)	10,900	50	6,560	--
Cement kiln dust (CKD)[4]	425	304	288	156
Lime[4]	248	15	17	5
Other	41	--	62	--
Aluminous:				
Clay	3,780	--	2,500	3
Shale and schist	3,290	20	2,540	--
Other[5]	849	--	438	--
Ferrous:				
Iron ore	609	--	481	--
Mill scale	702	--	536	--
Other[6]	65	--	40	--
Siliceous:				
Sand, calcium silicates	3,970	--	2,550	--
Sandstone, quartzite, soils, nonpozzolanic rocks	693	--	464	--
Fly ash	2,710 r	95 r	2,290	74
Other ash, including bottom ash	948	--	706	--
Granulated blast furnace slag[7]	81	328	44	192
Other blast furnace slag	262	--	99	--
Steel slag	428	--	169	--
Other slag	67	30	38	--
Natural rock pozzolans[8]	--	9	--	11
Other pozzolans[9]	79	3	45	3
Other:				
Gypsum and anhydrite	--	4,620 r	--	3,367
Other[10]	115	90	79	57
Total[11]	131,000	7,480 r	93,600	5,380
Clinker, imported, raw materials equivalent[12]	--	1,810	--	1,250
Grand total[11]	131,000	9,290 r	93,600	6,630

r Revised. -- Zero.

[1]Excludes Puerto Rico.

[2]Data have been rounded to three significant digits to reflect inherent reporting accuracy and the incorporation of estimates for some facilities.

[3]Includes portland, blended, and masonry cements.

[4]Data are probably underreported.

[5]Includes alumina, aluminum dross, bauxite, spent catalysts, and other aluminous materials.

[6]Includes iron sludges, pyrite, and other ferrous materials.

[7]Includes both ground (GGBFS) and unground material.

[8]Includes pozzolana and burned clays or shales (except where directly reported as clay or shale).

[9]Includes diatomite, silica fume, other microcrystalline silica, and other pozzolans, even if not used as such.

[10]Includes fluorspar and all other materials not listed earlier.

[11]Data may not add to totals shown because of independent rounding.

[12]Converted as the weight of foreign clinker consumed times 1.7.

TABLE 7

CLINKER PRODUCED AND FUEL CONSUMED BY THE U.S. CEMENT INDUSTRY, BY KILN PROCESS[1]

	Clinker production[2]			Conventional fuels[3]				Waste fuels[3]		
Kiln process	Number of plants	Quantity (thousand metric tons)	Percentage of total	Coal[4] (thousand metric tons)	Petcoke (thousand metric tons)	Oil[5] (thousand liters)	Natural gas[6] (thousand cubic meters)	Tires (thousand metric tons)	Solid (thousand metric tons)	Liquid (thousand liters)
2008:										
Wet	22	9,930	12.7	1,230	518	24,300	23,200	91	10	370,000
Dry	81	64,664	82.5	6,440	1,610	28,000	218,000	341	335	354,000
Both[7]	3	3,788	4.8	561	--	--	38,900	6	9	67,200
Total[8]	106	78,382	100.0	8,240	2,130	52,300	280,000	438	354	791,000
2009:										
Wet	19	4,866	8.7	569	157	7,310	96,200	50	16	256,000
Dry[9]	81	50,112	89.3	4,690	1,300	26,500	247,000	263	307	493,000
Both[7]	3	1,138	2.0	186	33	1,810	1,190	--	--	34,600
Total[8]	103	56,116	100.0	5,450	1,490	35,600	344,000	313	324	784,000

-- Zero.

[1]Excludes Puerto Rico.

[2]Clinker production data are all reported. Although unrounded, data are thought to be accurate to no more than three significant digits.

[3]All fuel data have been rounded to no more than three significant digits.

[4]Essentially all reported to be bituminous.

[5]Distilliate and residual fuel oils. Excludes used oils that were reported under liquid wastes.

[6]Includes landfill gas and propane.

[7]Plants that can operate both wet and dry kilns, whether or not both types were active during the year. Includes plants that converted from wet to dry technology during the year. For 2009, excludes one plant as noted in footnote 9.

[8]Data may not add to totals shown because of independent rounding.

[9]Includes one plant that operated a dry kiln in 2009 that had wet kilns which, although technically idle all year, were deemed as closed.

TABLE 8

ELECTRICITY CONSUMED BY U.S. CEMENT PLANTS, BY KILN PROCESS[1]

Plant process	Electricity consumed[2]: Generated: Number of plants	Electricity consumed[2]: Generated: Quantity (million kilowatthours)	Electricity consumed[2]: Purchased: Number of plants	Electricity consumed[2]: Purchased: Quantity (million kilowatthours)	Electricity consumed[2]: Total[3]: Number of plants	Electricity consumed[2]: Total[3]: Quantity (million kilowatthours)	Electricity consumed[2]: Total[3]: Percentage of total	Cement produced[4] (thousand metric tons)	Average consumption (kilowatthours per ton of cement produced)
2008:									
Integrated plants:									
Wet	--	--	22	1,530	22	1,530	12.4	10,598	145
Dry	3	236	83 [5]	9,960	83 [5]	10,200	82.9	70,279	145
Both[6]	--	--	3	563	3	563	4.6	3,736	151
Total or average[3]	3	236	108 [5]	12,100	108 [5]	12,300	100.0	84,612	145
Grinding plants[7]	--	--	5	130	5	130	--	1,481	88
Exclusions[8]	--	--	3	XX	3	XX	--	216	XX
2009:									
Integrated plants:									
Wet	--	--	19	815	19	815	8.8	5,804	140
Dry[9]	2	223	83 [5]	8,000	83 [5]	8,210	88.6	55,739	148
Both[6]	--	--	3	222	3	222	2.4	1,334	166
Total or average[3]	2	223	105 [5]	9,030	105 [5]	9,260	100.0	62,877	147
Grinding plants[7]	--	--	5	91	6	91	--	908	99
Exclusions[8]	--	--	3	XX	3	XX	--	143	XX

XX Not applicable. -- Zero.

[1]Excludes Puerto Rico.

[2]Electricity data are rounded to no more than three significant digits because they contain estimates.

[3]Data may not add to totals shown because of independent rounding.

[4]Portland and masonry cement. Data are all reported and are unrounded.

[5]Includes two grinding plants whose data were included with the integrated plants.

[6]Plants that can operate both wet and dry kilns, whether or not both types were active during the year. Includes plants that converted from wet to dry technology during the year. For 2009, excludes one plant as noted in footnote 9.

[7]Plants that did not produce clinker but ground clinker from outside sources. Excludes plants that only made masonry cement or just reground one type of portland cement into another, or which also reported a significant component of grinding of excess granulated blast furnace slag.

[8]Plants whose production of portland cement was by simply regrinding of one type into another, or which reported production only of masonry cement.

[9]Includes one plant that operated a dry kiln in 2009 that had wet kilns which, although technically idle all year, were deemed as closed.

TABLE 9

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement		Masonry cement	
	2008	2009	2008	2009
Destination:				
Alabama	1,559	1,140	122	85
Alaska[3]	148	146	--	--
Arizona	2,778	1,727	44	26
Arkansas	902	732	49	40
California, northern	3,179	2,133	73	45
California, southern	6,189	4,395	238	170
Colorado	2,156	1,403	14	7
Connecticut[3]	640	478	12	11
Delaware[3]	217	159	7	5
District of Columbia[3]	168	129	(4)	(4)
Florida	5,875	3,946	351	231
Georgia	3,112	1,887	235	131
Hawaii[3]	397	306	4	2
Idaho	507	367	1	(4)
Illinois, excluding Chicago	1,656	1,397	13	10
Illinois, metropolitan Chicago[3]	1,636	1,181	31	19
Indiana	1,719	1,454	56	39
Iowa	1,658	1,448	2	1
Kansas	1,430	1,133	10	7
Kentucky	1,085	870	68	49
Louisiana[3]	2,477	2,135	62	49
Maine	239	185	3	2
Maryland	1,223	902	59	42
Massachusetts[3]	919	702	15	11
Michigan	1,858	1,384	59	42
Minnesota[3]	1,374	1,135	13	12
Mississippi	1,063	805	59	40
Missouri	2,079	1,728	26	19
Montana	349	256	1	1
Nebraska	1,134	1,018	3	2
Nevada	1,651	1,008	15	12
New Hampshire[3]	269	198	4	7
New Jersey[3]	1,594	1,152	59	43
New Mexico	709	534	9	7
New York, eastern	573	476	13	10
New York, western[3]	748	652	23	16
New York, metropolitan[3]	1,637	1,304	73	59
North Carolina[3]	2,343	1,612	229	135
North Dakota[3]	391	375	1	1
Ohio	2,817	2,232	99	78
Oklahoma	1,570	1,338	54	39
Oregon	923	663	1	(4)
Pennsylvania, eastern	1,722	1,270	48	37
Pennsylvania, western	1,082	913	42	33
Rhode Island[3]	139	106	2	1
South Carolina	1,242	822	103	70
South Dakota	453	450	1	1
Tennessee	1,692	1,223	164	108
Texas, northern	6,580	4,255	123	79
Texas, southern	7,668	5,344	198	157
Utah	1,313	1,058	(4)	(4)

See footnotes at end of table.

TABLE 9—Continued

CEMENT SHIPMENTS TO FINAL CUSTOMER, BY DESTINATION AND ORIGIN[1, 2]

(Thousand metric tons)

Destination and origin	Portland cement 2008	Portland cement 2009	Masonry cement 2008	Masonry cement 2009
Destination—Continued:				
Vermont[3]	116	95	3	2
Virginia	2,019	1,526	118	80
Washington	2,044	1,437	1	1
West Virginia	504	402	21	14
Wisconsin[3]	1,729	1,410	13	10
Wyoming	497	348	(4)	(4)
Total[5]	93,751	68,885	3,047	2,102
Foreign countries[6]	564	502	(4)	(4)
Puerto Rico	1,397	979	--	(4)
Grand total[5]	95,710	70,366	3,047	2,102
Origin:				
United States	83,178	63,486	2,995	2,070
Foreign countries[7]	11,197	5,948	52	32
Puerto Rico	1,335	932	--	--
Total shipments[5]	95,710	70,366	3,047	2,102

-- Zero.

[1]Includes cement produced from imported clinker and imported cement shipped by domestic producers and importers.

[2]Data are developed from consolidated monthly surveys of shipments by companies and may differ from data in tables 1, 10–12, and 14–15, which are from annual surveys of individual plants and importers. Although presented unrounded, data are thought to be accurate to no more than three significant digits.

[3]Has no cement plants.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Includes shipments to U.S. possessions and territories.

[7]Imported cement sold to final customers in the United States as reported by domestic producers and other importers. Data do not match the imports in tables 17–20.

TABLE 10

SHIPMENTS OF PORTLAND CEMENT IN THE UNITED STATES, BY TYPE OF CARRIER[1, 2]

(Thousand metric tons)

	Plant to terminal		Plant to customer		Terminal to customer		Total to
	In bulk	In bags[3]	In bulk	In bags[3]	In bulk	In bags[3]	customers[4]
2008:							
Railroad	10,700	108	1,870	3	438	2	2,310
Truck	5,350	308	49,000	1,310	39,900	644	90,900
Barge and boat	7,230	3	323	43	37	--	403
Total[4]	23,300	419	51,200	1,360	40,400	647	93,600 [5]
2009:							
Railroad	9,580	8	1,460	2	528	4	2,000
Truck	4,000	116	36,000	1,040	29,400	400	66,900
Barge and boat	7,120	--	55	--	--	--	55
Total[4]	20,700	125	37,500	1,040	30,000	404	69,000 [5]

-- Zero.

[1]Includes imported cement and cement made from imported clinker. Excludes Puerto Rico.

[2]Data are rounded to no more than three significant digits because they contain estimates.

[3]Includes packages, bags, and supersacks.

[4]Data may not add to totals shown because of independent rounding.

[5]Shipments are based on an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 11

PORTLAND CEMENT SHIPPED IN THE UNITED STATES, BY DISTRICT[1]

	2008			2009		
		Value[2]			Value[2]	
District[4]	Quantity[3] (thousand metric tons)	Total (thousands)	Average (per metric ton)	Quantity[3] (thousand metric tons)	Total (thousands)	Average (per metric ton)
Maine and New York	3,820 [5]	$403,000 [5]	$105.50 [5]	2,580 [5]	$250,000 [5]	$97.00 [5]
Pennsylvania, eastern	3,838	382,000 [5]	99.50 [5]	2,995	285,000 [5]	95.00 [5]
Pennsylvania, western	1,248	121,000 [5]	97.00 [5]	949	90,800 [5]	95.50 [5]
Illinois	2,810	279,000 [5]	99.00 [5]	2,014	191,586	95.11
Indiana	2,346	205,153	87.46	1,951	169,069	86.66
Michigan	4,986	508,000 [5]	102.00 [5]	4,114	406,143	98.72
Ohio	733	71,200	97.20	582	55,691	95.69
Iowa, Nebraska, South Dakota	4,366	453,124	103.79	3,382	365,298	108.01
Kansas	2,115	217,519	102.85	1,627	166,000 [5]	102.00 [5]
Missouri	5,058	490,008	96.89	4,219	414,000 [5]	98.00 [5]
Florida	5,763	599,000 [5]	104.00 [5]	3,790 [5]	371,000 [5]	98.00 [5]
Georgia, Virginia, West Virginia	2,299	243,026	105.71	4,141 [6]	367,335 [6]	88.70 [6]
Maryland	2,957	240,275	81.25	W [6]	W [6]	W [6]
South Carolina	2,756	267,411	97.02	1,826	165,160	90.46
Alabama	4,444	432,000 [5]	97.00 [5]	3,515	315,408	89.72
Kentucky, Mississippi, Tennessee	2,673	268,412	100.43	1,885	187,660	99.53
Arkansas and Oklahoma	2,643	262,806	99.44	2,300	231,363	100.60
Texas, northern	7,316	733,000 [5]	100.00 [5]	4,557	453,000 [5]	99.50 [5]
Texas, southern	6,417	645,641	100.61	4,730	452,380	95.65
Arizona and New Mexico	3,106	391,316	125.97	2,173	255,708	117.68
Colorado and Wyoming	2,554	273,303	107.02	1,932	190,508	98.63
Idaho, Montana, Nevada, Utah	2,589	260,250	100.53	2,063	199,834	96.87
Alaska and Hawaii	497	86,882	174.79	406	66,690	164.27
California, northern	2,481	256,000 [5]	103.00 [5]	W [7]	W [7]	W [7]
California, southern	7,540	784,938	104.10	6,835 [7]	618,000 [5, 7]	90.50 [5, 7]
Oregon and Washington	2,196	212,013	96.53	1,651	150,011	90.85
Importers[8]	4,060 [5]	478,000 [5]	117.50 [5]	2,747	315,000 [5]	115.00 [5]
Total or average[9]	93,600 [5, 10]	9,560,000 [5]	102.00 [5]	69,000 [5, 10]	6,730,000 [5]	97.50 [5]
Puerto Rico	1,381	W	W	978 [5]	W	W
Grand total[9]	95,000 [5, 10]	W	W	69,900 [5, 10]	W	W

W Withheld to avoid disclosing company proprietary data.

[1]Includes gray and white portland cement. Includes cement made from imported clinker. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Values are mill net or ex-plant (free on board) valuations of total sales to final customers, including sales from plants' external distribution terminals. The data are ex-terminal for independently reporting terminals. Data include all varieties of portland cement and both bulk and bag shipments. Unless otherwise specified, data are presented unrounded. Unrounded or not, unit value data should be viewed as value indicators, good to no better than the nearest $0.50 or $1.00 per metric ton.

[3]Tonnages are those by reporting entities in the district but may include shipments into other districts. They differ from the data in table 9, which are the actual reported sales into the specific States.

[4]District is the location of the reporting entities, not necessarily the location of sales (see table 9 for sales data, by State). Specific districts include shipments by importers where district assignations were possible.

[5]Data are rounded (unit values to the nearest $0.50) because they include estimates.

[6]For 2009, data for Maryland are included with Georgia, Virginia, West Virginia district.

[7]For 2009, data for Northern California are included with those for Southern California.

[8]Importers for which district assignations were not possible.

[9]Data may not add to totals shown because of independent rounding.

[10]Shipments are based on an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 12

MASONRY CEMENT SHIPPED IN THE UNITED STATES, BY DISTRICT[1, 2]

District[5]	2008 Quantity[4] (thousand metric tons)	2008 Value[3] Total (thousands)	2008 Value[3] Average (per metric ton)	2009 Quantity[4] (thousand metric tons)	2009 Value[3] Total (thousands)	2009 Value[3] Average (per metric ton)
Maine and New York	82	$10,100 [6]	$124.50 [6]	56	$6,265	$112.54
Pennsylvania	241	32,300 [6]	134.00 [6]	187	25,300 [6]	135.00 [6]
Illinois, Indiana, Ohio	335	47,725	142.55	230	33,900 [6]	147.50 [6]
Michigan	136	16,400 [6]	121.00 [6]	95	11,538	121.87
Iowa, Nebraska, South Dakota	19	2,161	114.53	15	1,921	128.09
Kansas and Missouri	84	13,427	159.64	51	6,353	124.50
Florida	282	42,800 [6]	151.50 [6]	192 [6]	29,100 [6]	151.50 [6]
Georgia, Maryland, Virginia, West Virginia	320	57,900 [6]	180.50 [6]	214	36,547	170.78
South Carolina	305	39,409	129.07	169	21,376	126.43
Alabama	353	44,247	125.38	242	29,735	122.90
Kentucky, Mississippi, Tennessee	80	11,784	146.57	57	8,360	146.39
Arkansas and Oklahoma	125	15,070	120.65	93	11,100 [6]	119.00 [6]
Texas, northern	155	26,100 [6]	168.00 [6]	W [7]	W [7]	W [7]
Texas, southern	146	18,300 [6]	125.50 [6]	221 [7]	31,000 [7]	140.40 [7]
Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming	67	9,259	137.47	42	5,387	129.76
Alaska and Hawaii	3	946	279.55	2	620	289.54
California, northern; Oregon; Washington	51	6,511	128.31	W [8]	W [8]	W [8]
California, southern	279	36,213	129.87	232 [6, 8]	27,700 [6, 8]	119.50 [6, 8]
Importers[9]	10 [6]	1,950 [6]	196.00 [6]	6 [6]	1,220 [6]	191.50 [6]
Total or average[10]	3,070 [6, 11]	433,000 [6]	140.50 [6]	2,100 [6, 11]	287,000 [6]	136.50 [6]

W Witheld to avoid disclosing company proprietary data; included in "Total."

[1]Shipments are those by cement companies to final customers and include imported cement and cement made from imported clinker. Sales are those by cement plants and exclude masonry cement made by portland cement customers from purchased portland cement and which was then resold and/or consumed. Data exclude Puerto Rico, which did not record any masonry cement sales. Even where presented unrounded, data are thought to be accurate to no more than three significant digits.

[2]Data include true masonry, plastic, portland-lime, and stucco cements.

[3]Values are mill net or ex-plant (free on board) valuations of total sales to final customers, including sales from plants external distribution terminals. The data are ex-terminal for independently reporting terminals. Data include both bulk and bag shipments. Unless otherwise specified, data are presented unrounded. Unrounded or not, unit value data should be viewed as value indicators, good to no better than the nearest $0.50 or even $1.00 per metric ton.

[4]Tonnages are those by reporting entities in the district but may include shipments into other districts. They differ from the data in table 9, which are the actual reported sales into the specific States.

[5]District is the location of the reporting entities, not necessarily the location of sales (see table 9 for sales data, by State). Specific districts include importers for which district assignations were possible.

[6]Data are rounded (unit values to the nearest $0.50) because they include estimates.

[7]For 2009, data for Northern Texas are included with those for Southern Texas.

[8]For 2009, data for Northern California, Oregon, and Washington are included with those for Southern California.

[9]Importers for which district assignations were not possible.

[10]Data may not add to totals shown because of independent rounding.

[11]Shipments are based on an annual survey of plants and importers; may differ from totals in table 9, which are based on consolidated monthly data.

TABLE 13

AVERAGE MILL NET VALUE OF CEMENT SOLD IN THE UNITED STATES[1, 2]

(Dollars per metric ton)

Year	Portland cement			Masonry cement	All cement
	Gray	White[3]	Total		
2008	101.00	221.50	102.00	141.00	103.50
2009	96.50	211.00	97.50	136.50	99.00

[1]Values are average of sales to final customers, free on board the plant or independently reporting terminal. Values include any bagging charges, but exclude delivery charges to customers or to exterminal terminals. Data exclude Puerto Rico.

[2]Data are rounded to the nearest $0.50 per metric ton because they contain estimates.

[3]Data for white cement include a component of resales showing significant price markups.

TABLE 14

PORTLAND CEMENT SHIPMENTS IN 2009, BY DISTRICT AND TYPE OF CUSTOMER[1]

(Thousand metric tons)

District[2]	Ready-mixed concrete	Concrete product manufacturers	Contractors	Building material dealers	Oil well, mining, waste stabilization	Government and other[3]	Total[4, 5]
Maine and New York	1,930	288	77	220	--	60	2,580
Pennsylvania, eastern	1,750	739	182	206	--	115	2,995
Pennsylvania, western	625	159	113	12	7	32	949
Illinois	1,390	182	164	25	164	91	2,014
Indiana	1,480	254	157	42	6	11	1,951
Michigan	3,300	387	309	80	14	29	4,114
Ohio	442	71	58	10	1	--	582
Iowa, Nebraska, South Dakota	2,520	301	418	32	51	62	3,382
Kansas	1,250	173	96	49	38	19	1,627
Missouri	3,080	390	579	56	64	47	4,219
Florida	2,640	783	261	98	--	6	3,790
Georgia, Maryland, Virginia, West Virginia	2,970	702	231	124	5	106	4,141
South Carolina	1,250	297	116	37	3	123	1,826
Alabama	2,460	458	370	111	15	99	3,515
Kentucky, Mississippi, Tennessee	1,480	220	90	61	23	14	1,885
Arkansas and Oklahoma	1,490	90	530	103	75	16	2,300
Texas, northern	2,870	367	662	114	456	84	4,557
Texas, southern	3,150	441	598	220	315	6	4,730
Arizona and New Mexico	1,680	310	125	38	18	2	2,173
Colorado and Wyoming	1,410	132	170	52	142	28	1,932
Idaho, Montana, Nevada, Utah	1,440	157	137	70	217	43	2,063
Alaska and Hawaii	317	61	9	18	--	--	406
California	4,930	1,150	346	306	89	20	6,835
Oregon and Washington	1,280	186	83	73	24	4	1,651
Importers[6]	2,020	272	258	54	49	99	2,747
Total[5]	49,100	8,570	6,140	2,210	1,780	1,120	69,000
Puerto Rico	504	91	5	377	--	--	978
Grand total[5]	49,700	8,660 [7]	6,150 [8]	2,590	1,780 [9]	1,120	69,900

-- Zero.

[1]Includes imported cement and cement made from imported clinker. Except for district totals, data have been rounded to three significant digits, but are likely accurate to only two significant digits. District totals are likely accurate to no more than three significant digits.

[2]District is the location of the reporting entity, not the location of sales (see table 9 for sales data, by State). Specific districts include shipments by importers for which district assignations were possible.

[3]Includes shipments to miscellaneous customer types and for which customer types were not specified.

[4]District totals are unrounded except in accord with table 11.

[5]Data may not add to totals shown because of independent rounding.

[6]Shipments by importers for which district assignations were not possible.

[7]Grand total shipments to concrete product manufacturers include brick and block—3,090; precast and prestressed—2,330; pipe—929; and other or unspecified—2,300.

[8]Grand total shipments to contractors include airport—156; road paving—2,910; soil cement—1,575; and other or unspecified—1,500.

[9]Grand total shipments include oil well drilling—1,380; mining—228; and waste stabilization—173.

TABLE 15
PORTLAND CEMENT SHIPMENTS IN THE UNITED STATES,
BY TYPE OF CEMENT[1, 2, 3]

(Thousand metric tons)

Type[4]	2008	2009
General use and moderate heat (Types I and II)[5, 6]	73,600	55,000
High early strength (Type III)	3,450	2,460
Sulfate resisting (Type V)[5]	11,800	8,610
Block	509	167
Oil well	1,470	846
White[7]	823	577
Blended:[8]		
Portland, natural pozzolans	38	34
Portland, ground granulated blast furnace slag	981	580
Portland, fly ash	381	357
Portland, other pozzolans[9]	563	325
Total blended[10]	1,960	1,300
Expansive and regulated fast setting	36	13
Miscellaneous[11]	(12)	27
Grand total[10]	93,600	69,000

[1]Includes sales of imported cement. Excludes Puerto Rico.
[2]Data are rounded to no more than three significant digits.
[3]Gray portland-type cements unless otherwise specified.
[4]Sold mostly under specifications ASTM C–150, ASTM C–595, and ASTM C–1157.
[5]Type II/V and similar sulfate-resisting cement hybrids are included within Type V.
[6]Includes ASTM C–1157 general use cements that contain no pozzolans.
[7]White or colored portland-type cements. Most are Types I or II but may include Types III and V and block cements.
[8]Cements sold under ASTM C–590 and those under ASTM C–1157 that contain pozzolans.
[9]Includes blends with cement kiln dust, silica fume, or other pozzolans, and blends containing multiple pozzolans.
[10]Data may not add to totals shown because of independent rounding.
[11]Includes low heat (Type IV), waterproof, and other portland-type cements.
[12]Less than ½ unit.

TABLE 16

U.S. EXPORTS OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

Country	2008 Quantity	2008 Value[2]	2009 Quantity	2009 Value[2]
United States:				
Angola	1	183	2	323
Anguilla	1	42	4	255
Aruba	1	352	2	336
Bahamas	28	3,853	48	5,628
Barbados	1	153	(3)	61
Belize	1	224	36	1,513
Bermuda	16	1,430	(3)	224
Brazil	1	136	(3)	39
Canada	711	82,814	674	79,836
Cayman Islands	3	293	(3)	95
China	1	354	(3)	133
Colombia	1	675	1	680
Costa Rica	1	89	(3)	19
Dominica	--	--	1	12
Dominican Republic	3	322	2	219
Greece	7	352	15	729
Haiti	10	726	1	62
Hong Kong	(3)	98	1	326
Ireland	(3)	101	4	225
Jamaica	(3)	25	26	2,737
Japan	(3)	26	1	225
Mexico	23	4,540	23	5,915
Netherlands Antilles	1	187	1	196
Nicaragua	1	414	(3)	3
Niger	2	114	--	--
Pakistan	(3)	3	1	43
Panama	3	413	28	3,794
Peru	1	255	1	198
Russia	(3)	8	1	47
Saudi Arabia	1	259	1	844
St. Christopher and Nevis	(3)	133	2	102
Sweden	1	90	1	77
Taiwan	1	366	(3)	149
Turks and Caicos Islands	1	267	(3)	55
Other	5 r	3,169 r	5	2,230
Total[4]	823	102,466	884	107,330
Puerto Rico:				
Anguilla	12	846	--	--
British Virgin Islands	13	1,778	15	1,807
Netherlands Antilles	1	332	(3)	5
Turks and Caicos Islands	8	545	1	152
Other	1 r	131 r	(3)	30
Total[4]	34	3,631	16	1,994
Grand total[4]	858	106,097	900	109,323

[r]Revised. -- Zero.

[1]Includes portland and masonry cements.

[2]Free alongside ship value. The value of exports at the U.S. seaport or border point of export is based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier. The value excludes the cost of loading.

[3]Less than ½ unit.

[4]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 17
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT AND CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Algeria	4	316	520	14	1,576	2,123
Brazil	36	2,780	3,225	--	--	--
Canada	4,104	338,225	356,325	3,426	272,829	291,298
China	2,020	103,055	164,401	608	35,251	50,161
Colombia	964	67,117	90,608	654	39,799	56,216
Croatia	34	10,048	13,061	15	5,687	6,890
Denmark	99	9,768	14,898	69	9,924	12,302
Dominican Republic	11	786	1,082	4	307	381
Egypt	57	4,873	7,331	55	6,345	7,965
France	108	22,266	24,999	65	20,373	21,607
Germany	1	464	564	(4)	265	340
Greece	213	11,717	18,514	186	10,705	12,429
India	1	98	153	1	151	209
Japan	6	773	1,038	1	523	654
Korea, Republic of	1,229	50,550	85,899	855	34,694	56,700
Mexico	1,071	84,714	99,673	366	35,342	39,132
Netherlands	4	3,894	4,800	2	1,925	2,539
Norway	20	897	897	--	--	--
Peru	92	4,727	7,509	--	--	--
Sweden	261	13,192	24,583	74	3,821	7,074
Taiwan	855	36,424	55,867	254	11,332	16,677
Thailand	77	5,165	7,909	21	2,594	3,801
Turkey	96	5,257	12,201	95	7,858	12,220
United Kingdom	4	1,712	2,076	1	153	281
Other	(4) r	69 r	74 r	(4)	138	148
Total[5]	11,365	778,888	998,208	6,767	501,592	601,148
Puerto Rico:						
China	78	3,270	5,701	(4)	5	7
Colombia	4	529	665	5	674	862
Korea, Republic of	54	3,861	5,812	27	1,350	2,322
Mexico	17	1,981	2,808	14	1,641	2,216
Spain	(4)	25	33	81	5,694	7,064
Other	(4)	14 r	18 r	(4)	169	174
Total[5]	153	9,681	15,037	127	9,532	12,645
Grand total[5]	11,519	788,569	1,013,244	6,894	511,125	613,793

[r]Revised. -- Zero.

[1]Includes portland, masonry, and other hydraulic cements.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 18
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Anchorage, AK:						
Canada	7	419	1,479	9	745	2,267
China	1	98	106	15	1,036	1,561
Japan	5	187	282	--	--	--
Korea, Republic of	102	4,471	8,689	72	3,165	5,658
Taiwan	--	--	--	16	1,047	1,066
Total[4]	114	5,175	10,556	112	5,994	10,552
Baltimore, MD:						
Germany	(5)	13	15	--	--	--
Netherlands	(5)	229	259	(5)	42	48
United Kingdom	--	--	--	(5)	20	21
Total[4]	(5)	242	274	(5)	62	70
Boston, MA, Canada	45	2,537	4,584	77	4,196	6,824
Buffalo, NY:						
Canada	707	57,564	60,681	574	48,103	52,028
France	(5)	60	61	--	--	--
Germany	(5)	3	3	--	--	--
Japan	--	--	--	(5)	13	13
Total[4]	708	57,627	60,744	574	48,116	52,041
Charleston, SC:						
China	--	--	--	(5)	5	9
Germany	--	--	--	(5)	12	13
Netherlands	--	--	--	(5)	41	47
Total[4]	--	--	--	(5)	59	70
Chicago, IL:						
Croatia	(5)	38	53	--	--	--
Denmark	(5)	15	16	--	--	--
France	(5)	3	25	--	--	--
Germany	(5)	2	3	--	--	--
Japan	(5)	220	259	(5)	107	117
Netherlands	(5)	231	296	(5)	92	141
Poland	(5)	41	44	(5)	19	22
Total[4]	1	551	696	(5)	218	280
Cleveland, OH:						
Canada	485	40,608	41,506	493	34,399	36,894
China	(5)	13	17	--	--	--
Croatia	1	261	354	--	--	--
Netherlands	(5)	37	57	(5)	137	158
Poland	--	--	--	(5)	21	24
Total[4]	485	40,919	41,935	494	34,558	37,077
Columbia-Snake, OR-WA						
Canada	135	8,012	8,756	55	4,256	4,503
China	653	26,857	44,713	237	13,016	19,757
Thailand	(5)	2	4	--	--	--
Total[4]	788	34,872	53,473	292	17,272	24,259

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

Customs district and country	2008			2009		
		Value			Value	
	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Dallas, Fort Worth, TX:						
Italy	(5)	3	4	--	--	--
Netherlands	--	--	--	(5)	34	95
Total[4]	(5)	3	4	(5)	34	95
Detroit, MI:						
Canada	837	76,193	77,285	841	66,897	68,458
China	--	--	--	(5)	41	42
Germany	(5)	5	5	--	--	--
Netherlands	(5)	260	356	(5)	60	100
Total[4]	838	76,457	77,645	841	66,998	68,600
El Paso, TX, Mexico	384	31,680	35,277	275	23,449	25,875
Great Falls, MT:						
Canada	9	468 r	503	(5)	20	21
China	(5)	24 r	32	(5)	143	171
Germany	(5)	13	21	--	--	--
Japan	--	--	--	(5)	2	2
United Kingdom	--	--	--	(5)	23	33
Total[4]	9	505 r	556	(5)	189	227
Honolulu, HI:						
China	10	705	1,597	(5)	14	47
Korea, Republic of	--	--	--	84	3,569	7,329
Taiwan	373	16,848	25,388	188	8,281	12,233
Thailand	(5)	3	6	3	188	552
Total[4]	383	17,556	26,991	276	12,052	20,160
Houston-Galveston, TX:						
Algeria	1	94	122	6	728	1,022
China	93	4,219	6,940	2	186	274
Colombia	403	30,692	39,484	235	14,822	20,624
Croatia	(5)	11	12	--	--	--
Denmark	--	--	--	(5)	3	3
Egypt	22	1,892	2,774	28	3,230	3,988
France	(5)	69	79	(5)	44	50
Germany	(5)	109	133	(5)	78	93
Korea, Republic of	799	31,413	51,352	472	19,219	30,821
Sweden	108	6,076	8,957	--	--	--
Taiwan	449	16,972	27,229	49	1,968	3,198
Turkey	1	58	89	--	--	--
Total[4]	1,876	91,605	137,171	793	40,278	60,074
Laredo, TX, Mexico	133	15,994	16,939	85	11,467	12,646
Los Angeles, CA:						
Algeria	2	179	328	--	--	--
China	505	23,241	42,027	21	2,408	2,876
Colombia	(5)	28	43	--	--	--

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Los Angeles, CA—Continued:						
Croatia	(5)	109	180	(5)	220	273
Egypt	11	964	1,667	1	68	72
Germany	(5)	188	206	(5)	53	72
India	--	--	--	(5)	24	25
Japan	(5)	36	51	--	--	--
Lithuania	(5)	13	13	(5)	26	28
Thailand	19	2,285	3,521	12	1,629	2,202
United Kingdom	(5)	12	12	(5)	80	194
Total[4]	538	27,055	48,048	35	4,508	5,741
Miami, FL:						
Algeria	1	43	70	7	848	1,101
China	(5)	23	36	(5)	41	73
Colombia	11	1,464	1,837	6	790	997
Denmark	3	414	529	--	--	--
Egypt	23	1,971	2,811	19	2,197	2,807
Italy	(5)	2	2	--	--	--
Mexico	98	9,869	12,580	5	410	590
Sweden	239	10,596	20,770	73	3,270	6,455
Turkey	--	--	--	74	6,618	9,585
Total[4]	375	24,382	38,636	185	14,174	21,609
Minneapolis, MN:						
Canada	154	17,524	17,541	113	12,105	12,117
China	--	--	--	(5)	15	15
Denmark	(5)	6	6	--	--	--
United Kingdom	(5)	11	11	(5)	15	15
Total[4]	154	17,541	17,558	113	12,136	12,148
Mobile, AL, Mexico	--	--	--	(5)	7	12
New Orleans, LA:						
China	26	5,076	6,461	5	1,062	1,269
Croatia	27	7,929	9,887	15	5,410	6,542
Korea, Republic of	45	1,506	2,412	34	1,273	1,961
Peru	62	3,205	4,652	--	--	--
Taiwan	--	--	--	1	36	180
Turkey	95	5,199	12,112	21	1,240	2,634
Total[4]	256	22,915	35,525	75	9,021	12,586
New York, NY:						
Colombia	16	777	1,650	(5)	68	116
Croatia	(5)	9	11	(5)	57	75
Denmark	38	4,440	6,564	24	2,804	3,655
France	--	--	--	3	107	110
Germany	(5)	14	19	(5)	22	23

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
New York, NY—Continued:						
Greece	213	11,717	18,514	186	10,705	12,429
Netherlands	(5)	336	398	(5)	79	105
Norway	20	897	897	--	--	--
Portugal	--	--	--	(5)	34	35
Sweden	3	1,670	1,856	--	--	--
United Kingdom	(5)	41	72	--	--	--
Total[4]	291	19,902	29,982	214	13,876	16,550
Nogales, AZ, Mexico	348	21,095	25,919	(5)	9	10
Norfolk, VA:						
Canada	113	8,044	8,940	53	5,003	5,373
China	(5)	9	11	--	--	--
Egypt	--	--	--	3	389	482
France	108	22,121	24,818	63	20,222	21,447
Germany	(5)	14	17	--	--	--
Netherlands	(5)	353	464	(5)	34	39
Sweden	(5)	79	89	1	551	619
United Kingdom	4	1,647	1,980	--	--	--
Total[4]	225	32,267	36,319	120	26,198	27,961
Ogdensburg, NY:						
Canada	399	41,749	42,237	248	23,489	23,989
Germany	--	--	--	(5)	3	3
South Africa	--	--	--	(5)	2	2
Total[4]	399	41,749	42,237	248	23,494	23,994
Pembina, ND						
Canada	173	10,174	10,293	162	12,370	12,455
France	(5)	5	5	--	--	--
Total[4]	173	10,179	10,298	162	12,370	12,455
Philadelphia, PA:						
Belgium	(5)	6	7	(5)	5	5
China	(5)	33	33	--	--	--
Germany	(5)	104	143	(5)	92	131
Korea, Republic of	137	5,032	11,590	139	4,988	7,063
Netherlands	1	1,275	1,463	1	814	937
Thailand	48	1,629	2,379	--	--	--
United Kingdom	--	--	--	(5)	14	17
Total[4]	187	8,079	15,616	140	5,913	8,153
Portland, ME, Canada	75	9,765	10,410	37	4,469	4,954
Providence, RI:						
Canada	80	4,572	8,488	62	4,069	6,273

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

Customs district and country	2008 Quantity	2008 Value Customs[2]	2008 Value C.i.f.[3]	2009 Quantity	2009 Value Customs[2]	2009 Value C.i.f.[3]
United States—Continued:						
Providence, RI—Continued:						
Colombia	48	2,502	3,909	--	--	--
Peru	29	1,522	2,857	--	--	--
Total[4]	158	8,596	15,253	62	4,069	6,273
San Diego, CA, Taiwan	13	515	517	--	--	--
San Francisco, CA:						
China	370	16,786	27,248	211	10,114	13,216
Egypt	1	46	79	1	108	173
France	(5)	9	12	--	--	--
India	1	98	153	1	127	184
Netherlands	(5)	18	37	--	--	--
Taiwan	20	1,036	1,679	--	--	--
Thailand	9	1,150	1,806	6	777	1,047
Total[4]	400	19,143	31,013	219	11,126	14,620
Savannah, GA:						
China	(5)	10	12	--	--	--
Colombia	258	17,005	23,652	221	12,861	18,609
Egypt	--	--	--	3	354	443
Japan	--	--	--	(5)	2	2
Netherlands	1	537	713	(5)	223	364
Portugal	--	--	--	(5)	31	31
Thailand	1	96	194	--	--	--
Total[4]	259	17,649	24,570	224	13,471	19,450
Seattle, WA:						
Canada	757	45,848	48,079	611	42,802	44,572
China	362	25,961	35,167	117	7,158	10,833
Japan	1	331	447	1	398	519
Korea, Republic of	123	6,170	9,308	54	2,480	3,869
Netherlands	(5)	188	257	(5)	40	61
Taiwan	(5)	1,053	1,055	--	--	--
Total[4]	1,243	79,551	94,312	783	52,879	59,853
St. Albans, VT:						
Canada	126	14,748	15,543	89	9,904	10,571
Germany	--	--	--	(5)	4	4
Total[4]	126	14,748	15,543	89	9,907	10,575
St. Louis, MO:						
China	--	--	--	(5)	11	18
Croatia	6	1,690	2,564	--	--	--
Netherlands	(5)	430	500	(5)	329	442
Total[4]	6	2,120	3,064	(5)	340	459

See footnotes at end of table.

TABLE 18—Continued
U.S. IMPORTS FOR CONSUMPTION OF HYDRAULIC CEMENT
AND CLINKER, BY CUSTOMS DISTRICT AND COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Customs district and country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States—Continued:						
Tampa, FL:						
Brazil	36	2,780	3,225	--	--	--
Colombia	39	2,103	2,865	58	3,225	4,557
Denmark	58	4,893	7,782	45	7,117	8,644
Korea, Republic of	24	1,958	2,548	--	--	--
Spain	(5)	4	4	--	--	--
Sweden	19	847	1,868	--	--	--
Total[4]	175	12,584	18,292	103	10,342	13,201
U.S. Virgin Islands:						
Colombia	2	213	219	--	--	--
Dominican Republic	11	786	1,082	4	307	381
Total[4]	13	998	1,300	4	307	381
Wilmington, NC, Colombia	186	12,333	16,952	134	8,033	11,313
U.S. total[4]	11,365	778,888	998,208	6,767	501,592	601,148
Puerto Rico (San Juan):						
China	78	3,270	5,701	(5)	5	7
Colombia	4	529	665	5	674	862
Dominican Republic	--	--	--	(5)	169	174
Korea, Republic of	54	3,861	5,812	27	1,350	2,322
Mexico	17	1,981	2,808	14	1,641	2,216
Peru	(5)	14	18	--	--	--
Spain	(5)	25	33	81	5,694	7,064
Total[4]	153	9,681	15,037	127	9,532	12,645
Grand total[4]	11,519	788,569	1,013,244	6,894	511,125	613,793

[r]Revised. -- Zero.

[1]Includes all varieties of hydraulic cement and clicker.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Data may not add to totals shown because of independent rounding.

[5]Less than ½ unit.

Source: U.S. Census Bureau.

TABLE 19
U.S. IMPORTS FOR CONSUMPTION OF GRAY PORTLAND CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Country	Quantity	Customs[1]	C.i.f.[2]	Quantity	Customs[1]	C.i.f.[2]
United States:						
Brazil	36	2,780	3,225	--	--	--
Canada	3,294	259,073	275,818	2,642	205,197	222,340
China	1,906	81,907	137,987	573	30,463	44,369
Colombia	891	60,180	81,614	636	37,333	52,800
Dominican	11	786	1,082	4	307	381
France	(3)	27	34	3	107	110
Greece	213	11,717	18,514	186	10,705	12,429
Japan	5	187	282	(3)	5	5
Korea, Republic of	1,227	50,410	85,539	854	34,641	56,563
Mexico	744	45,002	55,076	185	11,770	13,305
Norway	20	897	897	--	--	--
Peru	92	4,727	7,509	--	--	--
Sweden	257	11,443	22,638	73	3,270	6,455
Taiwan	855	35,371	54,813	254	11,332	16,677
Thailand	48	1,629	2,379	3	188	552
United Kingdom	1	65	96	(3)	46	50
Other	(3) r	106 r	126 r	(3)	164	269
Total[4, 5]	9,599	566,307	747,629	5,414	345,529	426,307
Puerto Rico:						
China	78	3,270	5,701	--	--	--
Korea, Republic of	54	3,861	5,812	27	1,350	2,322
Spain	(3)	6	8	81	5,694	7,064
Total[4, 5]	132	7,137	11,521	108	7,044	9,386
Grand total[4, 5]	9,731	573,443	759,150	5,521	352,572	435,693

[r]Revised. -- Zero.

[1]The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[3]Less than ½ unit.

[4]Data may not add to totals shown because of independent rounding.

[5]Total imports do not include gray portland cement that was misregistered by importers under the white cement tariff code and which has been included in table 20.

Source: U.S. Census Bureau.

TABLE 20

U.S. IMPORTS FOR CONSUMPTION OF WHITE CEMENT, BY COUNTRY

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Country	Quantity	Customs[1]	C.i.f.[2, 3]	Quantity	Customs[1]	C.i.f.[2, 3]
United States:						
Algeria	4	316	520	14	1,576	2,123
Canada	296	40,213	41,086	251	33,932	34,681
China	88	15,869	19,697	29	3,396	4,125
Colombia	58	6,491	8,276	18	2,466	3,415
Denmark	99	9,747	14,875	69	9,921	12,300
Egypt	55	4,724	7,087	53	6,028	7,628
India	1	98	153	1	130	178
Korea, Republic of	2	140	360	2	53	137
Mexico	237	29,222	32,871	113	15,822	17,357
Thailand	29	3,536	5,530	18	2,406	3,249
Turkey	96	5,257	12,201	95	7,858	12,220
United Kingdom	--	--	--	1	99	219
Other	(4) r	1,056 r	1,058 r	(4)	7	7
Total[5]	964 [6]	116,669	143,715	664 [6]	83,693	97,638
Puerto Rico:						
Colombia	4	529	665	5	674	862
Mexico	17	1,981	2,808	14	1,641	2,216
Other	(4) r	14 r	18 r	--	--	--
Total[5]	21	2,525	3,491	19	2,315	3,078
Grand total[5]	985 [6]	119,194	147,206	683 [6]	86,008	100,715

[r]Revised. -- Zero.

[1]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing the merchandise to the United States.

[2]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[3]Values of less than $90.00 (c.i.f.) per metric ton likely indicate the mistaken total or partial inclusion of data for gray portland or similar cement or clinker. This error happens when the importer records the wrong tariff number with the U.S. Customs Service. Values that exceed $200 per ton likely indicate misidentified specialty cement, not white cement.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

[6]Total imports of white cement include substantial quantities of gray cement that were misregistered by importers under the white cement tariff code.

Source: U.S. Census Bureau.

TABLE 21

U.S. IMPORTS FOR CONSUMPTION OF CLINKER, BY COUNTRY[1]

(Thousand metric tons and thousand dollars)

	2008			2009		
		Value			Value	
Country	Quantity	Customs[2]	C.i.f.[3]	Quantity	Customs[2]	C.i.f.[3]
United States:						
Canada	477	35,048	35,310	489	30,192	30,459
China	19	3,414	4,285	3	709	855
Colombia	16	446	718	--	--	--
Egypt	2	149	244	3	318	337
France	107	20,976	23,550	62	19,571	20,732
Other	(4)	21	33	--	--	--
Total[5]	621	60,054	64,141	556	50,789	52,383

-- Zero.

[1]For all types of hydraulic cement.

[2]Customs value. The price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance, and other charges incurred in bringing in the merchandise to the United States.

[3]Cost, insurance, and freight. The import value represents the customs value plus insurance, freight, and other delivery charges to the first port of entry.

[4]Less than ½ unit.

[5]Data may not add to totals shown because of independent rounding.

Source: U.S. Census Bureau.

TABLE 22

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2005	2006	2007	2008	2009[e]
Afghanistan[e]	60	50	50	50	50
Albania	489	525	889	737 [r]	740
Algeria	12,800	14,702	15,886	17,398 [r]	18,000
Angola	1,315	1,373	1,400 [e]	1,780 [r]	1,800
Argentina	7,595	8,929	9,602	9,703	10,000
Armenia	605	625	722	770	750
Australia[e]	8,475 [r, 3]	9,000	9,500 [r]	9,000 [r]	8,500
Austria	4,560	4,852	5,203	5,309	4,600
Azerbaijan	1,538	1,622	1,691 [r]	1,595 [r]	1,283 [3]
Bahrain	400	400	400	438 [r]	800
Bangladesh[e]	5,100	5,100	5,100	5,000	5,000
Barbados	341	338	294	300 [e]	300
Belarus	3,131	3,495	3,820 [e]	4,219	4,350 [3]
Belgium	7,594	8,192	8,200 [e]	8,200 [e]	8,200
Benin[e]	250	1,489 [3]	1,550 [3]	1,500 [r]	1,500
Bhutan[e]	170	180	180	180 [r]	180
Bolivia	1,440	1,636	1,739	1,985 [r]	2,292 [3]
Bosnia and Herzegovina	1,026	1,226	1,283	1,406	1,074 [3]
Brazil	38,705 [r]	41,895 [r]	46,551 [r]	51,970 [r]	51,748 [p, 3]
Brunei[e]	266 [3]	240	200	240 [r]	220
Bulgaria	3,618	4,093	4,413	4,903 [r]	2,662 [3]
Burkina Faso[e]	30	30	30	30	30
Burma[4]	543	570	608	676	670 [3]
Cambodia	--	--	87	772 [r]	774 [3]
Cameroon[e]	1,000	1,000	1,000	1,000	1,000
Canada	14,179	14,336	15,078	13,672	10,985 [3]
Chile	3,999	4,112	4,440	4,622	3,876 [3]
China	1,068,850	1,236,770	1,361,170	1,400,000 [r]	1,629,000 [p, 3]
Colombia	9,959	10,038 [5]	11,068 [5]	10,456 [5]	10,000
Congo (Brazzaville)[e]	100 [3]	100	100	100 [r]	100
Congo (Kinshasa)	521 [r]	519 [r]	530 [r]	411 [r]	444 [3]
Costa Rica	2,000 [r, e]	1,900 [r]	2,300 [r]	2,500 [r]	2,500
Côte d'Ivoire[e]	650	650	650	650	650
Croatia	3,481	3,598	3,587 [r]	3,637 [r]	2,800
Cuba	1,567	1,705	1,805	1,707 [r]	1,700
Cyprus	1,805	1,786	1,873	1,870 [e]	1,800
Czech Republic	3,978	4,239	4,899	4,710 [r]	3,637 [3]
Denmark	2,120	2,115	2,100 [e]	2,100 [e]	2,000
Dominican Republic	2,779	3,777	4,100 [e]	4,000 [e]	3,000
Ecuador	3,690	4,110	4,420	5,493 [r]	5,000
Egypt	32,458	36,200	38,400	40,000 [e]	46,500
El Salvador	1,131	1,311	1,300 [e]	1,300 [e]	1,300
Eritrea[e]	45	45	45	45	45
Estonia	726	849	937	808	326 [3]
Ethiopia	1,569	1,731 [r]	1,626 [r]	1,834 [r]	2,300
Fiji[e]	143 [3]	143	145	143	110
Finland	1,357	1,685	1,743	1,745	1,750
France	21,277	22,540	22,300 [e]	21,700	18,300
French Guiana[e]	60	60	60	62	62
Gabon[e]	260	260	229 [3]	230	230
Georgia[e]	450	450	450	450	450

See footnotes at end of table.

TABLE 22—Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2005	2006	2007	2008	2009[e]
Germany	31,009	33,630	33,382	33,581	30,441 [3]
Ghana[e]	1,800 [r]	1,800 [r]	1,800 [r]	1,800 [r]	1,800
Greece	15,166	15,674	16,667	16,500 [e]	16,000
Guadeloupe[e]	240	230	230	230	230
Guatemala[e]	2,400	2,500	2,500	2,500	1,500
Guinea[e]	-- [r]	-- [r]	-- [r]	-- [r]	--
Haiti[e]	300	300	300	300	300
Honduras[e]	1,384 [3]	1,800	1,800	1,800	1,800
Hong Kong[e]	1,005 [3]	1,010	1,000	1,000	1,000
Hungary	3,371	3,724	3,552	3,544	3,200
Iceland	132	141	90 [e]	100 [e]	100
India[e]	145,000	160,000	170,000	185,000 [r]	205,000
Indonesia[e]	33,917 [3]	35,000	36,000	36,000 [r]	40,000
Iran[e]	32,650 [3]	35,300	41,000 [r]	44,400 [3]	50,000
Iraq[e]	3,000	3,500	4,500	6,453 [r, 3]	8,000
Ireland	5,083	4,981	5,000	5,000 [e]	5,000
Israel	5,093	5,089	5,000 [e]	4,819 [r]	4,759 [3]
Italy	40,284	47,814	47,542	43,030	36,317 [3]
Jamaica	845	761	592	725 [r]	700
Japan	69,629	69,942	67,685	62,810	54,800 [3]
Jordan	4,046	3,967	4,051	4,375 [r]	5,000
Kazakhstan	3,975	4,880	5,699	5,223	5,000
Kenya	2,123	2,174	2,546	2,829 [r]	3,320 [3]
Korea, North[e]	5,700	6,160	6,130	6,415 [r, 3]	6,400
Korea, Republic of	51,391	53,971	52,182 [r]	51,653 [r]	50,127 [3]
Kosovo[6]	450	450 [e]	470	590	600
Kuwait[e]	2,145 [3]	2,200	2,200	2,200	2,000
Kyrgyzstan	973 [r]	1,060 [r]	1,230 [r]	1,218 [r]	1,100
Laos[e]	250	400	400	400	400
Latvia[e]	280	280	300	310	300
Lebanon	4,600	4,400	4,900 [e]	5,000 [e]	5,000
Liberia	144	155	157	94 [r]	95
Libya	3,621	5,300 [e]	5,206	5,509 [r]	6,000
Lithuania	832	1,065	1,105	1,100 [e]	1,100
Luxembourg[e]	760 [3]	800	780	780	780
Macedonia	887 [r]	924 [r]	945 [r]	916 [r]	909 [3]
Madagascar[e]	150	150	270 [3]	270	240
Malawi	166	188	185	240 [e]	240
Malaysia	17,860	18,400 [e]	19,480	19,000 [r, e]	18,500
Martinique[e]	220	220	220	220	220
Mauritania	300 [e]	374	410	446 [r]	500
Mexico	37,452	40,362	40,670	47,609	35,160 [3]
Moldova	641	837	800 [e]	750 [e]	700
Mongolia	112	141	180 [r]	269 [r]	140
Morocco[e]	11,000	11,000	11,000	11,000	12,000
Mozambique[e]	490	600	800	730	830
Nepal[e, 4]	290	295	300	295 [r]	300
Netherlands	2,496	2,790	2,700 [e]	2,700 [e]	2,700
New Caledonia	119	133	134 [e]	134 [e]	130
New Zealand[e]	1,100	1,120 [3]	1,100	1,100	1,100
Nicaragua[e]	530 [3]	530	530	530	530

See footnotes at end of table.

TABLE 22—Continued

HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2005	2006	2007	2008	2009[e]
Niger[e]	59 [r]	83 [r]	62 [r]	42 [r]	40
Nigeria[e]	2,700	3,300	4,700	5,000	4,500
Norway	1,613	1,695	1,700 [e]	1,700 [e]	1,650
Oman	2,686	3,611	3,880	3,991 [r]	4,000
Pakistan[e]	17,000	20,652 [3]	27,000 [r]	31,000 [r]	32,000
Panama[e]	1,050 [3]	1,050	1,050	1,050	1,050
Paraguay[e]	550	600	600	600	600
Peru	5,107	5,782	6,231	6,922	6,862 [3]
Philippines	15,494	12,033	13,048	13,369 [r]	14,865 [3]
Poland	12,646	14,688	17,120	17,207	15,537 [3]
Portugal	8,438	8,340	12,631	12,650 [r]	12,700
Qatar	1,500	1,568	2,500 [e]	3,500 [e]	4,150
Réunion[e]	380	400	400	400	375
Romania	7,032	8,253	10,000 [r, e]	11,000 [r, e]	7,800
Russia	48,500	54,700	59,900	53,600	44,300 [3]
Rwanda	101	103	103	103 [r]	100
Saudi Arabia	26,064	27,056	30,369	31,823	40,000
Senegal	2,623	2,884	3,152	3,084 [r]	3,000
Serbia[7]	2,276 [8]	2,565	2,677	2,843	2,232 [3]
Sierra Leone	172	234	236	254 [r]	250
Slovakia	3,499	3,593	3,718	4,157	3,011 [3]
Slovenia	1,114	1,269	1,300 [e]	1,300 [e]	1,000
South Africa, sales[9]	11,464	12,658	13,651	13,341	11,500
Spain, including Canary Islands	50,347	54,033	54,720	42,088	29,505 [3]
Sri Lanka[e]	1,500	1,600	1,700	1,800	1,900
Sudan	331	202	326	370 [r, e]	1,000
Suriname[e]	65	65	65	65	65
Sweden	2,709	2,952	2,950	2,900 [e]	2,950
Switzerland	4,022	4,040	4,000 [e]	4,000 [e]	4,000
Syria	4,700 [e]	4,804	5,104	5,336	5,605 [3]
Taiwan	19,891	19,294	18,957	17,330	15,918 [3]
Tajikistan	253	282	313	190 [r]	190
Tanzania	1,366	1,370 [r]	1,630 [r]	1,756 [r]	1,700
Thailand	37,872	39,408	35,668	31,651 [r]	31,181 [3]
Togo[e]	800	800	800	800	800
Trinidad and Tobago	686	883	1,992 [r]	958 [r]	950
Tunisia	6,691	6,932	7,052	7,559	8,000
Turkey	42,787	47,499	49,553	54,027 [r]	53,973 [3]
Turkmenistan[e]	650	800	900	900	900
Uganda[e]	630	630	650	650	650
Ukraine	12,183	13,732	15,000	14,918	9,496 [3]
United Arab Emirates[e]	10,000 [r]	11,000 [r]	12,000 [r]	13,200 [r]	16,000
United Kingdom	11,216	11,471 [r]	11,887 [r]	10,071 [r]	7,622 [3]
United States, including Puerto Rico[10]	100,903	99,712	96,850	87,610	64,864 [3]
Uruguay[e]	620	620	620	620	620
Uzbekistan	5,068	5,700 [e]	6,500	6,600 [e]	6,600
Venezuela[e]	5,800	7,200	9,000	9,000	9,000
Vietnam	30,808	32,690	37,102 [r]	40,009 [r]	47,900
Yemen	1,550	1,470	1,728	3,000 [e]	4,000
Zambia[e]	435	650	650	700	600

See footnotes at end of table.

TABLE 22—Continued
HYDRAULIC CEMENT: WORLD PRODUCTION, BY COUNTRY[1, 2]

(Thousand metric tons)

Country	2005	2006	2007	2008	2009[e]
Zimbabwe[e]	600	700	400	400	300
Total	2,350,000	2,610,000	2,810,000	2,850,000 [r]	3,040,000

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. Even where presented unrounded, reported data are thought to be accurate to no more than three significant digits. Data are from a variety of sources, including the European Cement Association.

[2]Table includes data available through July 23, 2010. Data may include clinker exports for some countries.

[3]Reported figure.

[4]Data are for fiscal year ending March 31 of the following year.

[5]Data for 2006–08 are for gray cement only; white cement output was likely to have been an additional 50,000 to 100,000 tons per year.

[6]Not included in Serbia data.

[7]Excludes Kosovo data.

[8]Montenegro and Serbia formally declared independence in June 2006 from each other and dissolved their union. Montenegro has no cement plants.

[9]Data have been adjusted to remove sales of cementitious materials other than finished cement. Material sales removed (mostly fly ash and ground granulated blast furnace slag) amounted, in metric tons, to: 2005—1,511,716; 2006—1,599,505; 2007—1,664,304; 2008—1,395,124; and 2009—1,200,000 (estimated).

[10]Portland and masonry cements only.

UPDATE OF MINERAL LAND CLASSIFICATION: AGGREGATE MATERIALS IN THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION

BY

Susan Kohler-Antablin

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1996

CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
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Designated Areas Update, Regionally Significant Aggregate Resource Areas in the South San Francisco Bay Production-Consumption Region

EXECUTIVE SUMMARY

This report updates information presented in a classification study on construction aggregate in the South San Francisco Bay Production-Consumption (P-C) Region completed in 1983. Results of that study were published by the Department of Conservation's Division of Mines and Geology (DMG) as Special Report 146 - Mineral Land Classification: Aggregate Materials in the San Francisco-Monterey Bay Area, Part II South San Francisco Bay Production-Consumption Region (Stinson, Manson, and Plappert, 1987). Special Report 146 included the urban and urbanizing parts of Alameda, Contra Costa, San Francisco, San Mateo, and northern Santa Clara counties as a single P-C region.

All sand and gravel as well as stone deposits having material suitable for class III sub-base or above were classified in this study. For the purposes of discussion, aggregate meeting such specifications will be referred to as construction-grade aggregate. Construction-grade aggregate includes four basic types of aggregate which must meet specific standards. These are from highest quality standards to lowest: 1) portland cement concrete (PCC) aggregate, 2) asphaltic aggregate, 3) base, and 4) subbase. Subbase is divided into five classes. The lowest two categories, class IV and V, are considered types of fill and were not considered in the classification process because of their general abundance throughout the South San Francisco Bay P-C Region.

Data contained within this update were current as of January 1996, with the exception of the figures related to annual aggregate production--which are complete only to December 1994. In this case, the 1994 data are the most recent available from the U.S. Geological Survey.

Updated information for this report pertaining to classification is shown on Plate 1, a generalized classification map and Plates 2-7, revised Mineral Land Classification Maps. Plates 8-29 show updated information on areas designated by the State Mining and Geology Board (SMGB).

The only actions required of local lead agencies by this report are that the County of Alameda must incorporate the reclassification information on Plates 3 and 4 (Revised Mineral Land Classification Maps of the Niles, and La Costa Valley quadrangles) into their general plans; the Cities of Newark and Fremont must incorporate the reclassification information on Plates 2, 3, 5, and 6 (Revised Mineral Land Classification Maps of the Newark, Niles, Mountain View, and Milpitas quadrangles) into their general plans; and the classification information on Plate 7 (Revised Mineral Land Classification Map of the Mindego

Hill Quadrangle) must be incorporated into San Mateo County's general plan.

Based on this update study and assuming that the consumption forecast is accurate, the following conclusions were reached:

- The 676 million tons of presently permitted construction-grade aggregate resources (reserves) within the South San Francisco Bay P-C Region are enough to continue to supply the demand of the Region for 30 years - until the year 2024. In 1981, the region had 552 million tons of reserves which were projected to run out in 20 years or the year 2000.

- Since 1980, about 406 million tons of reserves were added to the South San Francisco Bay P-C Region through new mining permits or through new classification of resource areas. Most of the newly permitted reserves are in Alameda County. Permits were granted for mining aggregate in areas which were previously unmined as well as for deeper mining in permitted areas. One area covering about 100 acres in San Mateo County was newly classified for construction-grade aggregate.

- The anticipated consumption of aggregate in the South San Francisco Bay P-C Region for the next 50 years (through the year 2045) is estimated to be 1.76 billion tons, of which 32 percent or 563 million tons must be of PCC quality.

- The projected depletion of aggregate in the South San Francisco Bay P-C Region for the next 50 years is estimated to be 1.23 billion tons. This depletion rate is based on 70 percent of the projected aggregate consumption.

- In 1981, 22 square miles of land containing 6.3 billion tons of construction-grade aggregate resources were available in the South San Francisco Bay P-C Region. In 1986, the SMGB designated 18 square miles of this land as being regionally significant. These designated areas contained 4.1 billion tons of construction-grade aggregate resources. Since 1980, about 253 million tons of aggregate resources underlying designated areas have been lost due to aggregate consumption. About 2 percent of the total resources (75 million tons) underlying designated areas within the South San Francisco Bay P-C Region have been lost due to urbanization or other irreversible land uses since designation in 1986. Also, 32 million tons of aggregate resources have been subtracted from the total due to a change in classification in the Niles Cone area, located in the city of Newark, Alameda County.

- Within designated areas, there are presently 3,700 million tons of construction-grade aggregate resources available.

Aggregate resources in designated and non designated areas total 3,775 million tons.

o As of January 1996, 22 mines and one proposed mine, operated or controlled by 17 different mining companies were producing or permitted to produce construction-grade aggregate in the South San Francisco Bay P-C Region. Two of the 22 mines are currently not active. The proposed mine was permitted in 1984 but no mining has occurred to date. In 1980, there were 32 mines operated by 24 companies. All of the mine closures were crushed stone operations and most were small. This decline in active mines may be attributed in part from increased use of recycled aggregate in the production of class II aggregate base.

o Almost all of the aggregate produced within the South San Francisco Bay P-C Region is also consumed within the region. However, only 83 percent (1994 data) of the aggregate consumed in the P-C region is produced in the region. Imported aggregate comes from deposits of sand and gravel and crushed stone located in San Joaquin, Santa Clara, and San Benito counties.

o The average annual per capita consumption rate from 1953 to the end of 1994 was 5.7 tons. That rate was derived by correlating aggregate consumption and population for those years. Data collected from 1953 to the end of 1980 for Special Report 146, Part II determined that the average annual per capita consumption rate was 6.0 tons. The drop in per capita consumption may be a reflection of California's economic recession beginning in the early 1990's.

o The forecast of aggregate demand of 401 million tons for the South San Francisco Bay P-C Region for the period 1981-1994 was within 17 percent of the aggregate production of 335 million tons measured for that period for this study. This level of forecast accuracy is not unreasonable for the simplistic forecast technique used.

Changes in Mineral Land Classification of the Region Since 1983

DMG has classified the South San Francisco Bay P-C Region according to the presence or absence of significant construction-grade aggregate deposits. The land classification is presented in the form of Mineral Resource Zones (MRZs). MRZ-2 represents areas where adequate information indicates that significant mineral deposits are present or where it is judged that a high likelihood exists for their presence. MRZ-3 represents areas containing mineral deposits the significance of which cannot be evaluated from available data. For a more detailed explanation of MRZ's, see Appendix, Mineral Resource Zone Categories, page 48 of this report.

There are five changes in the mineral land classification of the South San Francisco Bay P-C Region from the 1983 report. They are: 1) the reclassification of the Mission Valley Rock property from MRZ-1 to MRZ-2 for construction-grade aggregate (see Plates 3 and 4); 2) the reclassification of Sunol Valley alluvial areas from MRZ-1 to MRZ-4 and MRZ-3 (see Plates 3 and 4); 3) the classification of the Langley Hill site, as MRZ-2 for construction-grade aggregate (see Plate 7); 4) the reclassification of a part of the Niles Cone from MRZ-2 to MRZ-3 (see Plates 2 and 3); and 5) the reclassification of a part of Sector J (also part of the Niles Cone) from MRZ-2 to MRZ-1 (see Plates 2, 3, 5, and 6).

The following table compares population, aggregate demand, reserves, annual per capita consumption, projected depletion of reserves, resources, number of aggregate mines, number of permitted properties, and the price of aggregate in the South San Francisco Bay P-C Region for the data-base year of the original classification (1980) with data current up to the end of 1994.

COMPARISON OF:	1980	1994
POPULATION	4,191,200	4,994,500
CALCULATED ANNUAL AGGREGATE DEMAND	22 MILLION TONS	22 MILLION TONS
TOTAL PERMITTED AGGREGATE RESERVES	552 MILLION TONS	676 MILLION TONS
CALCULATED ANNUAL PER CAPITA CONSUMPTION	6.0 TONS (1953-1980 average)	5.7 TONS (1953-1994 average)
CALCULATED YEARS UNTIL DEPLETION	20 YEARS	* 30 YEARS
AGGREGATE RESOURCES	**6.3 BILLION TONS	3.8 BILLION TONS
PERMITTED PROPERTIES	32	23 (20 active)
NO. OF COMPANIES	24	17 (15 active)
AVERAGE PRICE OF AGGREGATE PER TON	$2.00	$5.00

* Based on 70 percent of the projected aggregate consumption.

** Aggregate resources for all sectorized land prior to designation.

PART I - CLASSIFICATION OF AGGREGATE RESOURCES IN THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION

INTRODUCTION

The Department of Conservation's Division of Mines and Geology (DMG) published a four-part study of aggregate resources for the San Francisco-Monterey Bay Area as Special Report 146, Mineral Land Classification: Aggregate Materials of the San Francisco-Monterey Area, Parts I, II, III, and IV (Stinson and others, 1987). Special Report 146 covers three adjoining P-C Regions--Part II covers the South San Francisco Bay P-C Region, Part III covers the North San Francisco Bay P-C Region and Part IV covers the Monterey Bay P-C Region. Each of these P-C Regions covers a separate aggregate production district and its surrounding market or consumption area. Part I of Special Report 146 is an introduction to the three P-C Regions.

This report is an update of the South San Francisco Bay P-C Region (see Figure 1) which includes Alameda, Contra Costa, San Mateo, San Francisco, and northern Santa Clara counties. In Special Report 146, Part II, urbanizing lands within the South San Francisco Bay P-C Region were classified according to the presence or absence of significant construction-grade aggregate resources. Subsequent to classification and the completion of an Environmental Impact Report (California Department of Conservation, 1985), the State Mining and Geology Board (SMGB) designated areas within the P-C Region as having aggregate resources of regional significance on October 2, 1986 (California Department of Conservation, 1987). Special Report 146, Part II also projected future aggregate demand to the year 2030 (a 50-year projection).

This update report conveys important information on the present aggregate resources in the South San Francisco Bay P-C Region for the benefit of local lead agencies (see Table 1 for list of lead agencies). Information provided for the update reevaluates the availability of aggregate resources in the classified and designated areas within the South San Francisco Bay P-C Region and also projects the demand for construction-grade aggregate within the region to the year 2045.

The original study and this update were conducted as specified by the Surface Mining and Reclamation Act (SMARA) of 1975. Section I, Subsection 7 of the SMGB Guidelines for Classification and Designation of Mineral Lands, adopted in 1978 and published in 1983, requires the State Geologist to review mineral land classification information after a period of no longer than 10 years to determine whether reclassification and/or revision of projected requirements of construction materials is necessary. It was determined that a revision of projected

COUNTIES

*+Alameda	*+San Mateo
*+Contra Costa	*+Santa Clara
San Francisco	

INCORPORATED CITIES OR TOWNS

Alameda	Half Moon Bay	Pinole
Albany	Hayward	Pittsburg
Antioch	Hillsborough	Pleasant Hill
Atherton	Lafayette	+Pleasanton
Belmont	+Livermore	Portola Valley
Berkeley	Los Altos	Redwood City
Brentwood	Los Altos Hills	*+Richmond
Brisbane	Los Gatos	San Bruno
Burlingame	Martinez	San Carlos
Campbell	Menlo Park	San Francisco
Clayton	Millbrae	+San Jose
Colma	Milpitas	San Leandro
Concord	Monte Sereno	San Mateo
Cupertino	+Moraga	San Pablo
Daly City	+Newark	Saratoga
Dublin	+Oakland	South San Francisco
El Cerrito	+Orinda	Sunnyvale
Emeryville	+Pacifica	+Union City
Foster City	Palo Alto	Walnut Creek
*+Fremont	Piedmont	Woodside

OTHER

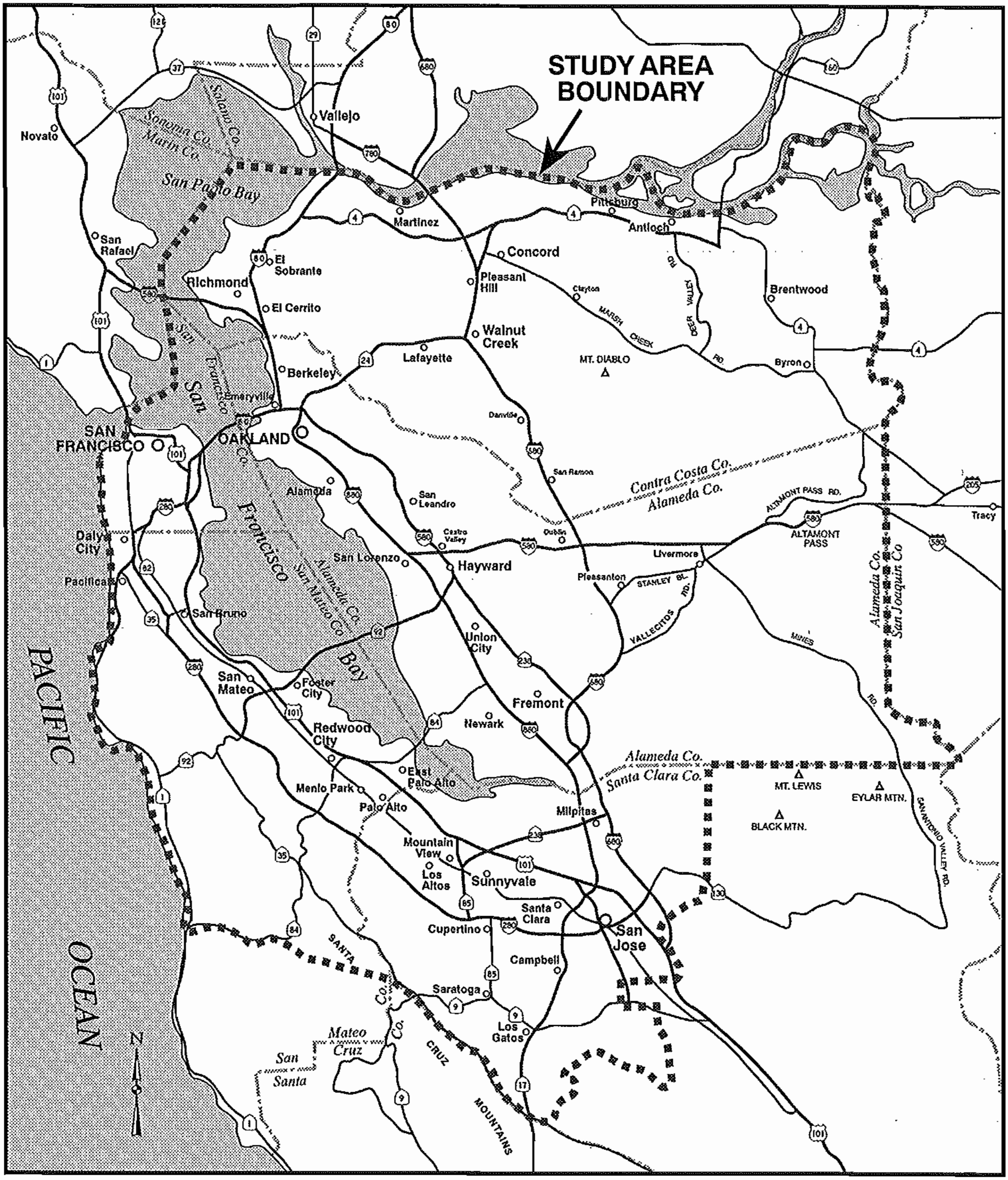
* San Francisco Bay Conservation and Development Commission

\+ East Bay Regional Park District
* State Lands Commission
State of California
U.S. Army
U.S. Department of Defense
U.S. Navy
U.S. Corps of Engineers

+Agencies that have designated land within their jurisdictions.

*Agencies that have active aggregate operations within their jurisdictions.

Table 1. Lead agencies (county, city, and other) located within the South San Francisco Bay Production-Consumption Region.



0 5 10 15 20 25 MILES

0 5 10 15 20 25 KILOMETERS

Figure 1. Map of the South San Francisco Bay Production-Consumption Region.

requirements was necessary for the South San Francisco Bay P-C Region.

It should be noted that the 1987 publication date for Special Report 146 does not reflect the report's completion date or the data-base year. Special Report 146 was completed and published in pre-print form in 1983. Consequently, information pertaining to classification is updated herein as of 1983. Data in Special Report 146 regarding land use was updated to conditions present in 1986 as part of the official designation process conducted by the SMGB. Changes in classification since 1983 and changes in available resource areas since designation in 1986 are shown on Plates 2 through 29 (see Figures 2 and 3 for indexes to Plates).

The most recent available data-base year for aggregate production used in Special Report 146 was 1980. Information pertaining to aggregate consumption and aggregate resources is updated as of the end of 1980. The last aggregate consumption data-base year for the following update report is 1994. All aggregate resource data for this report will be current to the end of 1994.

Classification of the South San Francisco Bay P-C Region was done with regard to the suitability of the underlying material for use in construction-grade aggregate. For Special Report 146, and this update, construction-grade aggregate is defined as portland cement concrete (PCC) aggregate, asphaltic aggregate, aggregate base, and aggregate subbase down to class III (class IV and V are considered types of fill and were not classified because of their abundance). This approach to classification is in contrast to the P-C Region studies done in southern California where only deposits meeting specifications for PCC aggregate were classified. In southern California, almost all aggregate production is from deposits which meet PCC specifications but in the South San Francisco Bay P-C Region, large amounts of high quality aggregate are not available. About half of the aggregate produced from the South San Francisco Bay P-C Region comes from crushed rock sources which do not meet PCC specifications. Consequently, the decision was made to classify for all construction-grade aggregate rather than exclusively for PCC.

The generalized land classification within the South San Francisco Bay P-C Region, as presented on Plate 1 at a scale of 1:125,000, has been revised from Special Report 146, Part II. Four areas have been reclassified and one area has been newly classified for this update. These areas are shown on Plates 2-7, Revised Mineral Land Classification Maps (see Index Map of Plates, Figure 2) The classification nomenclature in use at the time of the original report has been kept.

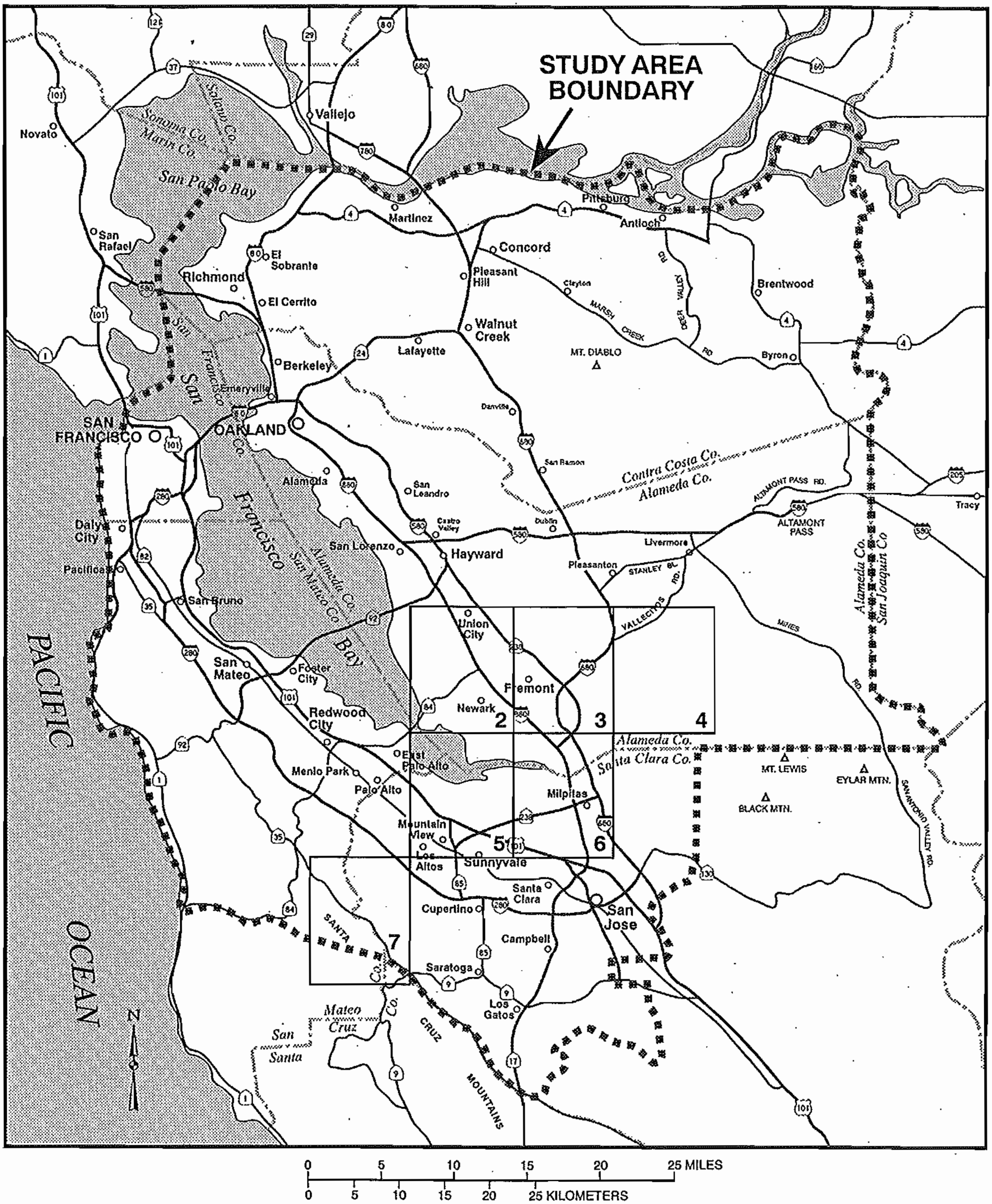


Figure 2. Index map of Plates 2-7; Revised Mineral Land Classification Maps.

REEVALUATION OF MINERAL LAND CLASSIFICATION

A reevaluation of Mineral Land Classification in the South San Francisco Bay P-C Region is presented in this section of the report. Based on new data that has become available since classification was completed in 1983, five changes have been made to the original classification report. These changes are shown on Plates 2-7, Revised Mineral Land Classification Maps. Three of these changes involve the addition or subtraction of aggregate resources. They are as follows:

1) Reclassification of about 160 acres in the Sunol Valley, Alameda County from MRZ-1 to MRZ-2 (see Plates 3 and 4).

2) Classification of about 100 acres in the Langley Hill area located in southern San Mateo County to MRZ-2 (see Plate 7)

3) Reclassification of about 340 acres in the Niles Cone area (Sector J) in western Alameda County, from MRZ-2 to MRZ-1 (see plates 2, 3, 5, and 6)

The reclassification of the Sunol Valley area and the new classification of the Langley Hill area have added resources to the South San Francisco Bay P-C Region. Both of these newly identified resource areas lie in non designated lands. They are discussed in more detail beginning on page 12, "Newly Classified Aggregate Resource Areas, Classified MRZ-2".

The reclassification of the Niles Cone area, Sector J, has resulted in lost resources within the P-C Region (see page 14 "Lost Resource"). This area is part of the Niles Cone, a large subaerial delta formed by Alameda Creek, containing sand and gravel deposits exceeding 100 feet in thickness. Based on geological information, water well data, and past mining in the Niles Cone area, this area was classified MRZ-2 in Special Report 146, Part II. Subsequent to classification, the area was designated by the SMGB in 1986. Since classification and designation, three exploratory holes have been drilled in the area underlying Sector J. The holes indicate that clay, silt and dirty sands underly the area to depths of at least 65-100 feet. Based on this information, the area was reclassified MRZ-1.

The following two remaining changes do not add or subtract from resources in the South San Francisco Bay P-C Region:

4) Reclassification of lands in the Sunol Valley area, Alameda County from MRZ-1 to MRZ-4 and MRZ-3 (see Plates 3 and 4). These changes were made in areas adjacent to or in the vicinity of current aggregate mining operations in the Sunol Valley.

5) Reclassification of land in the Niles Cone area in western Alameda County, from MRZ-2 to MRZ-3.(see Plates 2, 3, 5, and 6). This land is located directly north and west of the reclassified area in Sector J.

REEVALUATION OF AGGREGATE RESOURCES IN THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION

A reevaluation of aggregate resources in South San Francisco Bay P-C Region is presented in this section of the report. The reassessment was conducted on the basis of a quantitative evaluation of available construction-grade aggregate resources classified as MRZ-2 (see Appendix, p 50). Construction aggregate is defined for this report as any aggregate material (sand and gravel and crushed rock) which meets specifications for class III aggregate subbase or higher grades.

Concepts Used in Identifying Available Aggregate Resources

The State Geologist is responsible for calculating aggregate resources in those areas classified as MRZ-2 for aggregate. Recognizing that there are lands within these areas that have already been urbanized and therefore have a limited opportunity for mineral resource conservation and extraction, the State Geologist has limited the calculation of aggregate resource tonnages to areas classified as MRZ-2 that have not been urbanized. These areas were identified as sectors in Special Report 146, Part II (Stinson and others 1987). The majority of the sectors were subsequently designated by the SMGB as being regionally significant. All designated sectors which were identified in SMARA Designation Report No. 7. (California Department of Conservation, 1987) have been re-evaluated during the course of this update. Plates 8-29 (see Figure 3 for index to Plates) show all changes in designated sectors or parts of sectors since designation took place in October, 1986. These maps show areas of urbanization within designated areas and any changes in land owned or controlled by aggregate companies.

For purposes of identification of available aggregate resources, incompatible uses of land are defined as improvements of high cost such as high-density residential developments, intensive industrial developments, commercial developments, and major public facilities. Lands that have compatible uses are defined as those that are nonurbanized or that have very low density residential development (1 unit per 10 acres), lands that do not have high-cost improvements, and lands used for agriculture, silviculture, grazing, or open space.

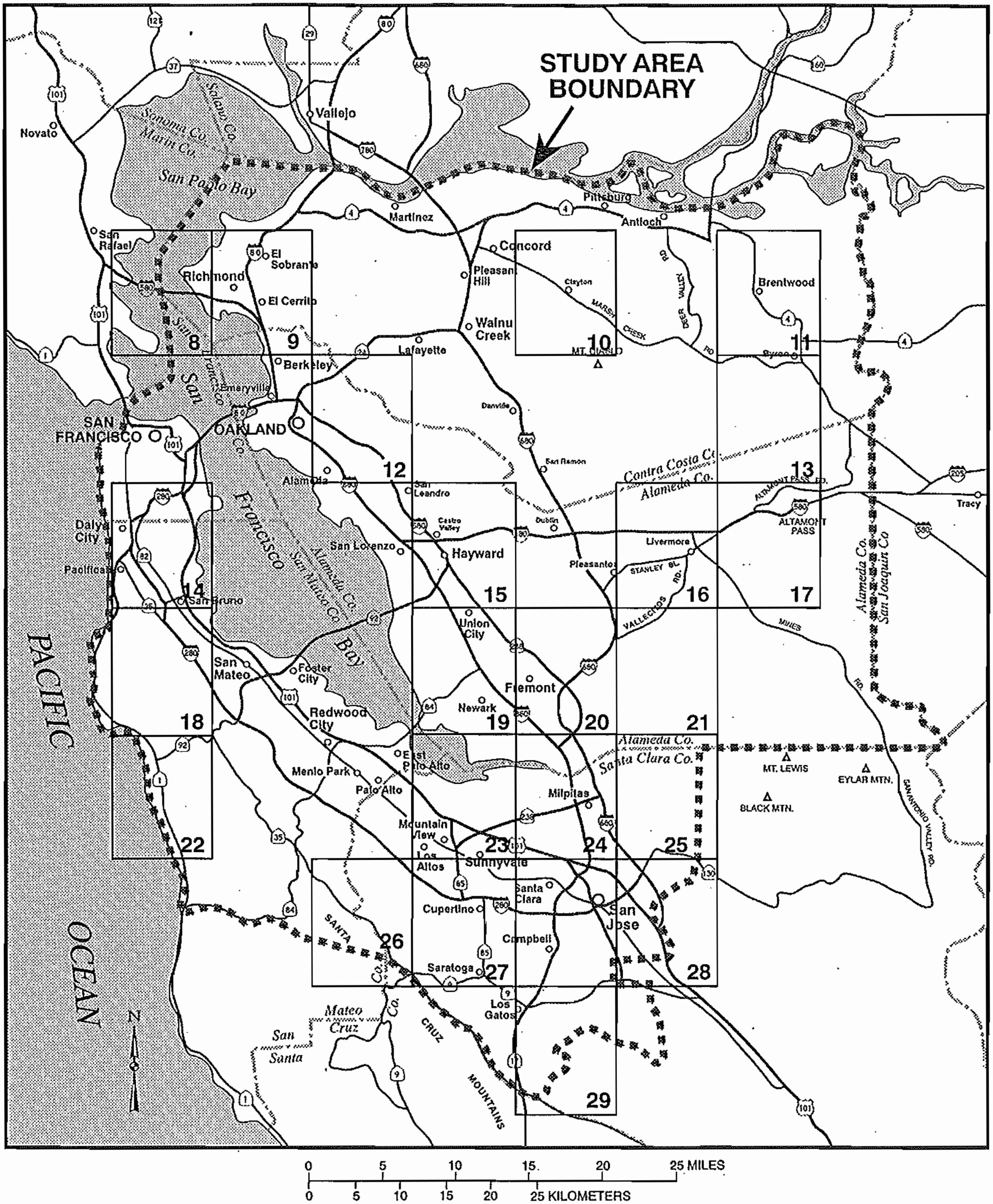


Figure 3. Index map of Plates 8-29; Designated Areas Update, Regionally Significant Aggregate Resources in the South San Francisco Bay Production-Consumption Region.

In this report, land use for aggregate resource areas classified MRZ-2 was based on conditions as of January, 1996. Use of these areas was determined after review of data from lead agencies, reference to aerial photographs and photo-revised topographic maps, and field reconnaissance.

The revised resource calculations of aggregate in the P-C Region are compared with the State Geologist's new forecast of the 50-year needs of that region. The comparison of regional needs with available reserves and resources provides the opportunity to focus attention on the mineral resource issues confronting the region, such as the need to plan carefully for the use of any lands containing mineral resources, and the need to consider the permitting of additional mining operations in the region as currently mined deposits are depleted.

It is highly likely that all available aggregate resources calculated for this report will not ultimately be mined. There may be political constraints and other considerations confronting local government in making aggregate resources available for extraction that are not accounted for. Considering this, it becomes important for local governments to carefully review the estimated resources in order to ensure that adequate resources will be available for future development of the region's economy.

Calculation of Available Resources

Reserves and Resources

In this report, <u>reserves</u> are calculations of tonnages of aggregate that have been determined to be acceptable for commercial use, that exist within properties owned or leased by aggregate producing companies, and for which permits have been granted to allow mining and processing of the material. Permits may be required by agencies other than the county, as is the case in rivers where a permit may also be required by the Army Corps of Engineers. <u>Resources</u> include <u>reserves</u> as well as all potentially usable aggregate materials that may be mined in the future, but for which no permit allowing mining has been granted.

Factors Considered in Calculations

The resource calculations given here are for those aggregate resources in the sectors designated by the SMGB (California Department of Conservation, 1987) with the addition of resources on the reclassified Sunol Valley Mission Valley Rock property and the newly classified Langley Hill property. The changes in the areas available for mining, as identified in this study, are shown on Plates 8-29 (see Figure 3 for index to Plates).

The factors used in this study to determine the areal extent and tonnage of aggregate resources remaining within the sectors were the same as those used in Special Report 146, Part II. (Stinson and others, 1987). They were as follows:

1. Resource tonnage calculations were based on measurements taken from base maps that have a scale of 1:24,000 or maps obtained from aggregate companies with varying scales.

2. Thicknesses of aggregate deposits were determined in the original reports through analysis of water well-log data, examination of active aggregate pits and natural outcrops, and other information provided by persons who have knowledge concerning aggregate deposits in this region.

3. A standard setback of 100 feet from utility and rail lines and urban developments was used in determining the limits of areas available for mining, unless otherwise stipulated on individual mining plans.

4. Side slopes were generally calculated to have a 1:1 gradient, or, if the deposit was permitted for mining, the side slopes of the mining plan.

5. In-place densities of 0.06 tons per cubic foot were assumed in calculating sand and gravel resources and densities of 0.06 to 0.09 tons per cubic foot were assumed in calculating crushed stone resources.

Resource Sectors

All lands in the South San Francisco Bay P-C Region classification report (Stinson and others, 1987) containing extractable aggregate deposits were divided into 42 sectors, covering 23 square miles of land. During the process of public and lead agency comment in response to the EIR, written prior to designation (California Department of Conservation, 1985), it was determined that 12 of these sectors should not be designated. All or parts of the remaining 30 sectors, covering 19 square miles, were designated by the SMGB in 1986 (California Department of Conservation, 1987). They are described below:

Sector A - Aggregate deposits located in the Amador Valley and Livermore Valley areas in the Cities of Pleasanton and Livermore, Alameda County.

Sector B - Alluvial deposits consisting of six parcels along Arroyo del Valle on the southwestern edge of Livermore, Alameda County.

Sector C - Alluvial deposits consisting of six parcels located along Arroyo Mocho on the eastern edge of Livermore, Alameda County.

Sector D - Greenstone deposit located on Apperson Ridge east of Sunol Valley, Alameda County.

Sector E - Alluvial deposit consisting of five parcels in Sunol Valley, Alameda County.

Sector H - Elongated sandstone deposit located on the foothills east of the Cities of Fremont and Union City, Alameda County.

Sector I - Elongated sandstone deposit consisting of four parcels located along the foothills east of the Cities of Fremont and Milpitas, Alameda and Santa Clara counties.

* Sector J - Alluvial deposit near Mowry Landing in the City of Newark, Alameda County.

Sector K - Alluvial deposit located west of Highway 17 on the southern edge of Fremont, Alameda County.

Sector L - Alluvial deposit consisting of five parcels located between the Nimitz Freeway, Alameda Creek, the Coyote Hills, and Jarvis Avenue in the northwestern part of the Fremont, Alameda County.

Sector M - Located at the southern end of the Coyote Hills on the west side of Fremont, Alameda County.

Sector N - Exposures of greenstone located in the Foothills east of the City of Hayward, Alameda County.

Sector O - Greenstone and rhyolitic rocks located in the Berkeley Hills west of Lake Chabot, Alameda County.

Sector P - Rhyolitic rocks located north of the Oak Knoll Naval Hospital in the Berkeley Hills, Alameda County.

Sector S - Diabase located at Mount Zion and a smaller adjacent hill southwest of the community of Clayton in central Contra Costa County.

Sector T - Exposures of basalt and andesite located at the south end of Gudde Ridge in the City of Moraga in southwestern Contra Costa County.

Sector U - Basalt and andesite located at the northern end of Gudde Ridge in the Berkeley Hills of southwestern Contra Costa County.

Sector V - Basalt and andesite exposed on a small ridge southwest of the City of Orinda, Contra Costa County.

Sector W - Sandstone and shale deposit consisting of three parcels located on the west side of the City of Richmond, Contra Costa County.

Sector X - The Guadalupe Quarry property on the north side of San Bruno Mountain, west of the City of Brisbane in San Mateo County.

Sector Y - Limestone and greenstone deposits located west of Pacifica near Rockaway Beach in northern San Mateo County.

Sector Z - Greenstone deposit located in the Los Altos Hills southwest of the City of Los Altos in northwestern Santa Clara County.
Sector BB - Limestone deposit located west of the City of Cupertino on Permanente Creek, Santa Clara County.
Sector CC - Greenstone body located northwest of Stevens Creek Reservoir west of the City of Cupertino, Santa Clara County.
Sector DD - Conglomerate deposit located northwest of Stevens Creek Reservoir on the western edge of the City of Cupertino, Santa Clara County.
Sector EE - Franciscan Complex melange and associated serpentinite and silica-carbonate rocks located west of the intersection of the Capitol Expressway and Monterey Road (Highway 82) in the City of San Jose, Santa Clara County.
Sector GG - Sandstone deposit located about 2.5 miles west of the town of Byron in eastern Contra Costa County.
Sector HH - Granitic rock deposit located northeast of the City of Half Moon Bay in western San Mateo County.
Sector II - Sandstone and siltstone deposit located in Limekiln Canyon east of Lexington Reservoir in southwestern Santa Clara County.
Sector LL - Sandstone deposit located in the foothills east of the City of Fremont, Alameda County.

* Sector J is no longer considered to be underlain by aggregate resources.

Newly Classified Aggregate Resource Areas Classified MRZ-2

Since the original classification and designation of the South San Francisco Bay Area P-C Region, two additional areas have been identified as containing significant aggregate resources. These are: 1) a reclassified area containing sand and gravel resources in the Sunol Valley, Alameda County (see Plates 3 and 4) and 2) a newly classified area containing crushed rock resources situated in the Santa Cruz Mountains along the eastern part of Langley Hill, San Mateo County (see Plate 7).

In classifying these deposits the SMARA guidelines were followed which require that:

1. The deposit be composed of material that is saleable as a marketable commodity (construction-grade aggregate) and
2. The deposit meet a minimum value of $12,150,000, based on the gross selling price of the first marketable product (5,000,000 1978-dollars, when the guidelines were written).

<u>Sunol Valley Area:</u> This reclassified area includes about 160 acres of land underlain by alluvial sand and gravel and

discontinuous layers of clay deposited in the floodplain of Alameda Creek. The aggregate is derived from rocks of the Franciscan Complex. The area reclassified as MRZ-2 is currently leased by Mission Valley Rock Company which has permits (SMP-29 and SMP-32) to mine the property. No mining has taken place to date on any of the reclassified land. Mission Valley Rock is currently mining to a depth of 200 feet on land located adjacent to the reclassified land, directly south of Interstate 680. Information which was available during the original classification (Stinson and others, 1987) indicated that the area was underlain by sand and gravel but had too much overburden and too many clay layers for the aggregate to be mined economically. Data on 15 new drill holes, provided to staff for this update by Mission Valley Rock Company through Spinardi Associates, indicated that this area is underlain by economically recoverable sand and gravel. Based on this new data, the area was reclassified MRZ-2.

Langley Hill Area: Covers about 100 acres in the Santa Cruz Mountains, and is located about 2 miles south of the outer boundary for areas subject to urbanization. This area has been newly classified MRZ-2. The area includes the eastern half of Langley Hill which is underlain by submarine deposited lava flows, pillow lavas, flow breccias, tuff breccia, and agglomerate belonging to the Miocene Mindego Hill Basalt. Overburden is generally less than 10 feet thick throughout the newly classified area. The newly classified area includes the Langley Hill Quarry and surrounding leased area where crushed rock has been mined since the early 1930s. The quarry is currently controlled by the Dempsey family who have operated the property since 1954. Aggregate produced at the quarry is largely used for base and drain rock. In Special Report 146, Part II, this area was discussed as an alternative source of crushed rock which was not classified because of its location outside the urbanizing boundary. With the loss of reserves caused by closures of several crushed rock operations throughout the South San Francisco Bay P-C Region since the original classification and designation, the Langley Hill Quarry site was classified.

Aggregate Resources in the South San Francisco Bay Production-Consumption Region

Aggregate resources of construction-grade aggregate for all designated land in the South San Francisco Bay P-C Region are shown on Table 2. This table also includes reserves and resources for the above mentioned lands reclassified MRZ-2, in the Sunol Valley and the newly classified Langley Hill area. The resources shown on Table 2 are current as of December, 1994.

As shown on Table 2, construction-grade aggregate resources within the South San Francisco Bay P-C Region currently total 3775 million tons, of which 3700 million tons lie in designated lands. This is a decrease of 285 million tons from the 4,060 million tons available at the time of designation in 1986. Permitted resources (reserves) available in the P-C region total 676 million tons, an increase of 124 million tons since 1980.

About 656 million tons (17 percent) of the total 3775 million tons of resources available in the P-C Region are sand and gravel. The remaining 3119 million tons (83 percent) are crushed stone resources. Of the 676 million tons of reserves available in the P-C Region, 308 million tons (46 percent) are sand and gravel and 368 million tons (54 percent) are crushed stone.

Lost Resources

Loss of resources was caused by aggregate consumption since 1980, by urbanization in aggregate resource areas since designation, and by reclassification of land formerly believed to contain construction aggregate resources. Since 1980, roughly 253 million tons of aggregate resources have been lost due to consumption in the South San Francisco Bay P-C Region. Since designation in 1986, about 2 percent of the designated areas have been made unavailable for mining due to urbanization. This amounts to about 75 million tons of lost resources (see Table 3). Most of this land lies within the jurisdiction of the City of Fremont. Also, 32 million tons of aggregate in Sector J has been subtracted from the total resources of the P-C Region (see page 6 "Reevaluation of Mineral Land Classification").

Newly Permitted or Newly Classified Aggregate Resources (Reserves)

Since 1980, about 406 million tons of construction-grade aggregate reserves have been added to the South San Francisco Bay P-C Region through new permits or through newly classified aggregate resources. Permits were granted for mining aggregate in previously unmined areas as well as for mining deeper in areas already permitted. Newly permitted sand and gravel reserves amounted to 179 million tons, most of which are located in the Sunol Valley and Livermore Valley aggregate production districts (see Figures 4 and 5). Crushed stone reserves for the P-C Region were increased by 227 million tons. This includes reserves added through new or expanded permits and also those added through the reclassification of the Langley Hill property. Over half of the new crushed stone reserves are on Apperson Ridge in Alameda County. To date, no mining has taken place on this property which is leased by the Oliver de Silva Company.

RESOURCE AREA	SECTOR	RESOURCES (includes reserves) *Million Short Tons*	RESERVES *Million Short Tons*
Livermore-Amador Valley	A-1	*	*
	A-2	*	*
	A-3	13	0
	Total:	254	*
Livermore Valley	B-1	9	0
	B-2	17	0
	B-3	29	0
	B-4	0	0
	B-5	2	0
	B-6	22	0
	Total:	79	0
Livermore Valley	C-1	30	0
	C-2	27	0
	C-3	9	0
	C-4	2	0
	C-5	20	0
	C-6	11	0
	Total:	99	0
Apperson Ridge	D-1	138	*
	D-2	299	*
	D-3	604	*
	Total	1,041	*
Alameda Creek-Sunol Valley	E-1	54	0
	E-2a	*	*
	E-2b	*	*
	E-3	*	*
	E-4	*	*
	E-5	*	*
	No Sector	*	*
	Total	153	*
Niles Deposit	H	112	0
Scott Creek Deposit	I-1	293	*
	I-2	*	*
	I-3	40	*
	I-4	29	0
	Total:	377	25

Table 2. Data on resource areas and designated sectors of the South San Francisco Bay Production-Consumption Region.

* Cannot be shown individually due to confidentiality; however, amount is included in total at bottom of page.

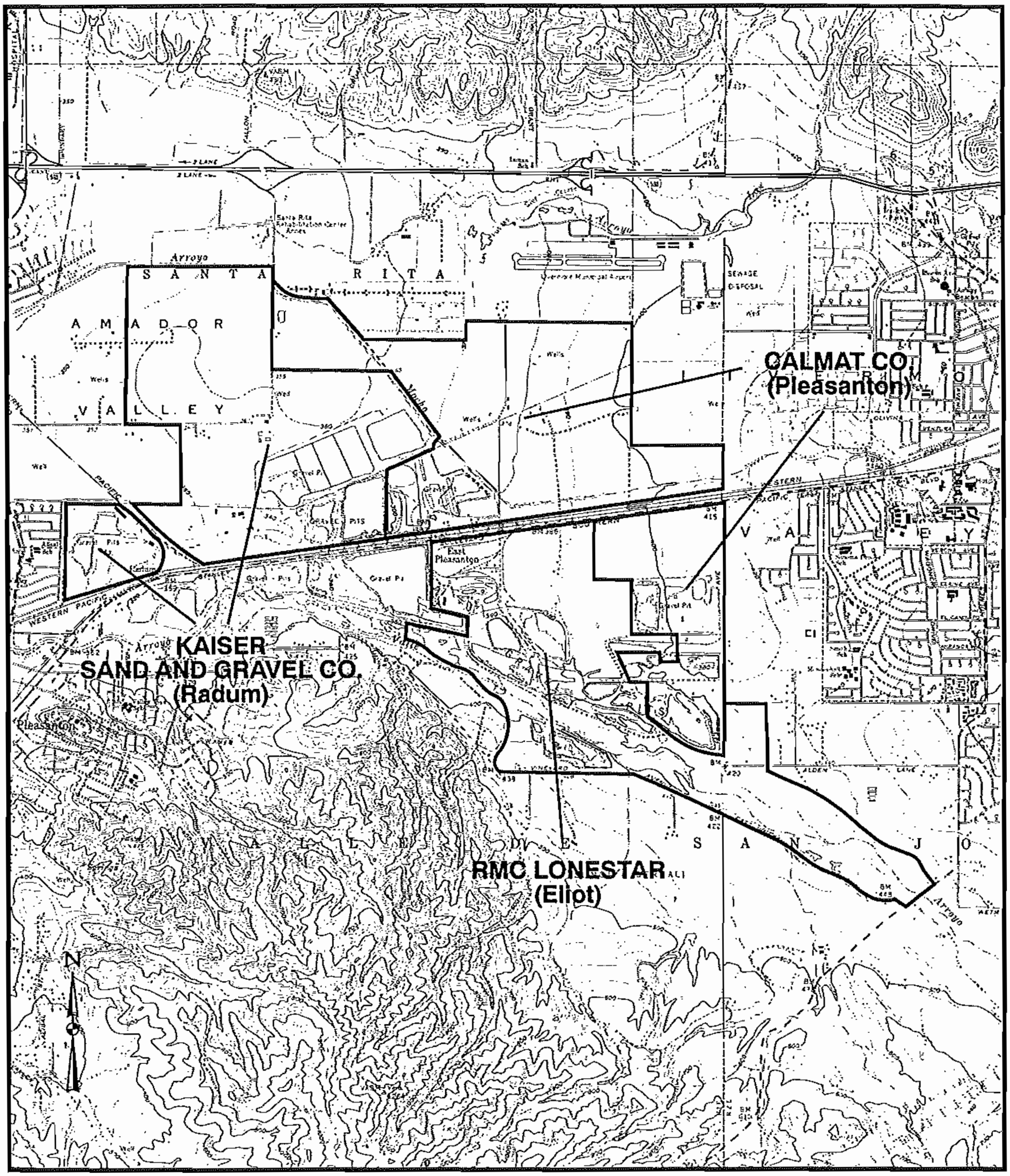
RESOURCE AREA	SECTOR	RESOURCES (includes reserves) *Million Short Tons*	RESERVES *Million Short Tons*
Alameda Creek	J	0	0
	K-2	21	0
	L-1	16	0
	L-2	19	0
	L-3	0	0
	SubTotal:	35	0
Coyote Hills Deposit	M	*	*
La Vista Deposit	N	*	*
San Leandro Deposit	O	*	0
Gallagher and Burke Quarry	P	*	*
Mount Zion Deposit	S-1	579	*
	S-2	71	*
	SubTotal:	650	*
South Gudde Ridge	T	121	0
North Gudde Ridge	U	94	0
Orinda Deposit	V	29	0
Richmond Deposit	W-1	33	0
	W-2	*	0
	W-3	*	*
	SubTotal:	46	*
San Bruno Mountain	X	*	*
Rockaway Beach	Y	32	0
Neary Quarry	Z	31	0
Permanente Quarry	BB	*	*
Stevens Creek Quarry	CC	177	*
Stevens Creek Quarry	DD	4	*
Hillsdale Deposit	EE-1	77	*
Ridgemoor Quarry	GG	11	*
Pilarcitos Quarry	HH	*	*
Lexington Quarry	II	*	*
Mission Peak Deposit	LL-1	85	0
	LL-2	88	0
	SubTotal:	173	0
Langley Hill	No Sector	*	*
Designated Areas	All Sectors	3700	*
Designated and Non-designated Areas	Grand Total	3775	676

Table 2 (continued)

* Cannot be shown individually due to confidentiality; however, amount is included in total at bottom of page.

Sector	Lost Resources (million tons)	% of Sector Lost	Plate #
B-4	4	100	16
B-1	5	35	16
L-1	10	40	19
L-2	5	20	19
L-3	47	100	19
M	4	19	19
Total	75		

Table 3 Resources made unavailable due to irreversible land use since designation in October, 1986.



Base map by U. S. Geological Survey

SCALE = 1:48,000

0 1 2 MILES

0 1 2 KILOMETERS

Figure 4. Map of the Livermore Valley production district showing land owned or leased by aggregate companies as of January, 1996.

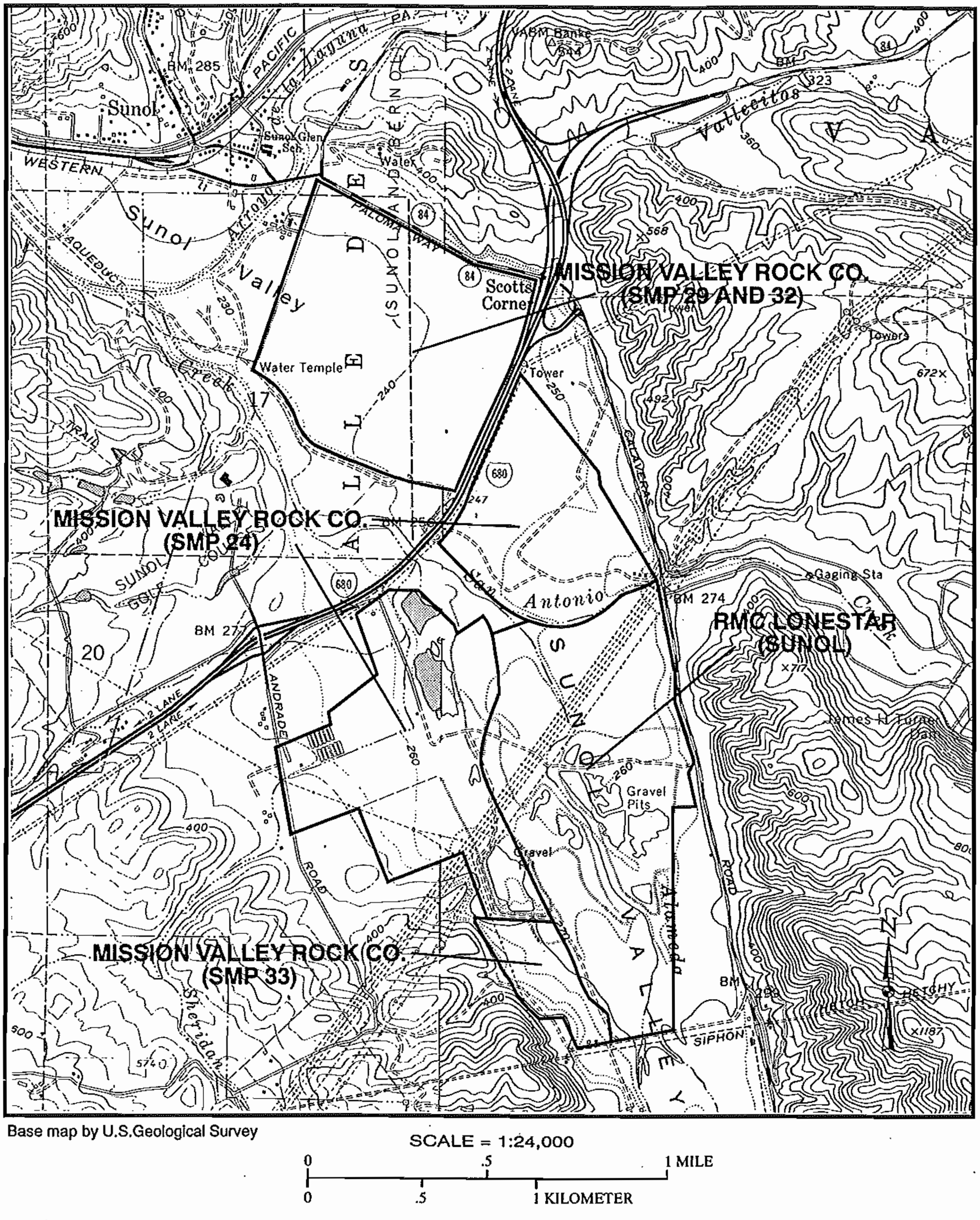


Figure 5. Map of the Sunol Valley production district showing land owned or leased by aggregate companies as of January, 1996.

Recycled Aggregate

Recycled construction and demolition waste material has become widely used in the South San Francisco Bay P-C Region for class II aggregate base. Although recycling of aggregate in the South San Francisco Bay area has been taking place to a limited extent for about the last 10-15 years, significant production of recycled aggregate began about 6 years ago. This increase in production may have been prompted by the Loma Prieta earthquake of 1989 which served to provide millions of tons of demolished concrete and asphalt for recycling. Twenty-seven operations currently produce recycled aggregate throughout the P-C Region (see Figure 6). Ten of these centers are located at active or inactive aggregate mining operations.

Production figures were collected from most of the recycling aggregate companies for as many years as possible since 1980. In most cases, records were incomplete and were largely estimates given by the producing company. Using this limited data, an estimated 2.3 million tons of class II aggregate base was produced from recycled concrete and asphalt in 1994. This amounts to roughly 11 percent of the total aggregate consumed in the P-C Region for that year.

Recycled material cannot now be used to make concrete aggregate or asphalt aggregate. Its use is limited to class II aggregate base and some Recycled Asphalt Pavement (RAP)--old asphalt which is torn up and mixed in small percentages with new asphalt paving at the batch plant. The increased use of recycled material will lead to an extended life of virgin aggregate reserves and resources in the South San Francisco Bay P-C Region.

Dredge Sand

Dredge sand is produced from bay areas in the northern part of the South San Francisco Bay P-C Region in Contra Costa and San Francisco counties. Because these resources are being replenished, they cannot be quantified and are not included in the total aggregate resources tonnage (Table 2). In 1994, a little over 1 million tons of sand dredged from the Suisun Bay, San Francisco Bay, and Carquinez Strait was consumed in the South San Francisco Bay P-C Region. This amounts to a little less than 5 percent of the total aggregate consumed in the P-C Region. Roughly 25 percent of the dredge sand can be used for PCC concrete sand. The remaining sand is largely used for fill. According to the sand dredging companies, sand removed from the bay areas is being replenished at about the same rate that it is being mined.

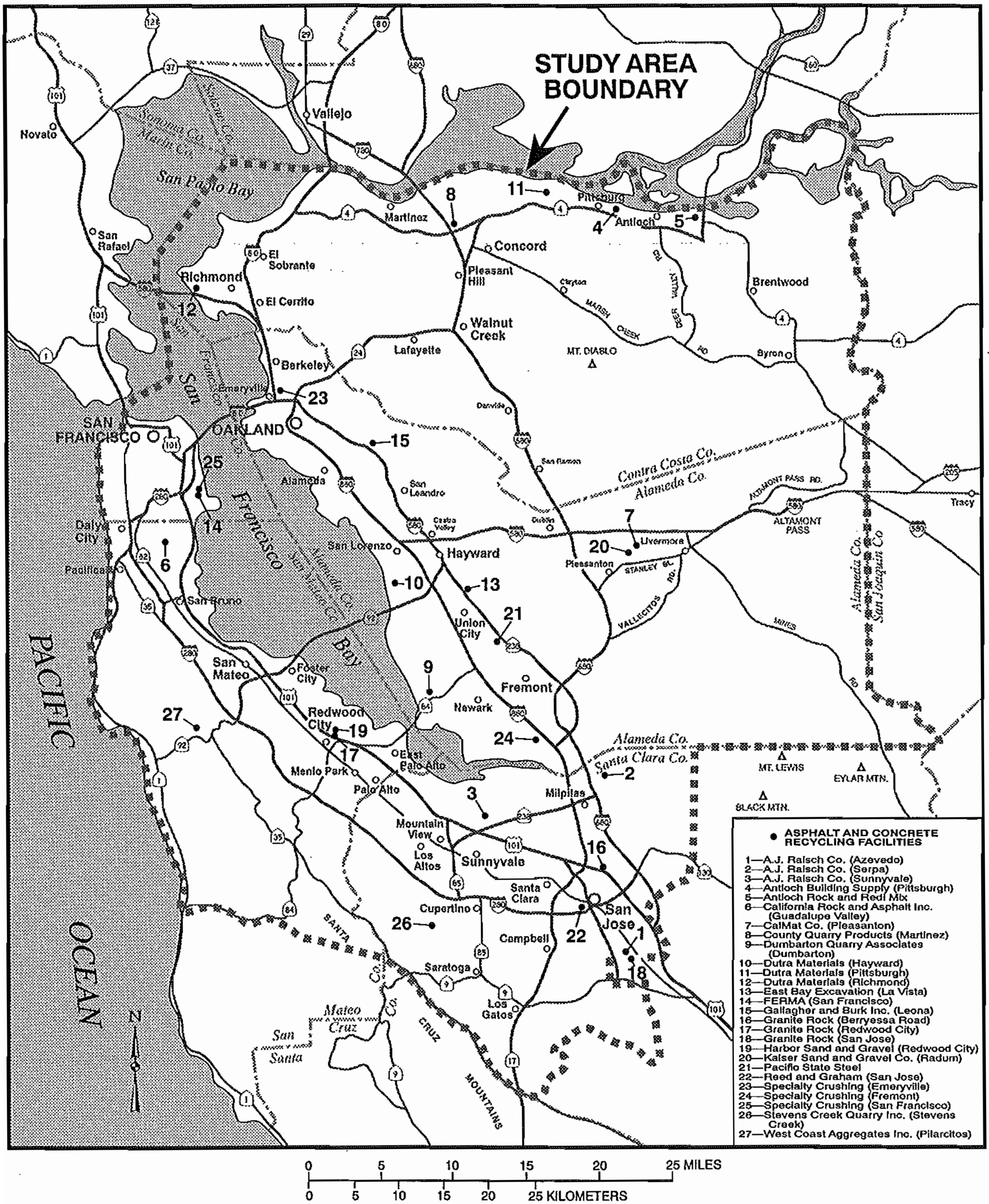


Figure 6. Aggregate Recycling Facilities located in the South San Francisco Bay Production-Consumption Region.

PART II - AGGREGATE PRODUCTION IN THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION

The historical aggregate production data for the South San Francisco Bay P-C Region were obtained from mining records of the U.S. Department of the Interior, Bureau of Mines (this function is now within the U.S. Geological Survey); the California Department of Conservation, Office of Mine Reclamation; and the aggregate companies. The U.S. Bureau of Mines records were compiled from responses to voluntary questionnaires sent annually or biannually to all known mining operators. Each producer was requested to divulge the production from each of his producing properties for the preceding year. The accuracy of these figures depends on the producer's response. DMG staff checked current and past production where possible, and modified the data accordingly.

As of January 1996, 20 active mines, two inactive mines, and one proposed mine had active permits to mine aggregate in the South San Francisco Bay P-C Region. These 23 permitted properties are shown on Plate 1 and Figure 7.

At the time Special Report 146, Part II was completed in 1983, there were 24 companies producing construction aggregate from 32 mines in South San Francisco Bay P-C Region. The total aggregate reserves at that time amounted to 552 million tons.

ACTIVE MINING OPERATIONS

As of January 1996, 15 companies were producing construction -grade aggregate from 20 different mines in the San Francisco Bay P-C Region. A list of the 15 companies and a brief summary of each company and their properties follow:

A.J. Raisch Company
Bauman Landscape, Inc. all private
California Rock and Asphalt, Inc.
CalMat Company
Dumbarton Quarry Associates all private
East Bay Excavation Company, Inc.
F.T.G. Construction Materials, Inc.
Kaiser Sand and Gravel Company
Kaiser Cement Corporation
Michael Dempsey
Mission Valley Rock Company
Oliver de Silva, Inc.
RMC Lonestar
Stevens Creek Quarry, Inc.
West Coast Aggregates, Inc.

Irvine Lake
Pala
CEMEX-Redlands

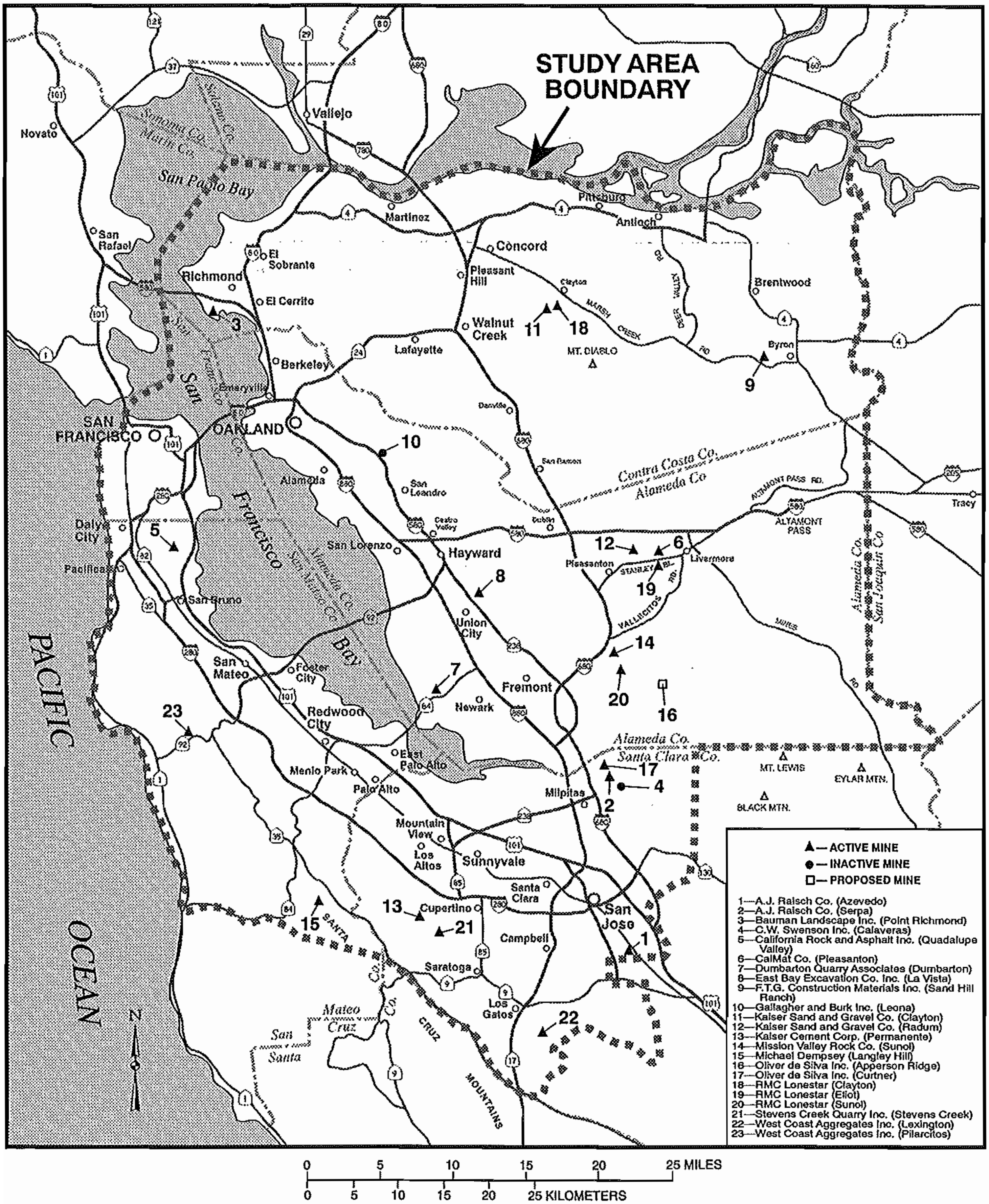


Figure 7. Locations of aggregate mines or proposed mines in the South San Francisco Bay Production-Consumption Region having current permits as of January, 1996.

A.J. Raisch Company operates the Azevedo and the Serpa quarries both located in Santa Clara County. The Azevedo Quarry lies near the eastern edge of a group of low isolated hills that are considered a northward continuation of the Santa Teresa Hills. The quarry has been operated almost continuously since 1971 by the A.J. Raisch Company, the original lessee of the property from M.T.A. Properties. Aggregate produced at the quarry is largely used for road base. Since 1986, the Azevedo Quarry operation has also been producing class II aggregate base from recycled asphalt and concrete. To date, the quarry has produced about 2 million tons of aggregate from recycled material.

Operations at the Serpa Quarry began in early 1958 and continued on a limited basis for about the next 10 years. A.J. Raisch Paving Company purchased the property in 1967. The quarry was mined almost continuously from 1968 until 1977. Little has been mined since then. The quarry chiefly produced aggregate subbase and fill. In May of 1995, a recycling operation was started at the Serpa Quarry site.

Bauman Landscape, Inc. operates the Point Richmond Quarry located on the southern end of San Pablo Peninsula along the eastern flank of Potrero Hills, Contra Costa County. Parts of the property were mined from 1959 to 1975. A conditional use permit was issued to reactivate the quarry in 1980. The permit was scheduled to expire in 1990 but mining has continued under a series of short term extensions. The main products have been base, subbase, and fill. The quarry was operated by Quarry Products, Inc. prior to Bauman Landscape, Inc. leasing the property in 1993.

California Rock and Asphalt, Inc. operates the Guadalupe Valley Quarry (also known as the Brisbane Quarry) located on the northeastern flank of San Bruno Mountain. Originally opened in 1895, the quarry is the oldest active quarry in the South San Francisco Bay P-C Region. Several owners and operators have worked the quarry during its 100 year history. Since 1980, the quarry has changed ownership three times. The last change in ownership occurred in November of 1995 when American Rock and Asphalt, Inc. sold the property to California Rock and Asphalt, Inc. The quarry's current permit has no specified expiration date but does specify a maximum amount of material which can be taken from the site. Aggregate produced from the quarry is largely used for asphaltic concrete.

CalMat Company owns and operates a group of sand and gravel pits in the Livermore Valley, Alameda County, located both north and south of Stanley Boulevard (see Figure 4). Collectively the pits are known as CalMat, Pleasanton. The pits north of Stanley Boulevard were formerly owned by Rhodes and Jamieson, Ltd. who began operations in the early 1950s. Operations have been continuous at this site since they began. CalMat purchased the mining lease from Rhodes and Jamieson in December, 1992. The group of pits south of Stanley Boulevard has been mined since 1932 when California Rock and Gravel Company began operations. In January 1978, California Rock and Gravel Company was bought by Rhodes and Jamieson. The lease was purchased by CalMat in December of 1993. CalMat currently runs an asphalt batch plant and a drum plant on its property. There is also a concrete batch plant located on the property which is leased to RMC Lonestar. Aggregate produced at the CalMat, Pleasanton operation is largely used for PCC and asphaltic aggregate. In March of 1996, CalMat started crushing recycled concrete and asphalt at the Pleasanton property for use in class II aggregate base and asphaltic aggregate.

Dumbarton Quarry Associates operates the Dumbarton Quarry located in the southern part of the Coyote Hills in the City of Fremont. The quarry was run by Lone Star Industries until 1967 when it was bought by Dumbarton Quarry Associates which has operated the property continuously since then. An asphalt plant was installed on the property in 1982. Aggregate mined from the quarry is used largely for road base and asphalt.

East Bay Excavation Company, Inc. operates the La Vista Quarry situated at the base of the western slope of the Berkeley Hills, Alameda County. Rock was first quarried at this property in the early 1950s. East Bay Excavation Company took over the property in 1964 and mining has taken place continuously since then. The mined rock is used primarily for asphaltic aggregate and other asphalt products, trench backfilling, and drain rock. The property has an asphalt batch plant with a capacity of 250 tons per hour. Some recycling of asphalt and concrete has been taking place at the La Vista site for the last 10-15 years.

F.T.G. Construction Materials, Inc. operates the Sand Hill Ranch Quarry for owner Tom Anderson. The quarry is located in Contra Costa County about 2.5 miles west of the town of Byron. The property was first mined in 1989 by V.E. Santos Enterprises. F.T.G. Construction Materials Inc. was contracted to mine the property in June 1993. The material mined has largely been used for fill.

Kaiser Sand and Gravel Company (owned by Hanson PLC) operates the Radum sand and gravel property in Livermore Valley, Alameda County (see Figure 4), and the Clayton crushed stone quarry on the west side of Mount Zion, Contra Costa County.

Kaiser Sand and Gravel began operations at the Radum site in 1930 and has been operating it continuously since then. The property has an asphalt batch plant and a concrete batch plant. The concrete plant has not been operated in the last 2 years.

Aggregate produced at the Radum property has largely been used for PCC aggregate, asphaltic aggregate, and road base.

Kaiser Sand and Gravel has been mining continuously at the Clayton Quarry since 1954. Most of the rock produced from the quarry is used for road base and asphaltic aggregate.

Kaiser Cement Corporation (owned by Hanson PLC) operates the Kaiser Permanente limestone quarry located on the west side of Santa Clara Valley in the eastern foothills of the Santa Cruz Mountains, Santa Clara County. The quarry largely produces limestone which is used for the manufacturing of cement; but the quarry is included in this aggregate study because roughly 25% of the rock mined at the quarry is used for aggregate. The first mining of the quarry is not known, but in 1930 (Franke, H.A., 1930) the quarry was listed as being idle for some time. In 1938, Kaiser Cement purchased the quarry from the Santa Clara Holding Company. Most of the early mining of the rock at the quarry was used for lime purposes. Aggregate production from the site began in the mid 1950s. The main aggregate use for the crushed limestone is for PCC, asphaltic concrete, and road base.

Michael Dempsey operates the Langley Hill crushed rock quarry and plant situated on the northeastern flank of Langley Hill, San Mateo County. Mining at the site started in the early 1930s. In 1954, Michael Dempsey's father took over the operation and the quarry has been mined continuously since then. Rock produced from the quarry is largely used for road base.

Mission Valley Rock Company leases four sand and gravel properties (SMP-24, SMP-29, SMP-32, and SMP-33) located in Sunol Valley on the western flood plain of Alameda Creek, Alameda County (see Figure 5). For Plate 1 and Figure 7, these four properties are listed together as Mission Valley Rock Company, Sunol. Only SMP-24 is currently being mined; yet all of the properties have active mining permits. Concrete Service Company began mining on the SMP-24 property in 1951. In 1965, Mission Pass Aggregates Company bought the operation and leased the property to Mission Valley Rock. The most southerly property, SMP-33, was purchased by Mission Valley Rock sometime in the late 1980s or early 1990s from Ivaldi Brothers, who was originally granted a permit to mine the site in 1966. Ivaldi Brothers last mined the property in 1987. SMP-29 and 32 are two adjoining unmined properties which were granted permits in 1991 and 1994 respectively. Mission Valley Rock is using 4,000-5,000 tons per year of by-product from glass recycling for select fill and trench backfilling. Mission Valley Rock currently has an on-site asphalt and concrete plant. Mission Valley Rock mainly produces aggregate for use in PCC and asphaltic concrete.

Oliver de Silva, Inc. operates the Curtner Quarry located in Santa Clara County north of Colera Creek and directly south of the Alameda-Santa Clara County line. Little is known about the quarry's history other than it has been mined since at least 1950. Most of the crushed rock produced at the Curtner Quarry has been used for fill.

RMC Lonestar operates the Eliot sand and gravel property in Livermore Valley, Alameda County (see Figure 4); the Sunol sand and gravel property located in Sunol Valley, Alameda County (see Figure 5); and the Clayton crushed rock quarry situated along the east side of Mount Zion in Contra Costa County.

The Eliot site originally had four processing plants in operation in the late 1920s. In 1928, Rhodes-Jamieson Company, G. and M. Gravel Company, Coast Rock and Gravel Company, and California Rock Company merged with several other firms to form Pacific Coast Aggregates, Inc. In the mid 1960s Pacific Coast Aggregates, Inc. bought a cement plant from Santa Cruz Cement and became Pacific Cement and Aggregate. Soon afterwards, Lonestar Industries purchased Pacific Cement and Aggregate. Lonestar Industries changed its name to RMC Lonestar in the mid 1980s. Aggregate produced at the Eliot property is largely used for PCC, asphaltic concrete, and road base.

The Clayton Quarry was opened in 1947 by the Harrison-Birdwell Company. In 1954, the quarry was purchased by Pacific Coast Aggregates, Inc. and followed the same history of ownership as the Eliot site. The Clayton Quarry has been in operation continuously since its opening in 1947. Aggregate produced at the Clayton Quarry has largely been used for road base and asphaltic concrete.

The Sunol property, owned by the City of San Francisco, was first mined in 1960. In 1961, the lease was sold to Santa Clara Sand and Gravel and has been under continuous operation since then. RMC Lonestar purchased the operation in 1984. The Sunol property is still operated under the name of Santa Clara Sand and Gravel Company which is a subsidiary of the RMC Lonestar Company. Aggregate produced from RMC Lonestar's Sunol property is mostly sold for asphaltic concrete, PCC, and road base.

Stevens Creek Quarry, Inc. operates the Stevens Creek Quarry located on the west side of Santa Clara Valley in the low eastern foothills of the Santa Cruz Mountains, Santa Clara County. The quarry was first opened in the late 1930s by A.J. Voss who later incorporated his business to become Stevens Creek Quarry, Inc. The property has been mined continuously since its opening despite a few periods of low activity. The rock is used primarily for base, drain rock, fill, and some rip rap. A recycling plant was installed on the property in 1995.

West Coast Aggregates, Inc. operates the Pilarcitos Quarry in San Mateo County, about 2.5 miles northeast of Half Moon Bay, and the Lexington Quarry along the western edge of Santa Clara County about 1.5 miles southeast of the City of Los Gatos.

The Pilarcitos Quarry was opened in 1957. Lonestar Industries, Inc. (now RMC Lonestar Company) owned the property in 1980 and the property was sold to the Piombo Corporation in 1981. In 1993, the property was sold to its current owner. The current operating permit is up for renewal in 1997. Crushed rock produced at the quarry is mainly used for road base, drain rock, and fill sand.

The Lexington Quarry was first worked in the early 1960s. In 1980, the operation was owned by Hillsdale Rock Company. The last recorded production by Hillsdale Rock Company was in 1981. Sometime after this date, the quarry was sold to the Zanker Road Disposal Company. The quarry had little production from 1982 up until 1989 when Zanker Road Disposal sold the quarry to the current operator. Aggregate produced at the quarry is sold for asphaltic concrete, drain rock, railroad ballast, and road base.

INACTIVE/PROPOSED PERMITTED AGGREGATE OPERATIONS

The C.W. Swensen Company's Calaveras crushed stone quarry, Santa Clara County has been inactive since 1986 but still has a valid permit to mine rock. It is not known if or when the quarry plans to re-open.

Gallagher and Burk, Inc. closed the Leona Quarry, Contra Costa County, in early 1995. The mine is currently undergoing reclamation and there are no plans to re-open the quarry. Recycling of aggregate at the Leona site has been taking place since 1992.

A large crushed rock reserve and resource lies beneath Apperson Ridge. A permit was granted for mining the property in 1984 to the Oliver de Silva Company. To date, no mining has taken place. The reserves and resources for the Calaveras Quarry, Leona Quarry, and the Apperson Ridge property have been included in the total reserves for the South San Francisco Bay P-C Region.

CLOSURES OF AGGREGATE OPERATIONS

Since the original mineral land classification report was written, several crushed rock quarries have closed and no longer have valid mining permits. These include the Hillsdale Quarry (Santa Clara County), closed in mid-1990; the Neary Quarry (Santa Clara County), closed in 1989; the Page Mill Quarry, (Santa Clara County), closed in 1981; the Pacifica Quarry (San Mateo County) closed in 1985; the Point Molate Quarry (Contra Costa County), also known as the Richmond Quarry or the Chevron Quarry, closed in the late 1980s; and the San Leandro Quarry (Alameda County) closed in 1986. Recycled aggregate is currently being produced at the Point Molate Quarry.

PART III - ESTIMATED 50-YEAR CONSUMPTION OF AGGREGATE IN THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION

The State Mining and Geology Board (SMGB), as specified in its guidelines for classification and designation of mineral land (California State Mining and Geology Board, 1983, p. 23) requires that mineral land classification reports for regions containing construction materials classified as MRZ-2 include "*An estimate of the total quantity of each such construction material that will be needed to supply the requirements of both the county and the marketing region in which it occurs for the next 50 years. The marketing region is defined as the area within which such material is usually mined and marketed. The amount of each construction material mineral resource needed for the next 50 years shall be projected using past consumption rates adjusted for anticipated changes in market conditions and mining technology.*" The SMGB guidelines also specify that the State Geologist periodically review (every 10 years or less) the information in the reports to determine if a revision is warranted.

POPULATION PROJECTION FOR THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION

The population projection for the South San Francisco Bay P-C Region was estimated from official projections published by the State of California in May 1993 (California Department of Finance, 1993) for Alameda, Contra Costa, San Mateo, San Francisco, and Santa Clara counties. The projections are for the years 2000, 2010, 2020, 2030, and 2040. The interim years were estimated by equally dividing the difference between the decade projections into 10 increments. Population projection for the years 2041 through 2045 were visually extrapolated from the projections made by the California Department of Finance. Subtracted from these population totals were the population estimates for that part of southern Santa Clara County located outside the region which is included in the adjacent Monterey Bay P-C Region.

CORRELATION BETWEEN AGGREGATE PRODUCTION AND POPULATION

Although there are many factors that control, to some degree, the yearly demand for aggregate in any region, the single factor of population was selected to keep the basis for the forecast as simple as possible. Past studies of marketing areas in California have demonstrated a correlation between the amount of aggregate consumed and the population in the market area over an extended period of time (Anderson and others, 1979). Miller (1994) recently completed a correlation study between population and aggregate consumption in Los Angeles County. Linear regression analyses were performed on population and production data from 1960 to 1992 for the populations of the four P-C regions within the county and their combined production. The correlation coefficient between population and aggregate production in Los Angeles County was calculated to be r = .83. If the correlation between the two were perfect, r would equal 1, and if there were no correlation between them, r would equal 0. It can be roughly estimated what percent of the variation in annual production can be accounted for by the annual population by multiplying r-squared by 100. The result--69 percent--can be interpreted as meaning that about two-thirds of the variation in annual aggregate production can be attributed to change in population, which, for the past 3 decades, has been generally increasing. Miller's study also shows that the economy has had a definite influence on aggregate production but to keep the basis for the aggregate demand projection simple, no attempt was made to account for future economic conditions or other factors, such as public construction projects, which can randomly add large amounts of aggregate to consumption.

PROJECTED AGGREGATE DEMAND FOR THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION TO THE YEAR 2045

A 50-year forecast of construction aggregate demand for the South San Francisco Bay P-C Region was made on the basis of reported aggregate consumption and population data for the years 1953-1994 (see Table 4 and Figure 8). Consumption and population data for 1953-1980 was used from Special Report 146, Part II with some slight modifications made on population data to adjust for the 1980 census data which became available after the completion of the study. To estimate the future consumption of aggregate, an average per-capita consumption figure of 5.7 tons per year was derived using population and consumption records from 1953 to 1994 (see Figure 9 and Table 4).

The simple analysis of the historical aggregate production explained in the preceding section was used to forecast the aggregate demand in South San Francisco Bay P-C Region through the year 2045 (see Table 5 and Figure 10). An annual per-capita consumption rate of 5.7 tons was multiplied times the annual projected population, derived from figures published by the California Department of Finance (1993). The aggregate demand through the year 2045 is based on construction aggregate consumption and population from 1953 through 1994.

The results of these projections show that an estimated 1.76 billion tons of aggregate will be needed to satisfy the future demand of the South San Francisco Bay P-C Region through the year 2045.

According to the U.S. Bureau of Mines aggregate production statistics for the years 1980 to 1994, about 32 percent of the total aggregate consumed in the region was used in PCC aggregate. This estimate is based only on the records that contained separate figures for PCC aggregate production, 5 of the 15 years. This percentage equates to 563 million tons of PCC aggregate that will be needed within the next 50 years. Table 6 is a summary of present aggregate resources and future aggregate demands for the South San Francisco Bay P-C Region.

The wide variations from year to year in the historic aggregate consumption rate (Figure 8) probably reflect to a large degree, changes in urban growth rates and intermittent large construction projects (for example: freeways, dams, and canals). In part, these variations also result from incompleteness and inaccuracies in the production records supplied by the U.S. Bureau of Mines and the Office Of Mining and Reclamation. Certainly the economic climate is a powerful variable that influences aggregate demand. Very high interest rates, for example, as in California in 1979 and 1980, tended to lower the amount of new construction and consequently lower the demand for aggregate. Also, the economic recession at the beginning of the 1990s caused a sharp drop in aggregate production. High consumption of aggregate occurred in the region in the mid-1960s due to construction of freeways, and in the mid-and late-1980s as the construction industry recovered after the economic recession in the early 1980s. Also, major unforeseen events such as disaster reconstruction in the wake of an earthquake or a major economic recession would cause aggregate demand to change radically.

COMPARISON OF THE 50-YEAR AGGREGATE DEPLETION WITH CURRENT RESERVES

If all aggregate consumed in the South San Francisco Bay P-C Region came from the reserves indicated on Table 2, a comparison of total aggregate reserves with projected aggregate consumption (Table 5) would indicate that the region should run out of aggregate in the year 2016. However, about 30 percent of the aggregate consumption in the region comes from other aggregate sources. These include aggregate imported from areas outside the P-C Region, aggregate from sand dredging, and aggregate produced from recycled concrete and asphalt. In considering the rate of depletion, it is necessary to factor in these other aggregate sources. By subtracting 30 percent of the projected aggregate consumption tonnages on Table 5, estimates of projected aggregate depletion for the South San Francisco Bay P-C Region were made (see Table 7). Table 7 indicates that estimated aggregate reserves of 676 million tons for the South San Francisco Bay P-C Region will be depleted in the year 2024 by supplying the region with 70 percent of its demand.

Table 4. - Population, aggregate consumption, and per-capita consumption of aggregate in the South San Francisco Bay Production-Consumption Region during the period 1953-1994.

YEAR	POPULATION	*AGGREGATE CONSUMPTION	ANNUAL PER-CAPITA CONSUMPTION (TONS)	YEAR	POPULATION	*AGGREGATE CONSUMPTION	ANNUAL PER-CAPITA CONSUMPTION (TONS)
1953	2,588,500	10,684,000	4.1	1974	3,972,500	25,611,000	6.4
1954	2,649,100	10,066,000	3.8	1975	4,005,300	17,684,000	4.4
1955	2,694,000	13,343,000	5.0	1976	4,035,400	19,016,000	4.7
1956	2,779,000	19,296,000	6.9	1977	4,060,600	19,892,000	4.9
1957	2,857,800	14,363,000	5.0	1978	4,088,700	25,223,000	6.2
1958	2,952,500	15,519,000	5.3	1979	4,108,000	30,428,000	7.4
1959	3,035,900	16,066,000	5.3	1980	4,148,300	22,927,000	5.5
1960	3,112,100	15,575,000	5.0	1981	4,196,300	22,163,000	5.3
1961	3,204,200	16,659,000	5.2	1982	4,245,400	21,140,000	5.0
1962	3,286,800	17,800,000	5.4	1983	4,314,100	23,518,000	5.5
1963	3,379,200	22,250,000	6.6	1984	4,367,100	25,482,000	5.8
1964	3,425,800	24,099,000	7.0	1985	4,432,000	27,829,000	6.3
1965	3,526,700	25,603,000	7.3	1986	4,482,000	27,212,000	6.1
1966	3,598,100	23,389,000	6.5	1987	4,529,100	24,990,000	5.5
1967	3,680,200	24,645,000	6.7	1988	4,594,400	25,336,000	5.5
1968	3,740,700	26,914,000	7.2	1989	4,662,000	26,616,000	5.7
1969	3,785,800	30,517,000	8.1	1990	4,719,300	25,833,000	5.5
1970	3,855,200	24,683,000	6.4	1991	4,790,200	22,291,000	4.7
1971	3,903,100	29,615,000	7.6	1992	4,875,500	20,342,000	4.2
1972	3,930,700	23,140,000	5.9	1993	4,941,200	20,604,000	4.2
1973	3,953,000	24,751,000	6.3	1994	4,994,500	21,834,000	4.4

Average annual per-capita aggregate consumption 1953-1994 = 5.7 tons
* rounded to nearest 1,000 tons

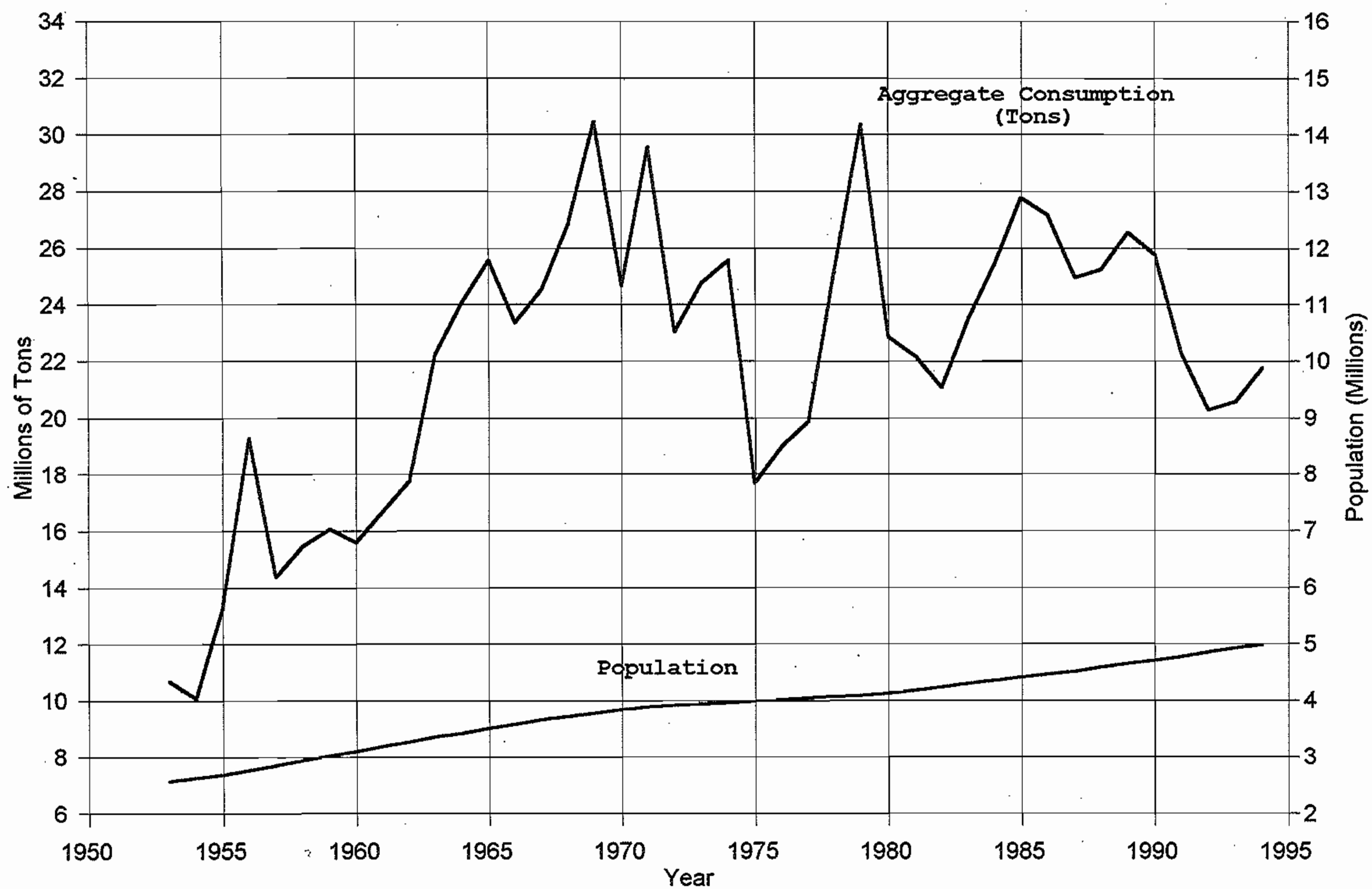


Figure 8. South San Francisco Bay Production-Consumption Region: population and aggregate consumption records for years 1953-1994.

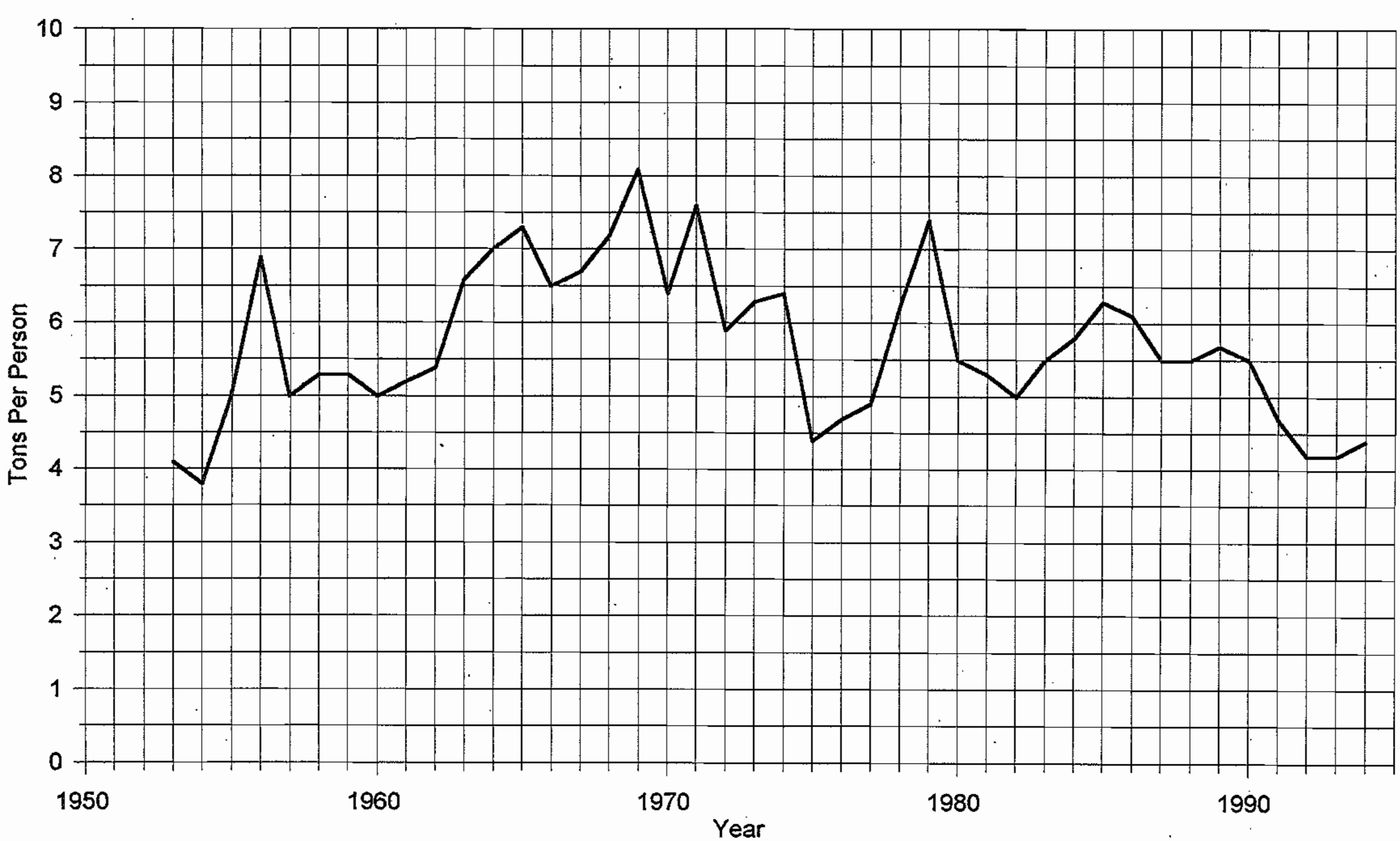


Figure 9. Annual per-capita consumption of aggregate in the South San Francisco Bay Production-Consumption Region for the years 1953-1994.

YEARS	AVERAGE POPULATION	PROJECTED AGGREGATE CONSUMPTION (TONS)	PROJECTED AGGREGATE CONSUMPTION (TONS) RUNNING TOTAL
1995-1999	5,177,620	147,600,000	147,600,000
2000-2004	5,440,164	155,000,000	302,600,000
2005-2009	5,638,710	160,700,000	463,300,000
2010-2014	5,828,181	166,100,000	629,400,000
2015-2019	6,004,040	171,100,000	800,500,000
2020-2024	6,173,070	175,900,000	976,400,000
2025-2029	6,331,858	180,500,000	1,156,900,000
2030-2034	6,469,213	184,400,000	1,341,300,000
2035-2039	6,574,419	187,400,000	1,528,700,000
2040-2044	6,682,525	190,500,000	1,719,200,000
2045	6,750,000	38,500,000	1,757,700,000

Table 5. Projected aggregate consumption for the South San Francisco Bay Production-Consumption Region 1995-2045 (all tonnage figures rounded to nearest 100,000 tons).

Total projected aggregate consumption to the year 2045 = **1,757,700,000 tons**

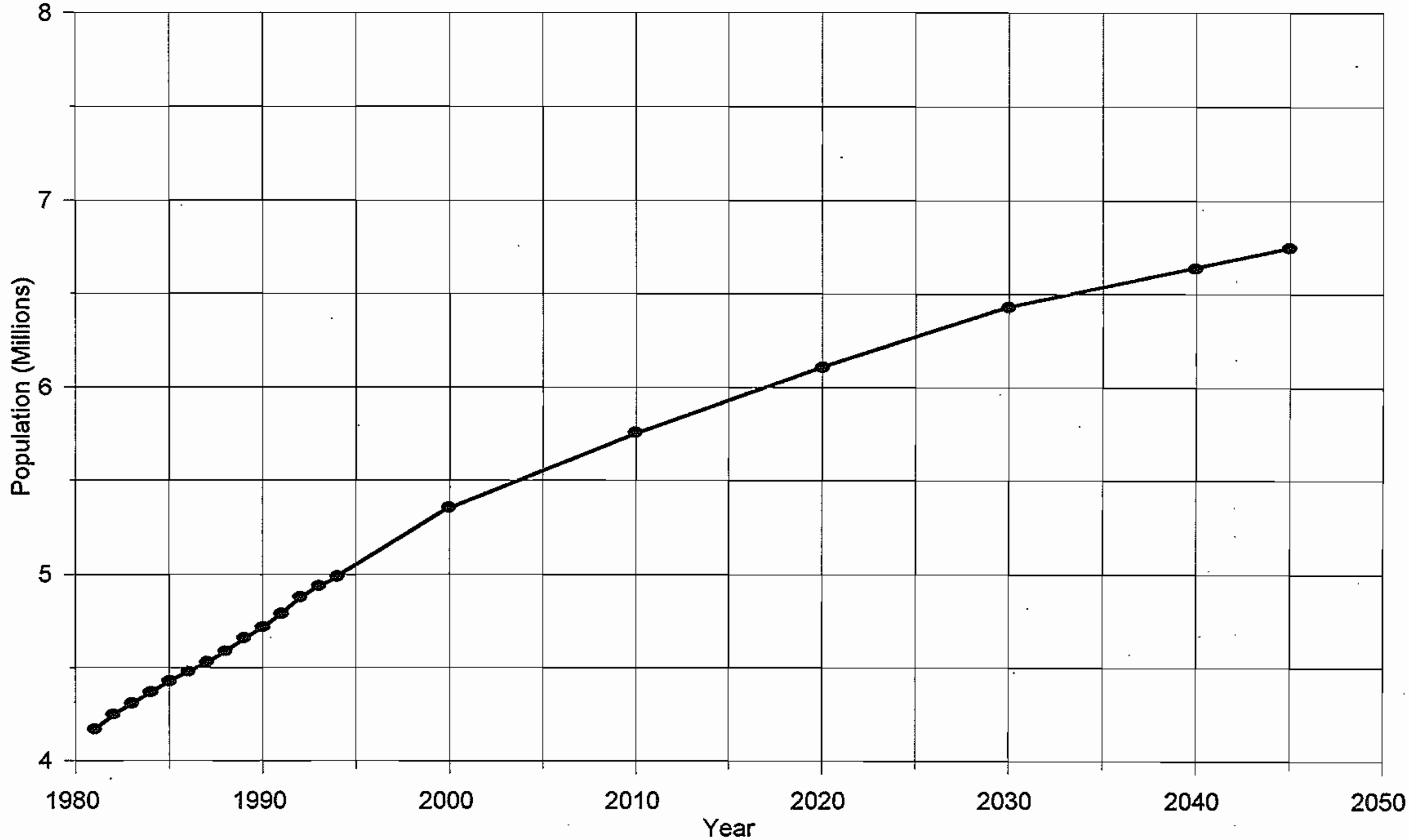


Figure 10. Projected population of the South San Francisco Bay Production-Consumption Region to the year 2045.

Construction-grade aggregate resources (includes aggregate reserves)	3,775 million tons
Construction-grade aggregate reserves	676 million tons
50-year demand, all aggregate	1,758 million tons
50-year demand, PCC aggregate	563 million tons

Table 6. Summary of aggregate resources and projected 50-year consumption for the South San Francisco Bay Production-Consumption Region.

YEARS	AVERAGE POPULATION	* PROJECTED AGGREGATE DEPLETION (TONS)	*PROJECTED AGGREGATE DEPLETION (TONS) RUNNING TOTAL
1995-1999	5,177,620	103,300,000	103,300,000
2000-2004	5,440,164	108,500,000	211,800,000
2005-2009	5,638,710	112,500,000	324,300,000
2010-2014	5,828,181	116,300,000	440,600,000
2015-2019	6,004,040	119,800,000	560,400,000
2020-2024	6,173,070	123,200,000	683,600,000
2025-2029	6,331,858	126,300,000	809,900,000
2030-2034	6,469,213	129,100,000	939,000,000
2035-2039	6,574,419	131,200,000	1,070,200,000
2040-2044	6,682,525	133,300,000	1,203,500,000
2045	6,750,000	27,500,000	1,230,500,000

Table 7. Projected aggregate depletion of reserves for the South San Francisco Bay Production-Consumption Region 1995-2045 (all tonnage figures rounded to nearest 100,000 tons).

Total projected aggregate depletion to the year 2045 = **1,230,500,000 tons.**

*Projected aggregate depletion based on 70 percent of the total projected aggregate consumption shown on Table 5.

PART IV - ALTERNATIVE SOURCES OF AGGREGATE

The potential sources of construction aggregate, in addition to the deposits classified as MRZ-2, which exist within and near the South San Francisco Bay P-C Region were discussed in Special Report 146, Part II. Included were potential resources within the P-C Region that were classified as MRZ-3, marine sand and gravel deposits in the San Francisco Bay area, and aggregate production districts in the neighboring P-C Regions of North San Francisco Bay, Monterey Bay, and Sacramento-Fairfield.

At the time of the original report, the only significant aggregate being imported to the South San Francisco Bay P-C Region came from the neighboring Monterey Bay P-C Region. Since then, sand and gravel has been imported from the Stockton-Lodi P-C Region. Roughly 17 percent of all aggregate consumed in the South San Francisco Bay P-C Region comes from adjacent P-C regions.

Sand dredged from the Suisun and San Francisco bays located in Marin and Solano counties is consumed in the South San Francisco Bay P-C Region. Although consumption data is not available, it is estimated to be less than 500,000 tons per year. About 25 percent of the sand produced from dredging is used for PCC sand.

PART V - COMPARISON OF PROJECTED AGGREGATE CONSUMPTION TO ACTUAL CONSUMPTION IN THE SOUTH SAN FRANCISCO BAY PRODUCTION-CONSUMPTION REGION, 1981-1994

The original mineral land classification of aggregate resources in the South San Francisco Bay P-C Region was published as Part II of Special Report 146 - Mineral Land Classification of the San Francisco-Monterey Bay Area (Stinson, and others, 1987). The report's projection for aggregate consumption of the South San Francisco Bay P-C Region to 1994 was based on an annual per-capita consumption of 6.0 tons and a population projection by the California Department of Finance (1977) and DMG staff.

Figure 11 compares the actual yearly aggregate consumption for the years 1981 through 1994 to that projected in the 1983 report for the same years. The projected aggregate consumption for this 14-year period totaled 401 million tons. This is 17 percent more than the 335 million tons that were actually consumed in the P-C Region that period. This level of accuracy is expected in the simplistic forecast technique used. This decrease in aggregate consumption was probably due to the economic recessions in the early 1980s and 1990s, slowing the rate of commercial and residential development in the region. The per-capita consumption rate decreased from an average of 6.0 tons in the period from 1953 to 1980 to 5.7 tons in the years 1981 to 1994. There were 271,000 more people in the P-C Region in 1994 than were predicted in 1980 (Figure 12). This is a 5 percent increase from the projected population.

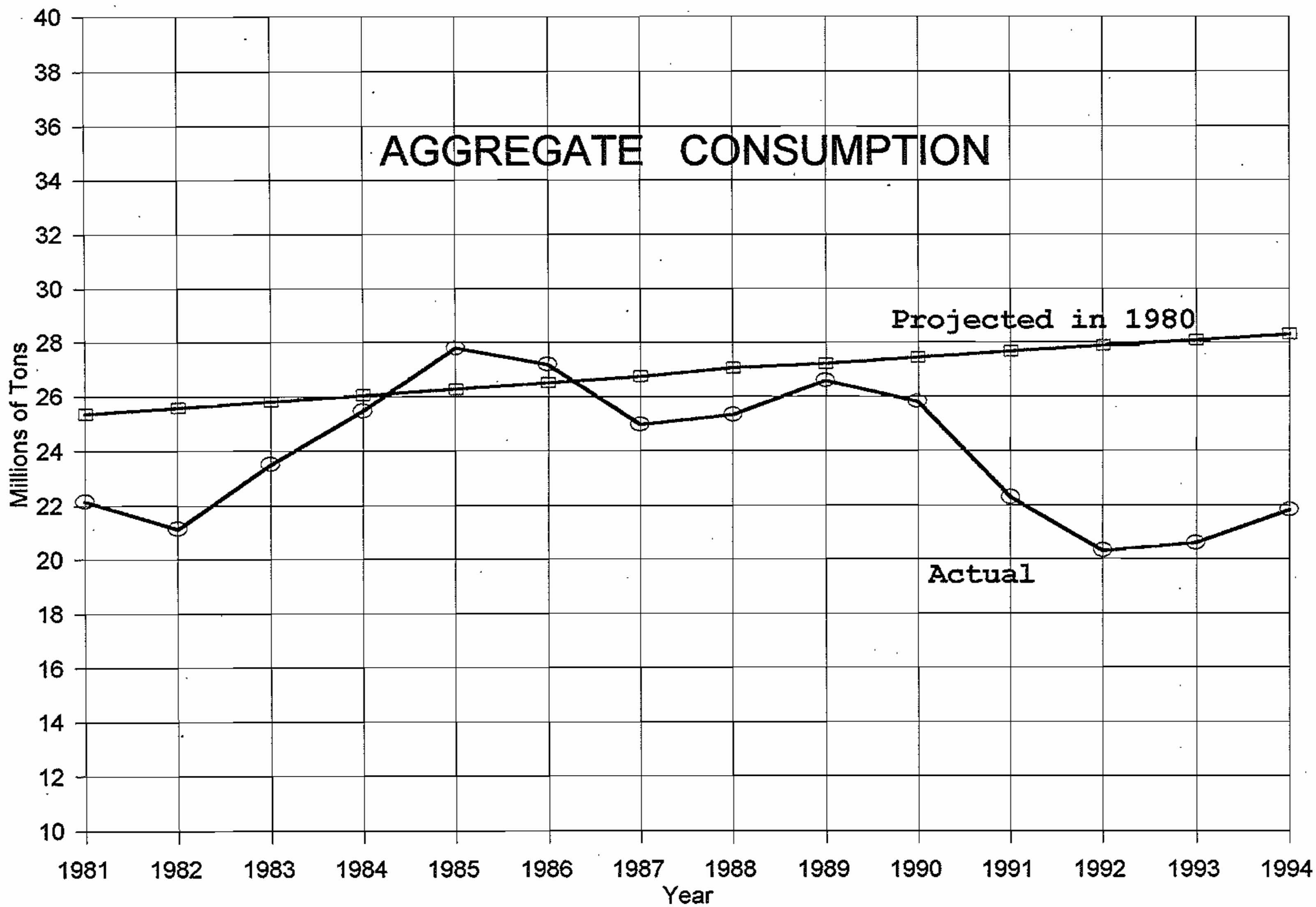


Figure 11. Comparison of aggregate consumption in the South San Francisco Bay Production-Consumption Region for the years 1981 to 1994, with the forecast in Special Report 146, Part II (Stinson and others, 1987).

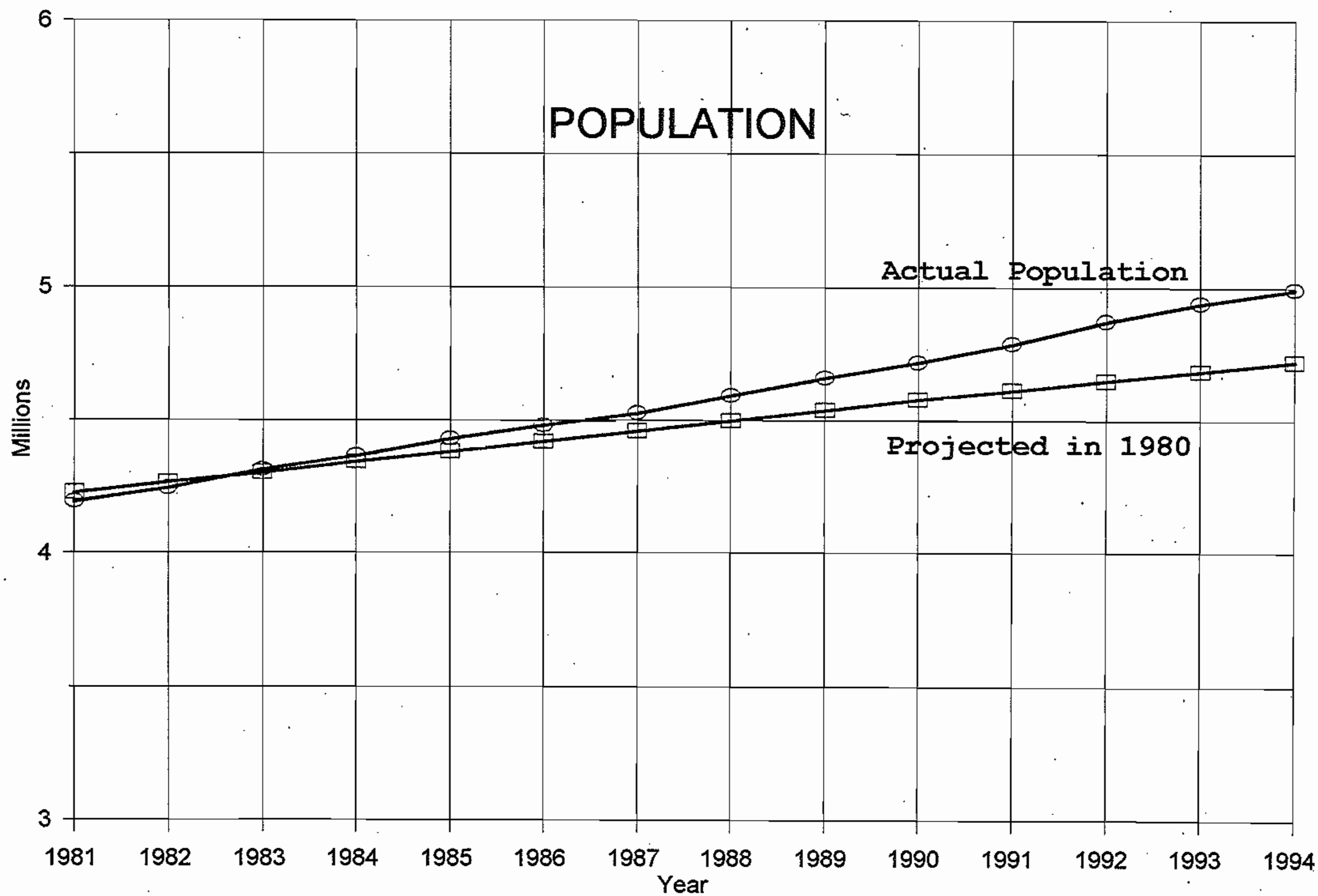


Figure 12. Comparison of population in the South San Francisco Bay Production-Consumption Region for the years 1981 to 1994, with the forecast in Special Report 146, Part II (Stinson and others, 1987).

PART VI - CONCLUSIONS

Within the South San Francisco Bay P-C Region, 42 Aggregate Resource Sectors have previously been classified, one area has been reclassified, and one area has been newly classified as containing significant resources of construction-grade aggregate, Of the 42 Aggregate Resource Sectors that were originally classified, 30 of them were designated by the SMGB as being regionally significant. A reevaluation of construction-grade aggregate resources (both permitted and unpermitted resources) shows that the designated areas and the newly classified areas combined contain an estimated total of 3,775 million tons of geologically and technologically available construction-grade aggregate resources.

The average annual per-capita consumption rate of aggregate materials in the South San Francisco Bay P-C Region from 1953 to 1994 was 5.7 tons. This is a reduction from the 6.0 tons per-capita consumption rate from 1953 to 1980. The population from 1980 to 1994 has increased by 5 percent more than the projection made in 1980.

Based upon available production data and population projections, the South San Francisco Bay P-C Region will need to produce about 1.76 billion tons of aggregate during the next 50 years. Of this projected demand, approximately 32 percent, or 563 million tons, must be suitable for use in PCC.

The use of recycled aggregate, dredge sand, and aggregate imported from outside the South San Francisco Bay P-C Region has reduced the rate of aggregate depletion by about 30 percent.

Unless new resources are permitted for mining, or alternative resources are utilized, existing reserves may be depleted in the year 2024. This is approximately 55 percent of the projected aggregate depletion for the next 50 years. If a major earthquake or similar unforeseen catastrophic event strikes the San Francisco Bay region and necessitates reconstruction, existing reserves will be depleted sooner.

The forecast of aggregate demand of 401 million tons published in the 1983 report for the period 1981 to 1994, was within 17 percent of the actual aggregate consumption of 335 million tons for this same period. This level of accuracy is expected for the simplistic forecast technique used.

Based upon results, designation appears to have been highly effective in preserving significant aggregate resources. Only 2 percent of the designated aggregate resources--75 million tons--were lost due to urbanization since designation in 1986 in spite of an influx of more that 500,000 people to the South San Francisco Bay P-C Region.

In 1980, construction-grade aggregate reserves available within the South San Francisco Bay P-C Region amounted to 552 million tons. Subtracting reserves lost due to consumption, mine closures and other causes, and adding newly permitted or newly classified reserves, the total reserves available in 1994 amount to 676 million tons. This is a total net gain of 124 million tons.

In 1986, the total construction-grade aggregate resources available in designated areas amounted to 4,060 million tons. Since then, aggregate consumption, urbanization and reclassification of land in designated areas have reduced these resources to 3,700 million tons. Updated mineral land classification has identified an additional 75 million tons of aggregate resources in non-designated areas which have been reclassified or newly classified. In adding these 75 million tons to the 3,700 million tons of resources in designated areas, the total 1994 resources for the South San Francisco Bay P-C Region amounts to 3,775 million tons. This is a net loss of 285 million tons.

The following two tables summarize construction-grade aggregate reserves and resources:

RESERVE SUMMARY (all totals in million tons)	
552	1980 Reserves
-29	Reserves lost due to mine closures and other causes
-253	Reserves lost due to consumption
+406	Newly permitted or newly classified reserves
676	1994 Reserves

Total net gain in reserves (1980-1994) = 124 million tons

RESOURCE SUMMARY (all totals in million tons)	
*4,060	Total resources in designated areas 1986
-253	Resources lost due to consumption
-75	Resources lost due to urbanization
-32	Resources lost due to classification change
3,700	Total resources available in designated areas 1994
+75	Resources added in reclassified and newly classified lands
3,775	1994 Resources in designated and non-designated areas

Total net loss in resources (1986-1994) = 285 million tons

* Does not include 2261 million tons of resources in non-designated areas.

ACKNOWLEDGMENTS

DMG gratefully acknowledges the full cooperation of all local government agencies, organizations, and especially the producers, all of whom provided information during the course of this study. Special thanks are extended to Leonard Banda, Senior Planner, City of Fremont; Herb Maricle, State Lands Commission; Malcom Carpenter, City of Colma; Bruce Jensen, Alameda County; Sam Hertzberg, San Mateo County; Ransom Bratton, Santa Clara County; George Cope, the Aggregate Producers Association of Northern California; Larry Appleton, Kaiser Sand and Gravel Company; Pete Cotter, RMC Lonestar; Richard Kelly, Don Kahler and Dennis Hunt, CalMat Company; Richard de Atley, West Coast Aggregates; Karen Spinardi, Spinardi Associates; Rick Navarro, A.J. Raisch, Inc.; Tom Chasm, Specialty Crushing, Inc.; Sam Johnson, California Rock and Asphalt, Inc.; Bill Montgomery, Harbor Sand and Gravel Co.; and Tom McKenzie, Stevens Creek Quarry, Inc.

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APPENDIX

CALIFORNIA MINERAL LAND CLASSIFICATION SYSTEM

MINERAL RESOURCE ZONE CATEGORIES

DMG has classified the South San Francisco Bay P-C Region according to the presence or absence of significant concrete-grade aggregate deposits. The land classification is presented in the form of Mineral Resource Zones, or MRZ's. Directions for the identification of Mineral Resource Zones are set forth in DMG's Special Publication 51 in the section "Guidelines for Classification and Designation of Mineral Lands" (California State Mining and Geology Board, 1983).

The guidelines for establishing the Mineral Resource Zones are as follows:

MRZ-1: Areas where available geologic information indicates that little likelihood exists for the presence of significant mineral resources.

MRZ-2a: Areas underlain by mineral deposits where geologic data indicate that significant measured or indicated resources are present. As shown on the California Mineral Land Classification Diagram (Figure 13), MRZ-2 is divided on the basis of both degree of knowledge and economic factors. Areas classified MRZ-2a contain discovered mineral deposits that are either measured or indicated reserves as determined by such evidence as drilling records, sample analysis, surface exposure, and mine information. Land included in the MRZ-2a category is of prime importance because it contains known economic mineral deposits.

MRZ-2b: Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present. For this report, areas classified MRZ-2b contain discovered mineral deposits that are significant inferred resources as determined by their lateral extension from proven deposits or their similarity to proven deposits. Further exploration work could result in upgrading areas classified MRZ-2b to MRZ-2a.

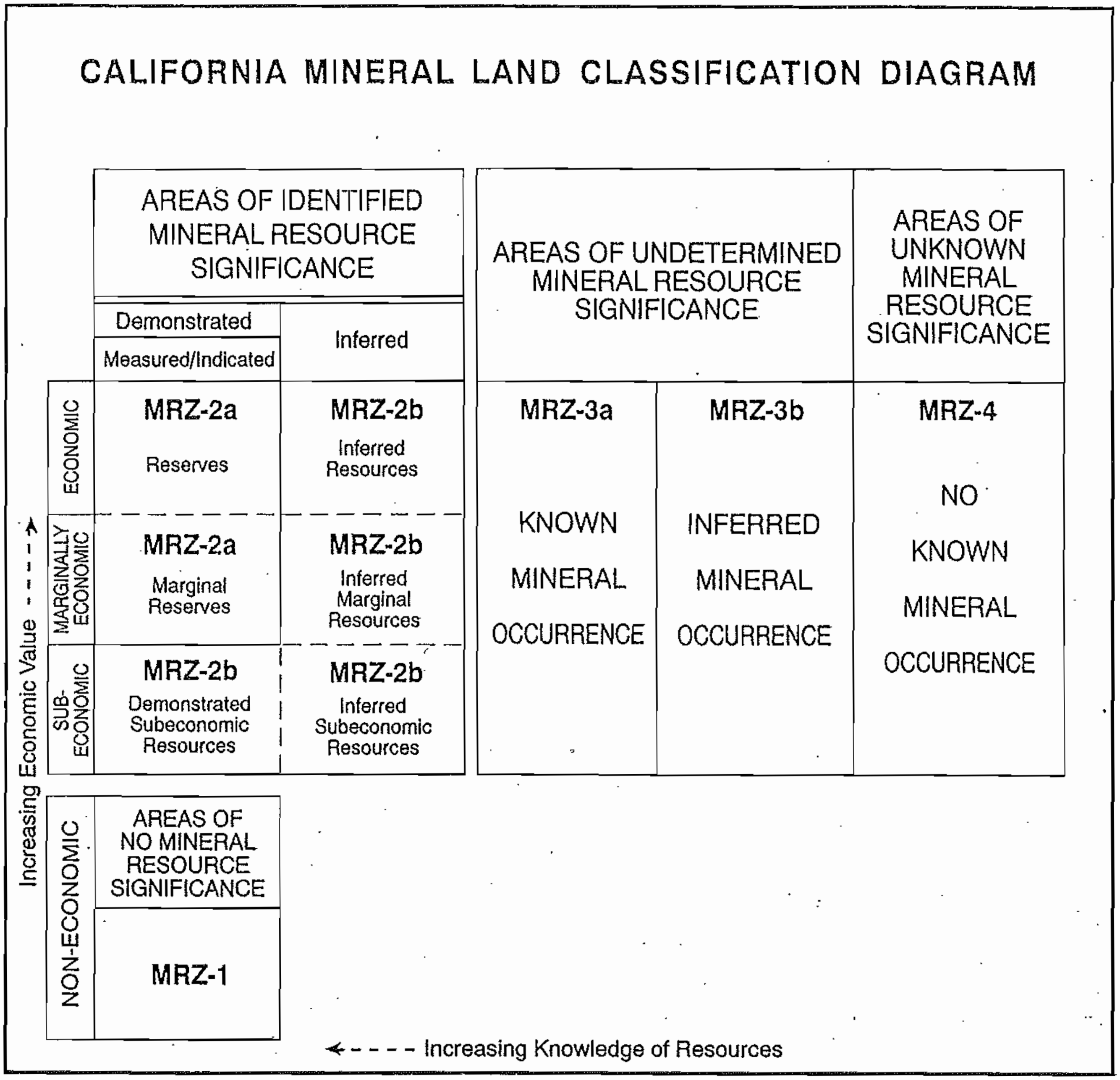

Figure 13. California Mineral Land Classification Diagram: Diagrammatic relationship of mineral resource zone categories to the resource/reserve classification system. Adapted from U.S. Bureau of Mines/U.S. Geological Survey (1980).

MRZ-3a: Areas containing known mineral occurrences of undetermined mineral resource significance. Further exploration work within these areas could result in the reclassification of specific localities into a MRZ-2a or MRZ-2b category. As shown on the California Mineral Land Classification Diagram, MRZ-3 is divided on the basis of knowledge of economic characteristics of the resources.

MRZ-3b: Areas containing inferred mineral occurrences of undetermined mineral resource significance. Land classified MRZ-3b represents areas in geologic settings that appear to be favorable environments for the occurrence of specific mineral deposits. Further exploration work could result in the reclassification of all or part of these areas into the MRZ-2a or MRZ-2b category.

MRZ-4: Areas of no known mineral occurrences where geologic information does not rule out either the presence or absence of significant mineral resources.

The distinction between the MRZ-1 and the MRZ-4 categories is important for land-use considerations. <u>It must be emphasized that MRZ-4 classification does not imply that there is little likelihood for the presence of mineral resources, but rather there is a lack of knowledge regarding mineral occurrence.</u> Further exploration work could well result in the reclassification of land in MRZ-4 areas to a MRZ-3 or MRZ-2 category.

MINERAL RESOURCE/RESERVE CLASSIFICATION NOMENCLATURE

Following are definitions of the nomenclature associated with the California Mineral Land Classification Diagram (Figure 13). It is important to refer to these definitions when studying the different resource categories shown on the California Mineral Land Classification Diagram. Particular attention should be given to the distinction between a mineral deposit and a resource and to how a mineral deposit may relate to resources.

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MINERAL DEPOSIT: A mass of natural occurring mineral material, e.g. metal ores or nonmetallic minerals, usually of economic value, without regard to mode of origin. The mineral material may be of value for its chemical and/or physical characteristics.

MINERAL OCCURRENCE: Any ore or economic mineral in any concentration found in bedrock or as float; especially a valuable mineral in sufficient concentration to suggest further exploration.

ECONOMIC: This term implies that profitable extraction or production under defined investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty.

MINERAL RESOURCE: A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible. The terms resource and mineral resource are synonymous in this report.

RESERVES: That part of the resource base which could be economically extracted or produced at the time of determination. For the purposes of this report, the term reserves has been further restricted to include only those deposits for which a valid mining permit has been granted by the appropriate lead agency.

IDENTIFIED MINERAL RESOURCES: Resources whose location, grade, quality, and quantity are known or estimated from specific geologic evidence. Identified mineral resources include economic, marginally economic, and subeconomic components. To reflect varying degrees of geologic certainty, these economic divisions can be subdivided into demonstrated and inferred.

DEMONSTRATED: A term for the sum of measured plus indicated.

MEASURED: Quantity is computed from dimensions revealed in outcrops, trench workings, or drill holes; grade and/or quality are computed from the results of detailed sampling. The sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of the resource are well established.

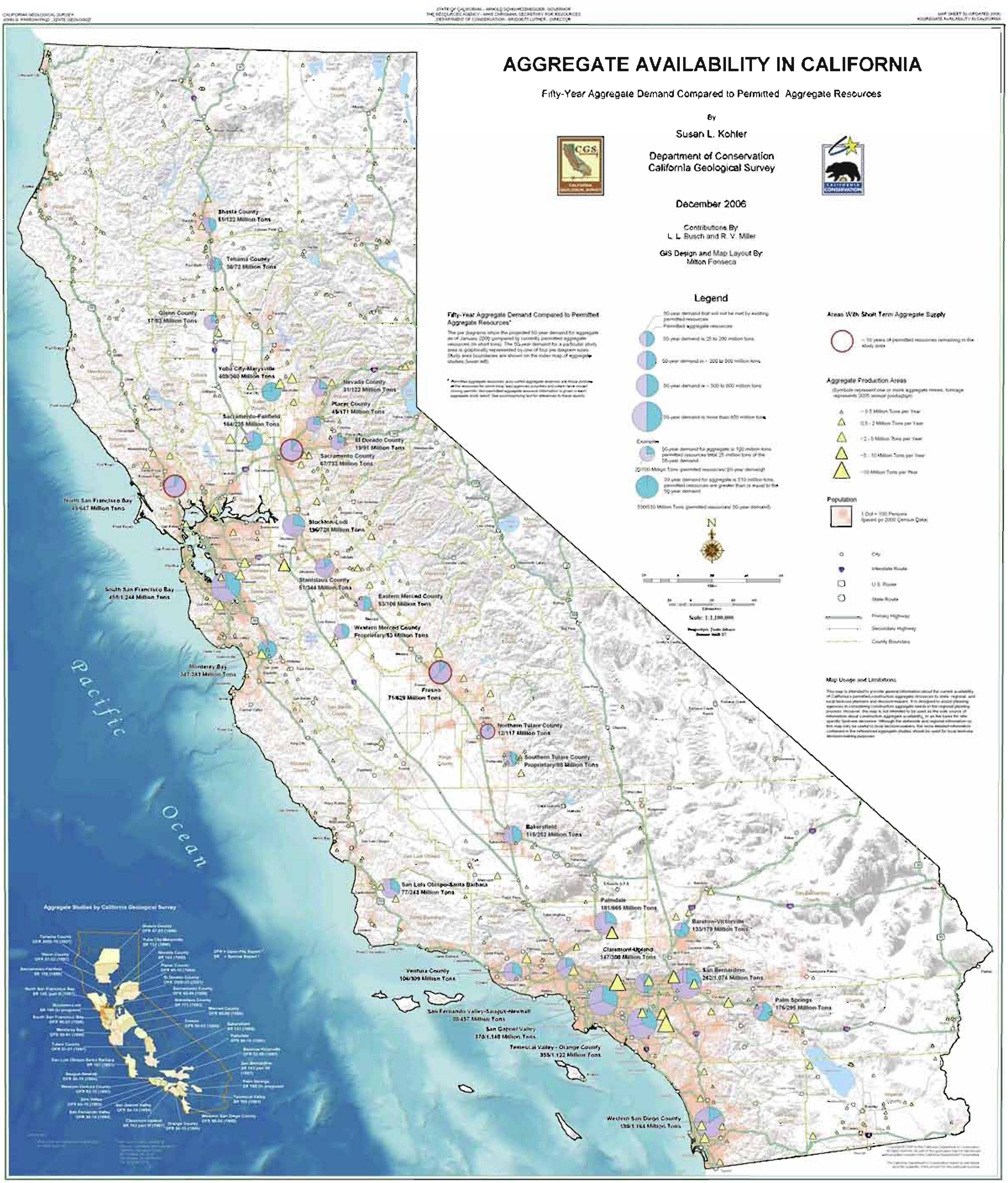
INDICATED: Quantity and grade and/or quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, and measurement are farther apart or otherwise less adequately spaced. The degree of assurance, although lower than that for measured resources, is high enough to assume continuity between points of observation.

INFERRED: Estimates are based on an assumed continuity beyond measured and/or indicated resources, for which there is geologic evidence. Inferred resources may or may not be supported by samples or measurements.

MARGINAL RESERVES: That part of the demonstrated reserve base that, at the time of determination, borders on being economically producible. The essential characteristic of this term is economic uncertainty. Included are resources that would be producible, given postulated changes in economic or technologic factors.

MARGINAL RESOURCES: That part of the inferred resource base that, at the time of determination, would be economically producible, given postulated changes in economic or technologic factors.

SUBECONOMIC RESOURCES: The part of identified resources that does not meet the economic criteria of marginal reserves and marginal resources.



AGGREGATE AVAILABILITY IN CALIFORNIA
Fifty-Year Aggregate Demand Compared to Permitted Aggregate Resources
By
Susan L. Kohler
Department of Conservation
California Geological Survey
December 2006
Contributions By
L. L. Busch and R. V. Miller
GIS Design and Map Layout By
Milton Fonseca
Legend
Fifty-Year Aggregate Demand Compared to Permitted Aggregate Resources*
Areas With Short Term Aggregate Supply
Aggregate Production Areas
Population
Map Usage and Limitations
Shasta County
51/122 Million Tons
Tehama County
30/72 Million Tons
Glenn County
17/83 Million Tons
Yuba City-Marysville
409/360 Million Tons
Nevada County
31/122 Million Tons
Placer County
45/171 Million Tons
Sacramento-Fairfield
164/235 Million Tons
El Dorado County
19/91 Million Tons
Sacramento County
67/733 Million Tons
North San Francisco Bay
Stockton-Lodi
Stanislaus County
51/344 Million Tons
South San Francisco Bay
Eastern Merced County
53/106 Million Tons
Western Merced County
Proprietary/53 Million Tons
Monterey Bay
Fresno
71/629 Million Tons
Northern Tulare County
12/117 Million Tons
Southern Tulare County
Proprietary/86 Million Tons
Pacific
Ocean
Bakersfield
115/252 Million Tons
San Luis Obispo-Santa Barbara
77/243 Million Tons
Palmdale
181/665 Million Tons
Barstow-Victorville
133/179 Million Tons
Claremont-Upland
147/300 Million Tons
Ventura County
106/309 Million Tons
San Bernardino
262/1,074 Million Tons
Palm Springs
176/295 Million Tons
San Fernando Valley-Saugus-Newhall
San Gabriel Valley
Temescal Valley - Orange County
Western San Diego County
Aggregate Studies by California Geological Survey

MAP SHEET 52

(UPDATED 2006)

AGGREGATE AVAILABILITY IN CALIFORNIA

2006

CALIFORNIA GEOLOGICAL SURVEY

DEPARTMENT OF CONSERVATION
California Geological Survey

THE RESOURCES AGENCY	**STATE OF CALIFORNIA**	**DEPARTMENT OF CONSERVATION**
MIKE CHRISMAN	ARNOLD SCHWARZENEGGER	BRIDGETT LUTHER
SECRETARY FOR RESOURCES	*GOVERNOR*	*DIRECTOR*

CALIFORNIA GEOLOGICAL SURVEY
JOHN G. PARRISH, PH.D., *STATE GEOLOGIST*

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MAP SHEET 52

(UPDATED 2006)

AGGREGATE AVAILABILITY IN CALIFORNIA

By

Susan Kohler

2006

DEPARTMENT OF CONSERVATION

CALIFORNIA GEOLOGICAL SURVEY

801 K Street, MS 14-34

Sacramento, CA 95814-3531

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TABLES

INTRODUCTION

California Geological Survey (CGS) Map Sheet 52, scale 1:1,100,000, and this accompanying report provide general information about the current availability of California's permitted aggregate resources. Although the statewide and regional information on the map and in this report may be useful to local decision-makers, the more detailed information contained in each of the aggregate studies employed in the compilation of Map Sheet 52 should be used for land-use and decision making purposes.

Map Sheet 52 (2006) is an update of the original version published in 2002 (Kohler, 2002). This updated Map Sheet 52 summarizes data from reports compiled by the CGS for 31 aggregate study areas throughout the state. These study areas cover about 25 percent of the state and provide aggregate for about 90 percent of California's population. This report is divided into three parts: Part I provides data sources and methods used to derive the information presented, Part II compares the updated 2006 Map Sheet 52 to the original map, and Part III is an overview of construction aggregate. **All aggregate data and any reference to "aggregate" in this report and on the map pertain to "construction aggregate" defined for this report as alluvial sand and gravel or crushed stone that meets standard specifications for use in portland cement concrete (PCC) or asphalt concrete (AC).** (See *Aggregate Quality and Use* section).

PART I: DESCRIPTION OF MAP SHEET 52, AGGREGATE AVAILABILITY IN CALIFORNIA

Map Sheet 52 is a statewide map showing a compilation of data about aggregate availability collected over a period of about 28 years and updated to January 1, 2006. The purpose of the map is to compare projected aggregate demand for the next 50 years with currently permitted aggregate resources in 31 regions of the state. The map also highlights regions where there is less than 10 years of permitted aggregate supply remaining (red circles). The following sections describe data sources and methodology that were used in the development of the map.

Mineral Land Classification Reports and Aggregate Studies

Data regarding aggregate resources and projected aggregate demand shown on Map Sheet 52 are updated from a series of mineral land classification reports published as Special Reports (SR) and Open-File Reports (OFR) by CGS between 1981 and 2005. These reports are referenced in the Appendix. They were prepared in response to California's Surface Mining and Reclamation Act of 1975 (SMARA) that require the State Geologist to classify land based on the known or inferred mineral resource potential of that land. SMARA, its regulations and guidelines, are described in Special Publication 51(Division of Mines and Geology, 2000). The Mineral Land Classification process identifies lands that contain economically significant mineral deposits. The primary goal of mineral land classification is to ensure that the mineral resource potential of lands is recognized and considered in land-use planning. The classification process includes an assessment of the quantity, quality, and extent of aggregate deposits in a study area.

Mineral land classification reports may be specific to aggregate resources, may contain information about both aggregate and other mineral resources, or they may only contain information on minerals other than aggregate. Reports that focus on aggregate include aggregate resource classification and mapping, quantitative calculations of permitted and non-permitted aggregate resources, calculated 50-year demand for aggregate resources, and an estimate of when the permitted resources will be depleted. Map Sheet 52 is a statewide updated summary of 50-year demands and permitted resource calculations for all SMARA classification reports pertaining to construction aggregate.

Mineral land classification studies completed before 1989 used Production-Consumption (P-C) regions as the study area boundary. A P-C region is one or more aggregate production districts (a group of producing aggregate mines) and the market area they serve. The State Mining and Geology Board (SMGB) in 1989 changed the scope of the mineral classification studies from P-C regions to countywide studies because counties are one of the primary users of the reports. As a result of this change, classification reports became more user-friendly for local government planners.

Mineral land classification reports include information from one or more P-C regions, or from a county. For ease in discussion, the area covered by each P-C region or county aggregate study is referred to as an "aggregate study area". These areas are shown at the lower left-hand corner of the map along with their respective OFR or SR number and publication date. It should be noted that an OFR or SR may include more than one aggregate study area.

As provided by SMARA, the State Geologist is required to review mineral land classification every 10 years following the census to determine if new classifications are necessary. The projected 50-year forecast of aggregate demand in the region may also be revised. Seven updated classification studies have been completed. Updated studies were done by counties (Los Angeles, Orange, and Ventura) and by P-C regions (South San Francisco Bay, Monterey Bay, Western San Diego County, and Fresno). Since Los Angeles and Ventura counties had more than one P-C region, separate updated 50-year forecasts were made for each region. The Los Angeles County update (OFR 94-14) includes the San Fernando Valley, San Gabriel Valley, Saugus-Newhall, and the Palmdale P-C regions. The Ventura County update (OFR 93-10) included the Western Ventura and the Simi Valley P-C regions. The index map of aggregate studies shown in the lower left hand corner of Map Sheet 52 shows the latest reports that cover an aggregate study area. Earlier reports covering the same areas or portions of areas are referenced in the Appendix with an asterisk ("*").

Fifty-Year Aggregate Demand Forecast

The fifty-year aggregate demand forecast for each of the aggregate study areas is presented on Map Sheet 52 as a pie diagram (See *Fifty-Year Aggregate Demand Compared to Permitted Aggregate Resources* section), and also is presented in Table 1. The demand information may be new, or updated from previously published mineral land classification reports. The demand forecast information depicted on Map Sheet 52 is for the period January 1, 2006 through December 2055.

The aggregate study areas with the greatest projected future need for aggregate are the South San Francisco Bay, San Gabriel Valley, Temescal Valley-Orange County, Western San Diego County and San Bernardino. Each is expected to require more than a billion tons of aggregate by the end of 2055. Aggregate study areas that have small demands generally are located in less populated areas. These include the Sierra Nevada counties of Placer, Nevada, and El Dorado, and Merced and Tulare counties in the San Joaquin Valley.

AGGREGATE STUDY AREA [1]	**50-Year Demand** (million tons)	**Permitted Aggregate Resources** (million tons)	**Percentage of Permitted Aggregate Resources as Compared to the 50-Year Demand**
Bakersfield P-C Region	252	115	46
Barstow-Victorville P-C Region	179	133	74
Claremont-Upland P-C Region	300	147	49
El Dorado County	91	19	21
Fresno P-C Region	629	71	11
Glenn County	83	17	21
Merced County[2]			
Eastern Merced County	106	53	50
Western Merced County	53	Proprietary	<50
Monterey Bay P-C Region	383	347	91
Nevada County	122	31	25
Palmdale P-C Region	665	181	27
Palm Springs P-C Region	295	176	60
Placer County	171	45	26
North San Francisco Bay P-C Region	647	49	8
Sacramento County	733	67	9
Sacramento-Fairfield P-C Region	235	164	70
San Bernardino P-C Region	1,074	262	24
San Fernando Valley-Saugus-Newhall [3]	457	88	19
San Gabriel Valley P-C Region	1,148	370	32
San Luis Obispo-Santa Barbara P-C Region	243	77	32
Shasta County	122	51	42
South San Francisco Bay P-C Region	1,244	458	37
Stanislaus County	344	51	15
Stockton-Lodi P-C Region	728	196	27
Tehama County	72	36	49
Temescal Valley-Orange County [3]	1,122	355	32
Tulare County[2]			
Northern Tulare County	117	12	10
Southern Tulare County	88	Proprietary	<50
Ventura County [3]	309	106	34
Western San Diego County P-C Region	1,164	198	17
Yuba City-Marysville P-C Region	360	409	>100
Total	**13,536**	**4,343**	

[1] Aggregate study areas follow either a Production-Consumption (P-C) region boundary or a county boundary. A P-C region includes one or more aggregate production districts and the market area that those districts serve. Aggregate resources are evaluated within the boundaries of the P-C Region. County studies evaluate all aggregate resources within the county boundary.
[2] The County study has been divided into two areas, each having its own production and market area. A separate permitted resource calculation and 50-year forecast is made for each area.
[3] Two P-C regions have been combined into one study area.

Table 1. Comparison of 50-year demand to permitted aggregate resources for aggregate study areas as of January 1, 2006. (Study areas with less than ten years of permitted resources are in bold type).

Methodology

Before selecting a method for predicting a 50-year aggregate demand, historical aggregate use was compared to such factors as housing starts, gross national product, population, and several other economic factors. It was found that the only factor showing a strong correlation to historical aggregate use was population change. Consequently, a per capita aggregate consumption forecast model is used for most of the aggregate study projections. This method of forecasting aggregate consumption benefits from its simplicity and the availability of population forecast data. The California's Department of Finance (DOF) makes 50-year county population forecast using U.S. census data.

The steps used for forecasting California's 50-year aggregate needs using the per capita consumption model are: 1) collecting yearly historical production and population data for a period of years ranging from the 1960s through 2005; 2) dividing yearly aggregate production by the population for that same year to determine annual historical per capita consumption; 3) projecting yearly population for a 50-year period from the beginning of 2006 through 2055; and, 4) multiplying each year of projected population by the average historical per capita consumption, the sum of which equals a total 50-year aggregate demand. It should be noted that the years chosen to determine an average historical per capita consumption may differ depending upon historical aggregate use for that specific region. For example, in Shasta County, major construction projects from the 1940s through the 1970s caused historical per capita consumption rates to be extremely high and unrepresentative of future aggregate demand (Dupras, 1997). Consequently, an average historical per capita consumption rate for Shasta County was based on the years 1980-1995.

Effectiveness of the Per Capita Consumption Model

The assumption that each person will use a certain amount of aggregate every year is a simplification of actual usage patterns, but overall, an increase in the population leads to the use of more aggregate. Over a long enough period, perhaps 20 years or longer, the random impacts of major public construction projects and economic recessions tend to be smoothed out and consumption trends become similar to historic per capita consumption rates. Per capita consumption is a commonly used and accepted national, state, and regional measure for purposes of forecasting.

The per capita consumption model has proved to be effective for predicting aggregate demand in major metropolitan areas. The Western San Diego and the San Gabriel Valley P-C regions are examples of how well the model works, having only a 2 percent and a 5 percent difference, respectively, in actual versus predicted aggregate demand (Miller, 1994; 1996). However, the per capita model may not work well in county aggregate studies or in P-C regions that import or export a large percentage of aggregate resulting in a low correlation between production districts and aggregate market areas. When this happens, projections are based on a historical production model where 50-year aggregate demand is determined by extending a best-fit line of historical aggregate production data for a county or region. This model was used to project Yuba City-Marysville's 50-year demand because the region exports about 70 percent its aggregate into neighboring areas such as northern Sacramento County and Placer County.

Permitted Aggregate Resources

Approximately 4.34 billion tons of permitted aggregate resources lie within the 31 aggregate study areas shown on Map Sheet 52. Permitted aggregate resources (also called reserves) are aggregate deposits that have been determined to be acceptable for commercial use, exist within properties owned or leased by aggregate producing companies, and have permits allowing mining of aggregate material. A "permit" is a legal authorization or approval by a lead agency, the absence of which would preclude mining operations. Although some permitted resources face legal challenges, these resources are included in this study pending resolution of those challenges. In California, mining permits usually are issued by local lead agencies (county or city governments). Map Sheet 52 shows permitted aggregate resources as a percentage of the 50-year demand on each pie diagram (See *Fifty-Year Aggregate Demand Compared to Permitted Aggregate Resources* section). Beneath the study area name located next to its corresponding pie diagram is the amount of permitted resource in tons along with the amount of 50-year demand. These figures are also given in Table 1. Tonnages are not given for eastern Merced County and for the southern Tulare County to preserve company proprietary data.

Permitted aggregate resource calculations shown on the map and in Table 1 were determined from information provided in reclamation plans, mining plans and use permits issued by the lead agencies. When information was inadequate to make reliable independent calculations, CGS staff used resource estimates provided by mine operators or owners. These data were checked against rough calculations made by CGS staff, and any major discrepancies were discussed with the mine operators or owners. All permitted resource calculations are current as of the beginning of 2006.

Fifty-year Aggregate Demand Compared to Permitted Aggregate Resources

Fifty-year aggregate demand compared to currently permitted aggregate resources, is represented by a pie diagram for each of the 31 aggregate study areas shown on Map Sheet 52. Each pie diagram is located in the approximate center of the aggregate study area it represents. There are four different sizes of diagrams, each size representing a 50-year demand range. The smallest pie diagram represents 50-year demands ranging from 25 million to 200 million tons, while the largest diagram represents demands of over 800 million tons. The amount of 50-year demand in tons is shown on the map along with the amount of permitted resources beneath the study area name located next to its corresponding pie diagram (permitted resources, left / 50-year demand, right). The whole pie represents the total 50-year aggregate demand for a particular aggregate study area. The blue portion of the pie represents the permitted aggregate resource (shown as a percentage of the 50-year demand) while the purple-colored portion of the pie represents that portion of the 50-year demand that will not be met by the currently permitted resources. For example, if the blue portion is 25 percent and the purple portion is 75 percent of a pie diagram that represents a total demand of 400 million tons, the permitted resources are 100 million tons, and the region will need an additional 300 million tons of aggregate to supply the area for the next 50 years. The pie representing the Yuba City-Marysville aggregate study area (north-central California) is completely colored blue showing permitted aggregate resources are equal to or greater than the area's 50-year aggregate demand.

Except for Yuba City-Marysville, all of the aggregate study areas have less permitted aggregate resources than they are projected to need for the next 50-years. Twenty-five of the 31 aggregate study areas have less than half of the permitted resources they are projected to need.

Non-Permitted Aggregate Resources

Non-permitted aggregate resources are deposits that may meet specifications for construction aggregate, are recoverable with existing technology, have no land overlying them that is incompatible with mining, and currently are not permitted for mining. While not shown on Map Sheet 52, non-permitted aggregate resources are identified and discussed in each of the mineral land classification reports used to compile the map (See Appendix). There are currently an estimated 74 billion tons of non-permitted construction aggregate resources in the 31 aggregate study areas shown on the map. While this number is large, it is unlikely that all of these resources will ever be mined because of social, environmental, or economic factors. Aggregate resources located too close to urban or environmentally sensitive areas can limit or stop their development. These resources may also be located too far from a potential market to be economic. In spite of such possible constraints, non-permitted aggregate resources are the most likely future sources of construction aggregate potentially available to meet California's continuing demand. Factors used to calculate non-permitted resource amounts and to determine the aerial extent of these resources, are given in each of the aggregate classification reports listed in the Appendix.

Aggregate Production Areas and Districts

Aggregate production areas are shown on the map by five different sizes of triangle. A triangle may represent one or more active aggregate mines. The relative size of each symbol corresponds to the amount of yearly production for each mine or group of mines. Yearly production was based on data from the Department of Conservation's Office of Mine Reclamation (OMR) records for the calendar year 2005. The smallest triangle represents a production area that produces less than 0.5 million tons of aggregate per year. These triangles represent a single mine operation. About 85 percent of the production areas on the map fall into this category, and many are located in rural parts of the state. The largest triangle represents aggregate mining districts with production of more than 10 million tons per year. Only two aggregate production districts fall into this category – the Temescal Valley District in western Riverside County and the San Gabriel Valley District in Los Angeles County. The Temescal Valley Production District produced about 12 million tons of aggregate in 2005 and is the largest sand and gravel production district in the United States.

Aggregate Study Areas with Less than Ten Years of Permitted Resources

Four of the 31 aggregate study areas – North San Francisco Bay, Sacramento County, Fresno County, and northern Tulare County – are projected to have less than 10 years of permitted aggregate resources remaining. They are highlighted by red halos around the pie diagrams on Map Sheet 52 and appear in bold type in Table 1. Calculations of depletion years are made by comparing the currently permitted resources to the projected annual aggregate consumption in the study area on a year-by-year basis. This is not the same as dividing the total projected 50-year demand for aggregate by 50 because, as population increases, so does the projected annual consumption of aggregate for a study area. It should be noted that these numbers are estimates and they can quickly change. For example, if a neighboring region runs out of aggregate and begins to import aggregate from another region, a 20-year supply can quickly drop to just a few years.

PART II COMPARISONS BETWEEN THE ORIGINAL (2002) AND THE UPDATED (2006) MAP SHEET 52

The original Map Sheet 52 was completed in early 2001 and published in 2002. **Permitted aggregate resource data were current as of January 1, 2001.** Most of the data for the map were collected and compiled in 2000. The latest aggregate production and location data available during this time were from 1999 records. The aggregate demand projections for the original map were based on DOF county population projections from the 1990 U.S. census (2000 census data were not yet available). Fifty-year aggregate demand from January 1, 2001 through the year 2050 was determined for 34 study areas.

The updated Map Sheet 52 was completed and published in 2006. **Permitted aggregate resource data for the updated map is current as of January 1, 2006.** All work conducted for the updated study also took place during 2006. The latest aggregate production and location data available for the updated map are from 2005 records. The aggregate demand projections for the updated map were based on DOF county population projections from the 2000 U.S. census. Fifty-year aggregate demand from January 1, 2006 through the year 2055 was determined for 31 study areas.

Significant changes also have occurred in aggregate supply (permitted aggregate resources) and demand in the five years since the original Map Sheet 52 was completed. Changes in permitted aggregate resources between the original Map Sheet 52 (2002) and updated Map Sheet 52 (2006) are shown on Table 2. New mining regulations, mine closures, new mining permits, and five years of consumption have contributed to these changes.

Significant changes have also occurred in 50-year aggregate demand figures for several study areas due to updated aggregate production and county population projection. Table 3 compares the changes in demand between Map Sheet 52 (2002) and the updated 2006 map.

The updated map had three fewer aggregate study areas (a total of 31) because of aggregate shortages that caused changes in market areas. These changes are discussed in the following section.

Aggregate Study Area Changes

Six aggregate study areas on the original Map Sheet 52 have been modified for the updated map, resulting in three fewer study areas. They include the Southern California P-C regions of Orange County, Temescal Valley, San Fernando Valley, Saugus-Newhall, Western Ventura County, and Simi Valley. These P-C regions were modified because they no longer fit the definition of a production-consumption region. The Western Ventura County P-C region is depleted of permitted resources, and the Orange County, San Fernando Valley and Saugus Newhall regions are nearly depleted. When these regions began to run out of permitted aggregate resources, they became dependent on aggregate sources from neighboring regions, resulting in market areas that no longer were served by their original production district.

Orange County's permitted resources are nearly exhausted and now the county relies on Temescal Valley for much of its aggregate needs. These two P-C Regions were combined into the Temescal Valley-Orange County aggregate study area. Permitted resources for this new study area total

AGGREGATE STUDY AREA	Permitted Aggregate Resources as of 1/1/01 (million tons) Map Sheet 52, 2002	Permitted Aggregate Resources as of 1/1/06 (million tons) Map Sheet 52, 2006	Percent Difference (%)
Bakersfield P-C Region	167	115	-31
Barstow Victorville P-C Region	115	133	15
Claremont-Upland P-C Region	134	147	10
Eastern Merced County	15	53	253
El Dorado County	13	19	46
Fresno P-C Region	98	71	-27
Glenn County	56	17	-70
Monterey Bay P-C Region	243	347	43
Nevada County	35	31	-11
Northern Tulare County	12	12	0
North San Francisco Bay P-C Region	178	49	-73
Palmdale P-C Region	216	181	-16
Palm Springs P-C Region	70	176	151
Placer County	43	45	5
Sacramento County	65	67	3
Sacramento-Fairfield P-C Region	130	164	26
San Bernardino P-C Region	356	262	-26
San Fernando Valley-Saugus Newhall *	**154	88	-43
San Gabriel Valley P-C Region	241	370	54
San Luis Obispo-Santa Barbara P-C Region	93	77	-17
Shasta County	28	51	82
Southern Tulare County	196	Proprietary	Proprietary
South San Francisco Bay P-C Region	564	458	-19
Stanislaus County	35	51	45
Stockton Lodi P-C Region	260	196	-25
Tehama County	40	36	-10
Temescal Valley-Orange County*	**837	355	-58
Ventura County (combined Western Ventura County and Simi Valley P-C Region)*	**129	106	-18
Western Merced County	>50	Proprietary	Proprietary
Western San Diego County P-C Region	275	198	-28
Yuba City-Marysville P-C Region	>2,000	409	-80
Total	**6,848**	**4,343**	

* Two P-C Regions have been combined for updated Map Sheet 52

**Total for combined P-C Regions

Table 2. Comparison of permitted aggregate resources between Map Sheet 52, 2002 and Map Sheet 52, 2006.

AGGREGATE STUDY AREA	50-Year Demand as of 1/1/01 (million tons) Map Sheet 52, 2002	50-Year Demand as of 1/1/06 (million tons) Map Sheet 52, 2006	Percent Difference (%)
Bakersfield P-C Region	246	252	2
Barstow-Victorville P-C Region	165	179	8
Claremont-Upland P-C Region	270	300	11
Eastern Merced County	98	106	8
El Dorado County	85	91	7
Fresno P-C Region	565	629	11
Glenn County	79	83	5
Monterey Bay P-C Region	381	383	0.5
Nevada County	169	122	-28
Northern Tulare County	107	117	9
North San Francisco Bay P-C Region	648	647	-0.15
Palmdale P-C Region	172	665	287
Placer County	126	171	36
Palm Springs P-C Region	198	295	49
Sacramento County	686	733	7
Sacramento-Fairfield P-C Region	225	235	4
San Bernardino P-C Region	969	1,074	11
San Fernando Valley/Saugus Newhall *	** 732	457	-38
San Gabriel Valley P-C Region	1,250	1,148	-8
San Luis Obispo-Santa Barbara P-C Region	99	243	145
Shasta County	118	122	3
Southern Tulare County	77	88	14
Stanislaus County	311	344	11
Stockton Lodi P-C Region	337	728	115
South San Francisco Bay P-C Region	1,213	1,244	3
Tehama County	52	72	38
Temescal Valley-Orange County *	** 1,203	1,122	-7
Ventura County (combined Western Ventura County and Simi Valley P-C Regions) *	** 257	309	20
Western Merced County	49	53	8
Western San Diego County P-C Region	1,099	1,164	6
Yuba City-Marysville P-C Region	30	360	1,100
Total	**12,016**	**13,536**	

* Two P-C Regions have been combined for updated Map Sheet 52
**Total for combined P-C Regions

Table 3. Comparison of 50-year demand between Map Sheet 52, 2002 and Map Sheet 52, 2006.

355 million tons as compared to the total resources for both of the original P-C regions of 837 million tons. This results in a decrease of 58 percent (See Table 2).

Western Ventura County has depleted its permitted aggregate resources and now relies heavily on aggregate production from the Simi Valley area. For the updated map, these two regions have been combined to form the Ventura County aggregate study area. Permitted aggregate resources for this area decreased by about 18 percent since the original Map Sheet 52 (See Table 2). A shortage of coarse aggregate in Ventura County has resulted in rock being hauled up to 60 miles into the county from the Palmdale aggregate production region.

Both the San Fernando Valley and the Saugus Newhall P-C regions shown on the original map are rapidly running out of permitted aggregate resources. These two regions have been merged for the updated map to form the San Fernando Valley-Saugus Newhall aggregate study area. Loss of permitted aggregate resources because of mine closures in the Saugus Newhall P-C region has resulted in increased importation of aggregate into the region from the San Fernando Valley P-C region. This puts an additional drain on San Fernando Valley's permitted resources that already are in short supply. The new San Fernando Valley-Saugus Newhall aggregate study area, shown on the updated map, has 88 million tons of permitted resources, or 19 percent of its projected 50-year demand (See Table 1). The 88 million tons includes 56 million tons of newly permitted aggregate resources granted to CEMEX in 2004 for its Soledad Canyon operation in Los Angeles County.

Decreases in Permitted Aggregate Resources

Eighteen of the 31 study areas shown on the updated map experienced a decrease in permitted aggregate resources since the original map was completed (See Table 2). Included in these 18 areas are Western Merced County and Southern Tulare County. Permitted resources for both of these county study areas cannot be shown because they are proprietary. Six of the18 areas had significant decreases of over 50 percent. They include the Glenn County, North San Francisco Bay, Temescal Valley-Orange County, Western Merced County, Southern Tulare County, and Yuba City-Marysville aggregate study areas.

Total permitted resources for all 31 areas decreased from 6.848 billion tons to 4.343 billion tons – a loss of 2.5 billion tons. Most of this decrease was because of aggregate consumption and a large reduction in Yuba City-Marysville's permitted aggregate resources. Approximately 1.2 billion tons of aggregate has been consumed in the 31 study areas during the five-year period from 2001-2005. The Yuba City-Marysville area had a decrease in permitted aggregate resources of 1.6 billion tons despite the addition of over 100 million tons of newly permitted resources to the area. The submission of revised reclamation plans contributed to most of the decrease. Other reasons for reductions in permitted aggregate resources throughout the state include economic or environmental conditions causing mine closures, new in-stream mining regulations, natural changes in the quality of aggregate deposits, and haulage restrictions.

Increases in Permitted Aggregate Resource

Of the 31 study areas shown on the updated Map Sheet 52, 12 areas had increases in permitted aggregate resources. Most of these increases are because of newly permitted or expanded mining operations. An expansion may increase the footprint of the mine or, as in the case of San Gabriel

Valley, mining depth. Significant increases exceeding 50 percent occurred in the Eastern Merced County, Palm Springs, San Gabriel Valley, and Shasta County aggregate study areas (See Table 2).

Changes in Fifty-Year Demand

All but five study areas shown on the updated Map Sheet 52 had increases in 50-year demand (See Table 3). Only two study areas had any significant decrease; these are Nevada County and the new combined aggregate study area of San Fernando Valley-Saugus Newhall. The North San Francisco Bay, San Gabriel Valley, and the Temescal Valley-Orange County study areas had slight decreases.

Nevada County's demand decreased because updated population projections by DOF (based on 2000 census data) for the county were lower than those made by DOF using 1990 census data. The 2000 census-based DOF projections were not available at the time the original study for Map Sheet 52 was being conducted. In most growing areas such as the Palm Springs region and Placer County, the 2000 census-based projections were higher than the 1990 census-based projections.

The nearly depleted permitted resources in the San Fernando Valley-Saugus Newhall study area has resulted in importation of aggregate from the Palmdale P-C region. In order to better reflect aggregate consumption in the San Fernando Valley-Saugus Newhall aggregate study, the method used to calculate 50-year demand for the area was changed from a per capita consumption to a historical production model. (See *Effectiveness of the Per Capita Consumption Model* section.). The new model resulted in a 38 percent decrease in the study area's 50-year demand.

Changes in Permitted Aggregate Resources and Demand

Table 4 shows the percentages of permitted aggregate resources as compared to the 50-year demand for the 2002 and updated 2006 Map Sheet 52. The graphic representations of these ratios are shown on both maps as pie diagrams – the blue portion of the pie depicting percentage of the 50-year demand met with current permitted aggregate resources. An increase in percent between the original and the updated map shows that permitted resources have increased relative to demand. Three of the 31 study areas shown on Table 4 could not be compared to the 2002 map because they are newly combined study areas that did not exist on the 2002 map (See *Aggregate Study Area Changes* section). Increases occurred in 10 of the 28 study areas that could be compared: Barstow-Victorville, Eastern Merced County, El Dorado County, Monterey Bay, Nevada County, Palm Springs, Sacramento-Fairfield, San Gabriel Valley, Shasta County, and Stanislaus County. Except for Nevada County, increases were because of new or expanded permits resulting in additional permitted aggregate resource for that study area. Nevada County's permitted resources decreased slightly. The increase in the supply to demand ratio for Nevada County was caused by a decrease in the county's population growth estimate.

Sixteen of the 28 study areas including Southern Tulare County and Western Merced County, had decreases in supply to demand percentages between the original and the updated map (See Table 4). Large decreases occurred in the Glenn County, Palmdale, San Luis Obispo-Santa Barbara, Southern Tulare County, Stockton-Lodi, and the Western Merced County aggregate study areas. All of these areas also had large decreases in permitted aggregate resources.

AGGREGATE STUDY AREA	Percentage of Permitted Aggregate Resources as Compared to 50-Year Demand as of 1/1/01 Map Sheet 52, 2002	Percentage of Permitted Aggregate Resources as Compared to 50-Year Demand as of 1/1/06 Map Sheet 52, 2006
Bakersfield P-C Region	68	46
Barstow-Victorville P-C Region	70	74
Claremont-Upland P-C Region	50	49
Eastern Merced County	15	50
El Dorado County	15	21
Fresno P-C Region	17	11
Glenn County	71	21
Monterey Bay P-C Region	64	91
Nevada County	21	25
Northern Tulare County	11	10
North San Francisco Bay P-C Region	27	8
Palmdale P-C Region	>100	27
Palm Springs P-C Region	35	60
Placer County	34	26
Sacramento County	9	9
Sacramento-Fairfield P-C Region	58	70
San Bernardino P-C Region	37	24
San Fernando Valley-Saugus Newhall *	**	19
San Gabriel Valley P-C Region	19	32
San Luis Obispo-Santa Barbara P-C Region	94	32
Shasta County	24	42
Southern Tulare County	>100	Proprietary
South San Francisco Bay P-C Region	46	37
Stanislaus County	11	15
Stockton Lodi P-C Region	77	27
Tehama County	77	49
Temescal Valley-Orange County *	**	32
Ventura County (combined Western Ventura County and Simi Valley P-C Regions)*	**	34
Western Merced County	>100	Proprietary
Western San Diego County P-C Region	25	17
Yuba City-Marysville P-C Region	>100	100

* Two P-C Regions have been combined for updated Map Sheet 52
**No percentage due to combining of two P-C Regions

Table 4. Percentage of permitted aggregate resources as compared to 50-year demand for Map Sheet 52, 2002 and Map Sheet 52, 2006.

Comparison of Areas with Less than 10-Years of Permitted Aggregate Resources

The 2006 Map Sheet 52 shows four aggregate study areas – Sacramento County, Fresno County, Northern Tulare County, and the North San Francisco P-C Region, with less than a 10-year supply of permitted aggregate resources. The map shows these areas with red halos around the pie diagrams. The original Map Sheet 52 shows seven areas with less than a 10-year supply of permitted aggregate. Fewer short-supply areas (red circles) shown on the updated map does not mean that California's supply has improved relative to demand. Three of these short supply areas have been combined with neighboring regions. This resulted in all three areas extending their permitted resource life to more than ten years. When regions combine, transportation cost usually increases because of longer and or more time-consuming hauls.

PART III: OVERVIEW OF CONSTRUCTION AGGREGATE

Construction aggregate is the leading non-fuel mineral commodity produced in California, as well as in the nation. Valued at $1.63 billion, aggregate made up about 44 percent of California's $3.72 billion non-fuel mineral production in 2005. California is the nation's leading producer of construction aggregate with a total production of 235 million tons in 2005.

Aggregate Price

The price of aggregate throughout California varies considerably depending on location, quality, and supply and demand. The highest quality aggregate is that which meets the California Department of Transportation's specifications for use in Portland Cement Concrete (PCC). All prices discussed in this section are for PCC-grade aggregate at the plant site or FOB (freight on board). Transportation cost is discussed in the next section. Price variance makes it difficult to estimate the average price of PCC-grade aggregate for the state.

The highest priced aggregate in the state is in the San Diego area, where PCC-grade sand is in very short supply, causing prices to range from $20-$22 /ton. Coarse PCC-grade aggregate is more abundant in the area and averages about $15 per ton. San Diego has started to import sand from Mexico. The price of aggregate in the Northern San Francisco Bay area is up to $18/ton for PCC-grade sand and $16/ton for coarse PCC-grade aggregate. Most of this aggregate is mined from terrace or in-stream deposits of the Russian River located in Alexander Valley. Aggregate is more plentiful and the demand is greater in the South San Francisco Bay area (includes the San Jose metropolitan area). The cost of alluvial sand is about $16/ton, and gravel runs about $15/ton. The price of high strength crushed stone from limestone and diorite in this region is higher at $16 to $17/ton. Sand shortages and subsequent higher prices have resulted in the economical importation of sand from Canada to the San Francisco Bay Region. Aggregate shipped from Canada to the San Francisco Bay and loaded onto trucks costs about $18-$19/ton.

The greater Los Angeles area has some of the best quality sand and gravel in the state. Aggregate prices in the major metropolitan areas supplied by alluvial fan deposits in the San Gabriel Valley and San Fernando Valley average $13-$16/ton. Aggregate from the more sparsely populated but rapidly growing Palmdale area (Northern Los Angeles County) averages about $10/ton. Much of the coarse aggregate consumed in Ventura County comes from the Palmdale Region – a haul distance of about 60 miles. The added cost for such a long haul is about $9/ton. The average cost for sand in Ventura County, supplied from the Simi Valley production region, is about $13-$16/ton – about the same as the greater Los Angeles area. Aggregate price in the Central Valley regions of Northern Tulare County and Fresno County ranges from $14-$18/ton. Aggregate shortages in the Fresno area have resulted in rock being imported into the area from Coalinga, a 60-mile haul. Aggregate prices in the Stockton-Lodi and Sacramento regions run about $10 and $11/ ton, respectively. The price of PCC-grade aggregate in the Yuba City-Marysville region averages about $7-$8/ton – some of the least expensive in the state. Relatively abundant aggregate in this region has kept aggregate prices low.

Transportation

Transportation plays a major role in the cost of aggregate to the consumer. Aggregate is a low-unit-value, high-bulk-weight commodity, and it must be obtained from nearby sources to minimize both the dollar cost to the aggregate consumer and other environmental and economic costs associated with transportation. If nearby sources do not exist, then transportation costs may significantly increase the cost of the aggregate by the time it reaches the consumer. For straight hauls with minimal traffic, the price of aggregate increases about 15 cents per ton for every mile that it is hauled from the plant. Currently, transporting aggregate a distance of 30 miles will increase the FOB price by about $4.50 per ton. For example, to construct one mile of six-lane interstate highway requires about 113,505 tons of aggregate. Transporting this amount of aggregate 30 miles adds $510 thousand to the base cost of the material at the mine. In major metropolitan areas, this rate is often greater because of heavy traffic that increases the haul time. Other factors that affect hauling rates include toll bridges and toll roads, road conditions, and elevation climbs. Transporting aggregate from distant sources also results in increased fuel consumption, air pollution, traffic congestion, and road maintenance. Moreover, transportation cost is the principal constraint defining the market area for an aggregate mining operation.

Increased Haul Distances

Throughout California, aggregate haul distances have been gradually increasing as local sources of aggregate diminish. Consequently, older P-C regions, most of which were established in the late 1970s have changed considerably since their boundaries were drawn. This is especially evident in Los Angeles, Orange, and Ventura counties where aggregate shortages have led to the merging of six P-C regions shown on the original map into three regions for the updated map (See *Aggregate Study area Changes* section).

The following lists some examples of aggregate hauls in Southern California that have caused significant transportation price increases:

- The Palmdale P-C Region in Northern Los Angeles County currently exports about half of its aggregate into the adjacent San Fernando Valley-Saugus Newhall Region. Some material from Palmdale also goes to downtown Los Angeles. Coarse aggregate from the Palmdale Region is hauled as far as 60 miles to the Western Ventura County.

- Aggregate from the San Gabriel Valley production district is hauled as far south as northern San Diego County.

- Although Orange County imports material mainly from Temescal Valley, some aggregate is hauled to Orange County from the San Bernardino, Upland-Claremont and the San Gabriel Valley production districts.

- Aggregate mined from the Claremont-Upland production district is hauled out of its region to downtown Los Angeles, Orange County and to San Bernardino.

- Northern San Diego County imports aggregate from the San Bernardino production area and from Temescal Valley.

- Aggregate is hauled from the Barstow-Victorville production district into San Bernardino.

- Aggregate is hauled from southwestern Imperial County into downtown San Diego, a distance of about 90 miles.

- Between 1 million and 2 million tons of aggregate are shipped annually by rail from the Cochella Valley area into Los Angeles County.

- Sand is being shipped by barge from Mexico into the San Diego Bay region.

Aggregate Quality and Use

Normally forming 80 to 100 percent of the material volume in the mix, aggregate provides the bulk and strength to PCC and AC. Rarely, even from the highest-grade deposits, is in-place aggregate raw material physically or chemically suited for every type of aggregate use. Every potential deposit must be tested to determine how much of the material can meet specifications for a particular use, and what processing is required. Specifications for PCC, AC, and various other uses of aggregate have been established by several agencies, such as the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, and the California Department of Transportation to ensure that aggregate is satisfactory for specific uses. These agencies and other major consumers test aggregate using standard test procedures of the American Society for Testing Materials (ASTM), the American Association of State Highway Officials, and other organizations.

Most PCC and AC aggregate specifications have been established to ensure the manufacture of strong, durable structures capable of withstanding the physical and chemical effects of weathering and use. For example, specifications for PCC and concrete products prohibit or limit the use of rock materials containing mineral substances such as gypsum, pyrite, zeolite, opal, chalcedony, chert, siliceous shale, volcanic glass, and some high-silica volcanic rocks. Gypsum retards the setting time of portland cement; pyrite dissociates to yield sulfuric acid and an iron oxide stain; and other substances contain silica in a form that reacts with alkali substances in the cement, resulting in cracks and "pop-outs." Alkali reactions in PCC can be minimized by the addition of pozzolanic admixtures such as fly ash or naturally occurring pozzolanic materials. Pozzolan materials are defined as a siliceous or siliceous and aluminous material of natural or artificial origin that, in the presence of moisture, reacts with calcium hydroxide to form cementitious compounds. Naturally occurring pozzalonic materials include diatomaceous earth, diatomite, volcanic ash, opaline shale, pumicite, tuff, and certain clays such as kaolinite.

Specifications also call for precise particle-size distribution for the various uses of aggregate that is commonly classified into two general sizes: coarse and fine. Coarse aggregate is rock retained on a 3/8-inch or a #4 U.S. sieve. Fine aggregate passes a 3/8-inch sieve and is retained on a #200 U.S. sieve (a sieve with 200 weaves per inch). For some uses, such as asphalt paving, particle shape is specified. Aggregate material used with bituminous binder (asphalt) to form sealing coats on road surfaces shall consist of at least 90% by weight of crushed particles. Crushed stone is preferable to natural gravel in asphaltic concrete (AC) because asphalt adheres better to broken surfaces than to rounded surfaces and the interlocking of angular particles strengthens the AC and road base.

The material specifications for PCC and AC aggregate are more restrictive than specifications for other applications such as Class II base, subbase, and fill. These restrictive specifications makes deposits acceptable for use as PCC or AC aggregate, the scarcest and most valuable aggregate resources. Aggregate produced from such deposits can be, and commonly is, used in applications other than concrete. PCC and AC-grade aggregate deposits are of major importance when planning for future availability of aggregate commodities because of their versatility, value, and relative scarcity.

Factors Affecting Aggregate Deposit Quality

The major factors that affect the quality of construction aggregate are the rock type and the degree of weathering of the deposit. Rock type determines the hardness, durability, and potential chemical reactivity of the rock when mixed with cement to make concrete. In alluvial sand and gravel deposits, rock type is variable and reflects the rocks present in the drainage basin of the stream or river. In crushed stone deposits, rock type is typically less variable, although in some types of deposits, such as sandstones or volcanic rocks, there may be significant variability of rock type within a deposit. Rock type may also influence aggregate shape. For example, some metamorphic rocks such as slates, tend to break into thin platy fragments that are unsuitable for many aggregate uses, while many volcanic and granitic rocks break into blocky fragments more suited to a wide variety of aggregate uses. Deposit type also affects aggregate shape. For example, in alluvial sand and gravel deposits, the natural abrasive action of the stream rounds the edges of rock particles, in contrast to the sharp edges of particles from crushed stone deposits.

Weathering is the in-place physical or chemical decay of rock materials at or near the Earth’s surface. Weathering commonly decreases the physical strength of the rock and may make the material unsuitable for high strength and durability uses. Weathering may also alter the chemical composition of the aggregate, making it less suitable for some aggregate uses. If weathering is severe enough, the material may not be suitable for use as PCC or AC aggregate. Typically, the older a deposit is, the more likely it has been subjected to weathering. The severity of weathering commonly increases with increasing age of the deposit.

Comparison of Alluvial Sand and Gravel to Crushed Stone Aggregate

The preferred use of one aggregate material over another in construction practices depends not only on specification standards, but also on economic considerations. Alluvial gravel is typically preferred to crushed stone for PCC aggregate because the rounded particles of alluvial sand and gravel result in a wet mix that is easier to work than a mix made of angular fragments. Also, crushed stone is less desirable in applications where the concrete is placed by pumping because sharp edges will increase wear and damage to the pumping equipment. The workability of a mix consisting of portland cement with crushed stone aggregate can be improved by adding more sand and water, but more cement must then be added to the mix to meet concrete durability standards. This results in a more expensive concrete mix and a higher cost to the consumer. In addition, aggregate from a crushed stone deposit is typically more expensive than that from an alluvial deposit due to the additional costs associated with the ripping, drilling and blasting necessary to remove material from most quarries and the additional crushing required to produce the various sizes of aggregate. Manufacturing sand by crushing is more costly than mining and processing naturally occurring sand. Although more care is required in pouring and placing a wet mix containing crushed stone, PCC made with this aggregate is as satisfactory as that made with alluvial sand and gravel of comparable rock quality. Owing to environmental concerns and regulatory constraints in many areas of the state, it is likely that extraction of sand and gravel resources from instream and floodplain areas will become less common in the future. If this trend continues, crushed stone may become increasingly important to the California market.

Factors Affecting Aggregate Demand

Strong economic growth may contribute to a faster rate of aggregate depletion than forecasted in the CGS classification reports. The nation’s strong economy since the mid 1990s has brought about a resurgence of new home and business construction, as well as large construction projects such as airports, new roads, rail systems, and re-paving of existing roads.

Several factors may contribute to extending the life of California’s permitted aggregate resources. A recession in the state’s or the nation’s economy will result in a decrease in construction activities. Also, an increase in the use of recycled aggregate for base rock will decrease the need for new aggregate. The importation of aggregate from other states and countries such as Canada and Mexico is also expected to extend the life of California’s permitted aggregate resources. New state-of-the-art ships are capable of hauling up to 70,000 tons of aggregate. California currently imports about one percent of the aggregate it consumes.

SUMMARY

Construction aggregate is the largest non-fuel mineral commodity produced in California as well as in the nation. Aggregate production plays a major role in the economy of California. Demand for aggregate is expected to increase as the state's population continues to grow and infrastructure is maintained and improved. For the last 28 years, CGS has conducted on-going studies that identify and evaluate aggregate resources throughout the state. Map Sheet 52 (Updated 2006) is an updated summary of supply and demand data from these studies. The map presents a statewide overview of aggregate needs and permitted resources.

In a five-year period (2001-2005), permitted aggregate resources have decreased by about 2.5 billion tons. Also, during this same period, more aggregate study areas had decreases in permitted aggregate resources than increases. Decreases were caused by changes in permitted resource calculations, aggregate consumption, and social and economic conditions leading to mine closures.

Aggregate price at the plant site and transportation cost have increased significantly in the past five years. Areas throughout the state are experiencing shortages in local permitted aggregate resources and are being forced to transport aggregate longer distances, significantly increasing the FOB cost by the time it reaches its final destination. Areas in very short supply of permitted aggregate resources include Fresno, North San Francisco Bay, Southern Tulare County, and Sacramento County. The shortage of PCC-grade sand in the San Diego and the San Francisco Bay areas has driven up the price in both areas, making importation of sand from Canada and Mexico into these regions competitive.

CONCLUSIONS AND RECOMMENDATIONS

Construction aggregate is essential to the needs of modern society, providing material for the construction and maintenance of roadways, dams, canals, buildings and other parts of California's infrastructure. Aggregate is also found in homes, schools, hospitals and shopping centers. In 2005, California consumed about 235 million tons of construction aggregate or about 6.6 tons per person. Because transporting aggregate is a significant part of the total cost to the consumer, aggregate mines generally are located close to communities that consume the aggregate.

The following conclusions can be drawn from Map Sheet 52 and this accompanying report. Reference is made to the 31 aggregate consumption areas that are represented by the pie diagrams shown on Map Sheet 52:

- About 32 percent of the total projected 50-year aggregate demand identified for the 31 study areas is currently permitted.

- Only six percent of the total aggregate resources identified within the 31 study areas are currently permitted.

- California currently has about 4.3 billion tons of permitted resources identified in the 31 study areas shown on Map Sheet 52.

- In the next 50 years, California will need approximately 13.5 billion tons of aggregate. This figure does not account for accelerated construction programs as a result of major bond initiatives, or from reconstruction following a major, damaging earthquake.

- Four of the updated aggregate study areas are projected to have less than ten years of permitted aggregate resources remaining as of January 2006 (pie diagrams highlighted with red borders).

- Ten of the updated aggregate study areas show less than 25 percent of the aggregate resources to meet the projected 50-year aggregate demand.

- About one-half (16) of the updated aggregate study areas show that 25 to 50 percent of the aggregate resources are available to meet the 50-year aggregate demand.

- Three (one tenth) of the updated aggregate study areas show between 50 and 75 percent of the aggregate resources are available to meet the 50-year aggregate demand.

- One study area shows between 75 and 100 percent of the aggregate resources to be available to meet its 50-year aggregate demand.

- Only one of the study areas has adequately permitted aggregate resources to meet or exceed its projected 50-year demand. The 2002 map showed six areas.

The information presented on Map Sheet 52 and in the referenced reports is provided to assist land use planners and decision makers in identifying those areas containing construction aggregate resources, and to identify potential future demand for these resources in different regions of the state. This information is intended to help planners and decision makers balance the need for construction aggregate with the many other competing land use issues in their jurisdictions, and to provide for adequate supplies of construction aggregate to meet future needs.

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*SR 143: Part I: Mineral Land Classification of the Greater Los Angeles Area: Description of the Mineral Land Classification Project of the Greater Los Angeles Area.
By Anderson T. P., Loyd, R.C., Clark, W.B., Miller, R.M., Corbaley, R., Kohler, S.L., and Bushnell, M.M., 1979.

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*SR 146: Part III: Mineral Land Classification: Aggregate Materials in the North San Francisco Bay Production-Consumption Region.
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*SR 146: Part IV: Mineral Land Classification: Aggregate Materials in the Monterey Bay Production-Consumption Region.
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By Cole, J.W., 1988.

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By Kohler, S.L., and Miller, R.V., 1982.

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By Dupras, D.L., 1988.

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*SR 159: Mineral Land Classification: Aggregate Materials in the Palm Springs Production-Consumption Region.
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*SR 160: Mineral Land Classification: Portland Cement Concrete-Grade Aggregate in the Stockton-Lodi Production-Consumption Region.
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By Miller, R.V., 1993.

OFR 94-14: Update of Mineral Land Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California: Part II - Los Angeles County.
By Miller, R.V., 1994.

OFR 94-15: Update of Mineral Land Classification of Portland Cement Concrete Aggregate in Ventura, Los Angeles, and Orange Counties, California: Part III - Orange County.
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OFR 95-10: Mineral Land Classification of Placer County, California.
By Loyd, R.C., 1995.

OFR 96-03: Update of Mineral Land Classification: Aggregate Materials in the South San Francisco Bay Production-Consumption Region.
By Kohler-Antablin, S.L., 1996.

OFR 96-04: Update of Mineral Land Classification: Aggregate Materials in the Western San Diego County Production-Consumption Region.
By Miller, R.V., 1996.

OFR 97-01: Mineral Land Classification of Concrete Aggregate Resources in the Tulare County Production-Consumption Region, California.
By Taylor, G.C., 1997.

OFR 97-02: Mineral Land Classification of Concrete-Grade Aggregate Resources in Glenn County, California.
By Shumway, D.O., 1997.

OFR 97-03: Mineral Land Classification of Alluvial Sand and Gravel, Crushed Stone, Volcanic Cinders, Limestone, and Diatomite within Shasta County, California.
By Dupras, D.L, 1997.

OFR 99-01: Update of Mineral Land Classification: Aggregate Materials in the Monterey Bay Production-Consumption Region, California.
By Kohler-Antablin, S.L., 1999.

OFR 99-02: Update of Mineral Land Classification: Aggregate Materials in the Fresno Production-Consumption Region, California.
By Youngs, L.G. and Miller, R.V., 1999.

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By Dupras, D.L., 1999.

OFR 2000-18: Mineral Land Classification of Concrete-Grade Aggregate Resources in Tehama County, California.
By Foster, B.D., 2001

OFR 2000-03: Mineral Land Classification of EL Dorado County, California.
By Busch L.L., 2001

***** These Mineral Land Classification reports have been updated and are not shown on the index map (lower left-hand corner of Map Sheet 52).

UPDATE OF
MINERAL LAND CLASSIFICATION:
AGGREGATE MATERIALS
IN THE
MONTEREY BAY
PRODUCTION-CONSUMPTION REGION

BY

Susan Kohler-Antablin

DMG OPEN-FILE REPORT 99-01

1999

CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF MINES AND GEOLOGY
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SACRAMENTO, CA 95814-3531

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OPEN-FILE REPORT RELEASE

OFR 99-01 "Update of Mineral Land Classification: Aggregate Materials in the Monterey Bay Production Consumption Region." by Susan Kohler-Antablin, 1999, 50 pages, 42 plates with map scales from 1:48,000 to 1:100,000, $100.00.

BACKGROUND: California's Surface Mining and Reclamation Act of 1975 (SMARA) requires the State Geologist to classify land into Mineral Resource Zones (MRZs) based on the known or inferred mineral resource potential of that land. The classification process is based solely on geology, without regard to existing land use or land ownership. The primary goal of mineral land classification is to help ensure that the mineral resource potential of lands is recognized and considered in the land-use planning process.

SUMMARY: This study updates information presented in a DMG classification study on construction aggregate in the Monterey Bay Production-Consumption (P-C) Region--Special Report 146-Part IV (Stinson and others, 1987). The Monterey Bay P-C Region includes portions of Monterey, San Benito, Santa Cruz and Santa Clara counties. This report includes information pertaining to the geology, location, tonnage, and quality of construction grade aggregate resources in the Monterey Bay P-C Region. Additionally, data is included about the past and current consumption of construction aggregate, and the projected demand for construction aggregate within the P-C Region for the next 50 years. Thirteen newly classified MRZ-2 aggregate resource areas have been added for this update of the Region.

Based on the updated data, permitted construction-grade aggregate resources (reserves) for the Monterey Bay P-C Region are estimated to be 269 million tons. The projected aggregate demand on the Region for the next 50- years is estimated to be 379 million tons. If no additional reserves become available within the Monterey Bay P-C Region, the 269 million tons of reserves are enough to supply the demand of the Region for 35 years—until the year 2033. An estimated 1,210 million tons of aggregate resources underlie the Monterey Bay P-C Region.

AVAILABILITY: OFR 99-01 is available for reference at the San Francisco, Sacramento and Los Angeles offices. It can be purchased: (1) by phone using VISA, MasterCard or American Express, (2) by mail with check or money order enclosed, or (3) over-the-counter at the San Francisco and Sacramento offices, cost $100.00.

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EXECUTIVE SUMMARY

Aggregate (sand and gravel and crushed stone) is the number one non-fuel mineral commodity in California as well as in the nation. Valued at 1.15 billion dollars, aggregate makes up almost 40 percent of California's 2.97 billion-dollar non-fuel mineral economy. Transportation plays a major role in the cost of aggregate to the consumer. To transport aggregate a distance of 35 miles will generally double the price of aggregate. Over half of the construction grade aggregate used in the state is for public works projects and is paid for with tax dollars.

Because much of California's aggregate is used in urbanized and urbanizing areas, it is extremely important that an adequate supply of aggregate is available close to those areas. California's largest aggregate consumption regions are in the Los Angeles and San Francisco Bay metropolitan areas.

The California Department of Conservation's Division of Mines and Geology (DMG) classifies mineral resources in compliance with the Surface Mining and Reclamation Act (SMARA) of 1975. The purpose of such classification is to identify mineral resources for land use planning and conservation. Under SMARA guidelines, classification studies are required to be periodically reviewed for updating.

This report updates information presented in a DMG classification study on construction aggregate in the Monterey Bay Production-Consumption (P-C) Region—Special Report 146-Part IV (Stinson and others, 1987). The Monterey Bay P-C Region includes portions of Monterey, San Benito, Santa Cruz, and southern Santa Clara counties.

This report (1) identifies new aggregate resource areas through the process of classification, (2) calculates current aggregate reserves (permitted resources) and resources as of January, 1998, and (3) forecasts aggregate demand for the next 50-years to 2047.

Thirteen newly classified MRZ-2 aggregate resource areas have been added for this update of the Monterey Bay P-C Region. These are shown on Plates 3-13. They are as follows:

1) The San Bruno Canyon deposit, a 110-acre site underlain by greenstone on the eastern flanks of the Santa Cruz Mountains (Santa Clara County).

2) A 17-acre western expansion of the Olive Springs Quarry (Santa Cruz County).

3) The Verne Freeman proposed quarry area, a 60-acre site containing brecciated greenstone (Santa Clara County).

4) A 52-acre extension of the Wilson Quarry (San Benito County).

5) The Williams Quarry, a 25-acre site underlain by sandstone (San Benito County).

6) The SCL/Bolsa deposit, a 130-acre site underlain by silty sand and gravel (San Benito County).

7) The Lomerias Muertas deposit, 55 acres underlain by pebbly sandstone (San Benito County).

8) The Pearce Quarry, a 70-acre site underlain by crystalline limestone and granitic rocks in the northern Gabilan Mountains (San Benito County).

9) The Hollister Hills/Harris area comprising four small deposits of limestone totaling 11.5 acres (San Benito County).

10)The Tres Pinos Creek area, an 11-mile stretch of the Tres Pinos Creek and an adjoining 128-acre terrace containing sand and gravel deposits (San Benito County).

11)The San Benito Aggregate Inc's 92-acre dolomite deposit (San Benito County).

12)The Stonewall Canyon Quarry area, 50 acres underlain by granitic rocks (Monterey County).

13)The Chalone Creek extension, eight acres of creek channel (Monterey County).

Based on the updated reserves for the Monterey Bay P-C Region, and assuming that the demand forecast is accurate, the following conclusions were reached:

- There are 269 million tons of permitted construction-grade aggregate resources (reserves) within the Monterey Bay P-C Region.

- The projected aggregate demand on the Monterey Bay P-C Region for the next 50 years (through the year 2047) is estimated to be 379 million tons.

- If no additional reserves become available within the Monterey Bay P-C Region, the 269 million tons of reserves are enough to supply the demand of the region for 35 years—until the year 2033.

- It is estimated that 1,210 million tons of aggregate resources underlie the Monterey Bay P-C Region.

The following table compares population, annual aggregate production, reserves, projected depletion of reserves, resources, number of permitted aggregate properties, and number of aggregate companies in the Monterey Bay P-C Region for the data-base year of the original classification (1980) with data current up to the end of 1997.

COMPARISON OF:	1980	1997
POPULATION	648,100	937,356
ANNUAL AGGREGATE PRODUCTION	*7.2 MILLION TONS	7.7 MILLION TONS
AGGREGATE RESERVES**	786 MILLION TONS	269 MILLION TONS
PROJECTED YEARS UNTIL DEPLETION OF RESERVES	Over 50 YEARS	35 YEARS
AGGREGATE RESOURCES**	***3,081 MILLION TONS	1,210 MILLION TONS
NO. OF PERMITTED PROPERTIES	22	27
NO. OF AGGREGATE COMPANIES	16	16

* Revised from DMG Special Report 146, Part IV.

**Reserves are aggregate deposits that have been determined to be acceptable for commercial use, that exist within properties owned or leased by aggregate producing companies, and for which permits have been granted to allow mining and processing of the material. Resources include reserves as well as all potentially usable aggregate materials that may be mined in the future, but for which no permit allowing mining has been granted.

*** Aggregate resources for all sectorized land prior to designation.

PART I - CLASSIFICATION OF AGGREGATE RESOURCES IN THE MONTEREY BAY P-C REGION.

INTRODUCTION

The Department of Conservation's Division of Mines and Geology (DMG) published a four-part study of aggregate resources for the San Francisco-Monterey Bay Area as Special Report 146, Mineral Land Classification: Aggregate Materials of the San Francisco-Monterey Area, Parts I, II, III, and IV (Stinson and others, 1987). Special Report 146 covers three adjoining Production-Consumption (P-C) Regions—Part II covers the South San Francisco Bay P-C Region, Part III covers the North San Francisco Bay P-C Region, and Part IV covers the Monterey Bay P-C Region. Each of these P-C Regions covers a separate aggregate production district and its surrounding market or consumption area. Part I of Special Report 146 is an introduction to the three P-C Regions.

This report is an update of the Monterey Bay P-C Region (see Figure 1) which includes portions of Monterey, San Benito, Santa Cruz, and Santa Clara counties. In Special Report 146, Part IV, urbanizing lands within the Monterey Bay P-C Region were classified according to the presence or absence of significant construction-grade aggregate resources. Subsequent to classification and the completion of an Environmental Impact Report (California Department of Conservation, 1985), the State Mining and Geology Board (SMGB) designated areas within the P-C Region as having aggregate resources of regional significance on October 2, 1986 (California Department of Conservation, 1987). Special Report 146, Part IV also projected future aggregate demand to the year 2030 (a 50-year projection).

This update report conveys important information on the present aggregate resources in the Monterey Bay P-C Region for the benefit of local lead agencies (see Table 1 for list of lead agencies). Information in this the update reevaluates the availability of aggregate resources in the classified and designated areas within the Monterey Bay P-C Region and also projects the demand for construction-grade aggregate for the region to the year 2047.

The original study and this update were conducted as specified by the Surface Mining and Reclamation Act (SMARA) of 1975. Section I, Subsection 7 of the SMGB Guidelines for Classification and Designation of Mineral Lands, adopted in 1978 and published in 1983, requires the State Geologist to review mineral land classification information after a period of no longer than 10 years to determine whether reclassification and/or revision of projected requirements of construction materials is necessary. It was determined that a revision of projected aggregate demand was necessary for the Monterey Bay P-C Region.

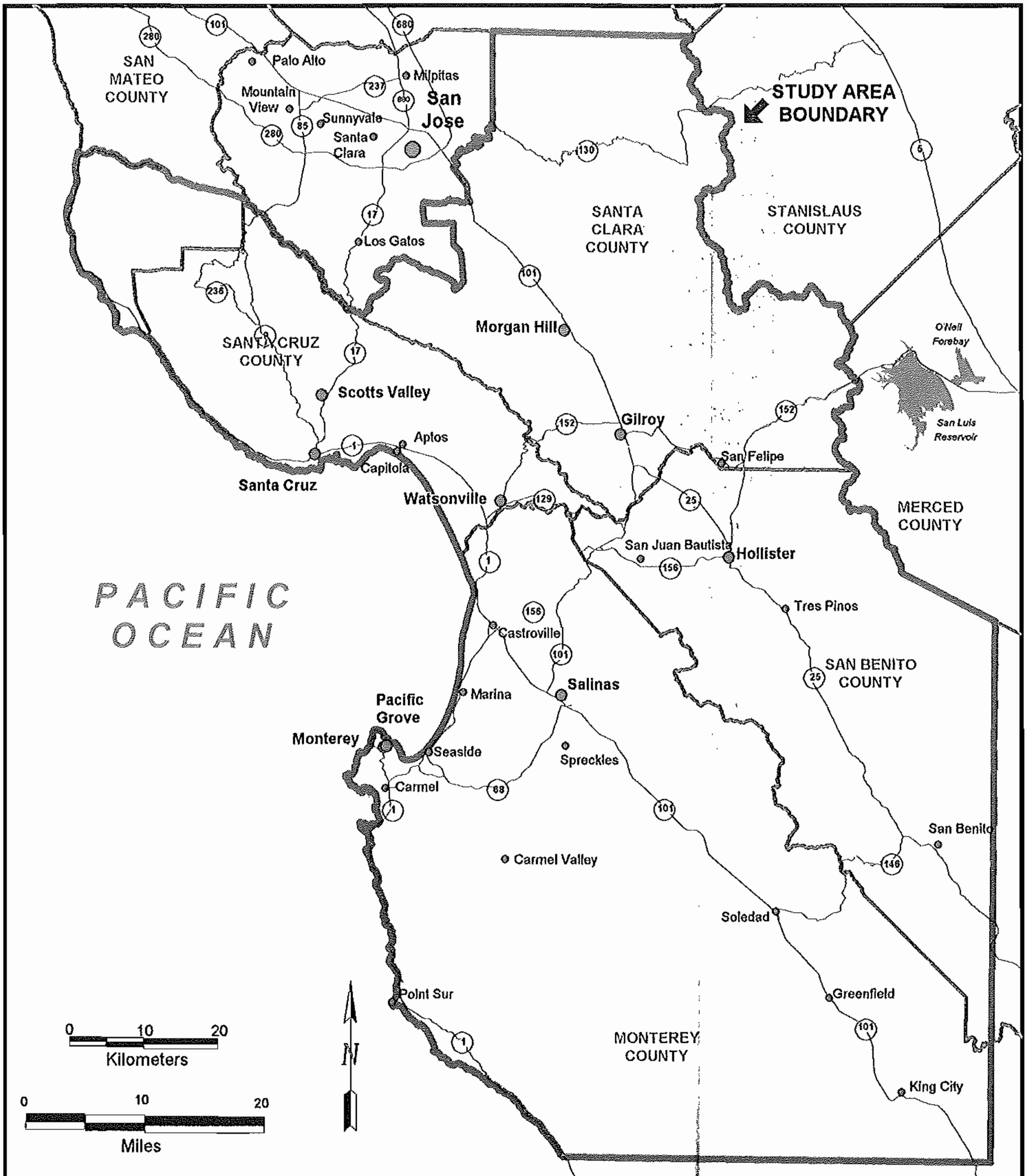

Figure 1. Map of the Monterey Bay Production-Consumption Region.

COUNTIES AND INCORPORATED CITIES OR TOWNS

Capitola
+ Carmel
DelRey Oaks
+ Gilroy
Hollister
*+ Marina
*+ Monterey
*+ Monterey County
+ Morgan Hill
Pacific Grove
Salinas
+ Sand City
+ San Benito County
San Jose
San Juan Bautista
*+ Santa Clara County
Santa Cruz
*+ Santa Cruz County
+ Scotts Valley
+ Seaside
Watsonville

*Agencies that have active aggregate operations within their jurisdictions

+Agencies that designated land within their jurisdiction.

Table 1. Lead agencies located within the Monterey Bay P-C Region.

It should be noted that the 1987 publication date for Special Report 146 does not reflect that report's completion date or the latest data-base year. Special Report 146 was completed and published in pre-print form in 1983. Consequently, information pertaining to classification is updated herein from 1983. Data regarding land use is updated as of 1986 from conditions present at the time of designation by the SMGB.

The most recent available data-base year for aggregate production used in Special Report 146 was 1980. Information pertaining to aggregate production and aggregate resources is updated herein from the end of 1980. The last aggregate production data-base year for this update report is 1997. All aggregate resource data for this report is current to the end of 1997.

Classification of the Monterey Bay P-C Region was done with regard to the suitability of the underlying material for use in construction-grade aggregate. For Special Report 146, and this update, construction-grade aggregate is defined as portland cement concrete (PCC) aggregate, asphaltic aggregate, aggregate base, and aggregate subbase down to Class III (Class IV and V subbase are considered types of fill and were not classified because of their abundance).

The generalized land classification within the Monterey Bay P-C Region, as presented on Plates 1 and 2 at a scale of 1:100,000, has been revised from Special Report 146, Part IV. Thirteen areas have been newly classified or reclassified for this update. These areas are shown on Plates 3-7, Revised Mineral Land Classification Maps and Plates 8-13, Newly Classified Mineral Resource Zones (see Index Maps of Plates, Figures 2 and 3). The classification nomenclature in use at the time of the original report has been kept.

REEVALUATION OF MINERAL LAND CLASSIFICATION

Based on new data that has become available since classification was completed in 1983, a total of eleven additions and two changes have been made to the original classification report. These are shown on Plates 3-13. All eleven additions are newly classified MRZ-2 areas. The two revisions are areas that were changed to MRZ-2, from a previous MRZ-3 or MRZ-4 classification.

Two of the eleven areas added were classified MRZ-2 at an earlier date in petition classification reports (Jensen, 1988 and Clinkenbeard, 1988). These are: 1) the Pearce Quarry, a 70-acre site underlain by crystalline limestone and granitic rocks in the northern Gabilan Mountains of San Benito County; and 2) the San Bruno Canyon deposit, a 110-acre site underlain by greenstone on the eastern flanks of the Santa Cruz Mountains in Santa Clara County.

The remaining nine additions are: 1) the Olive Springs Quarry expansion site (Santa Cruz County); 2) the Verne Freeman brecciated greenstone deposit

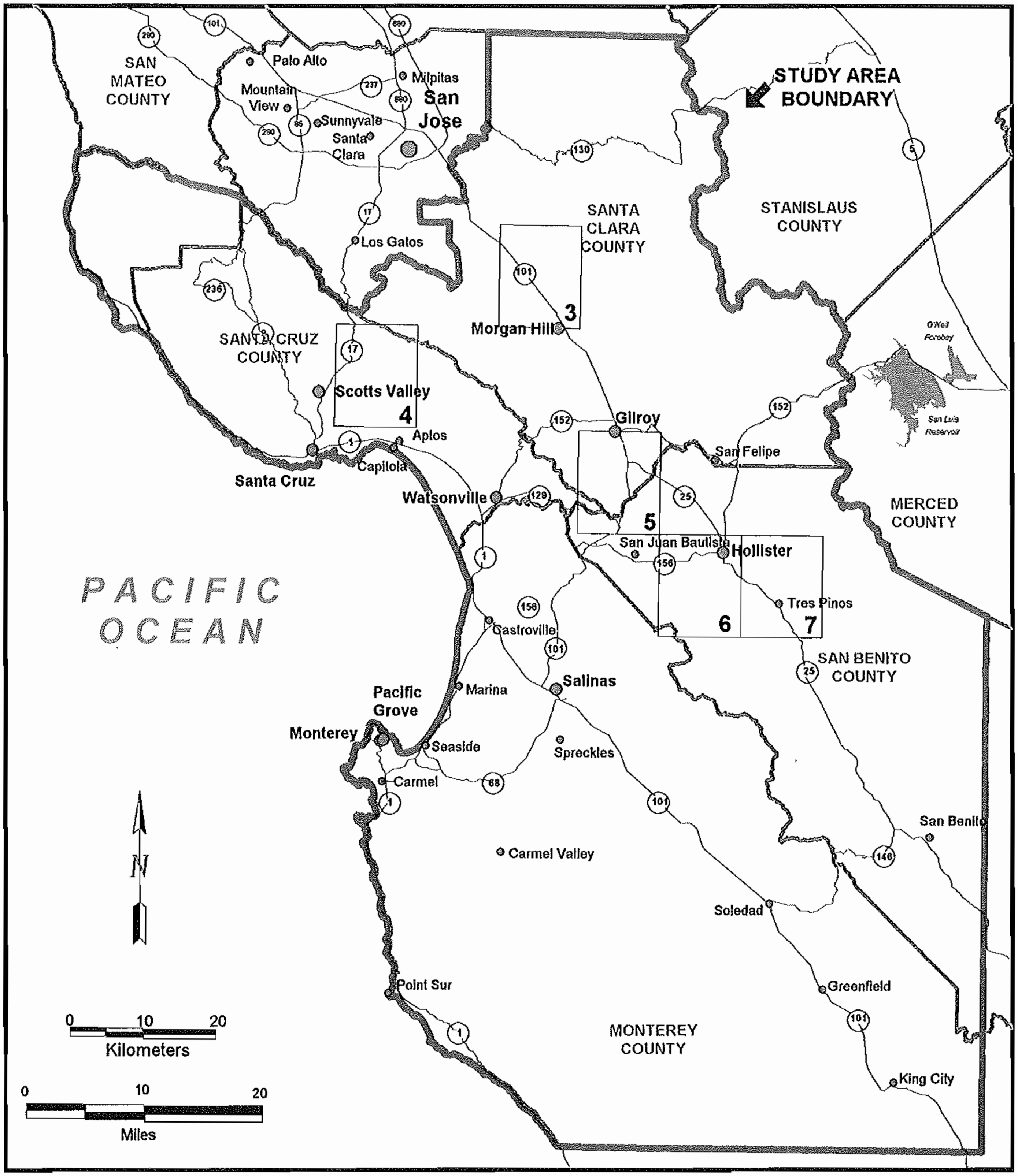

Figure 2. Index map of Plates 3-7; Revised Mineral Land Classification Maps

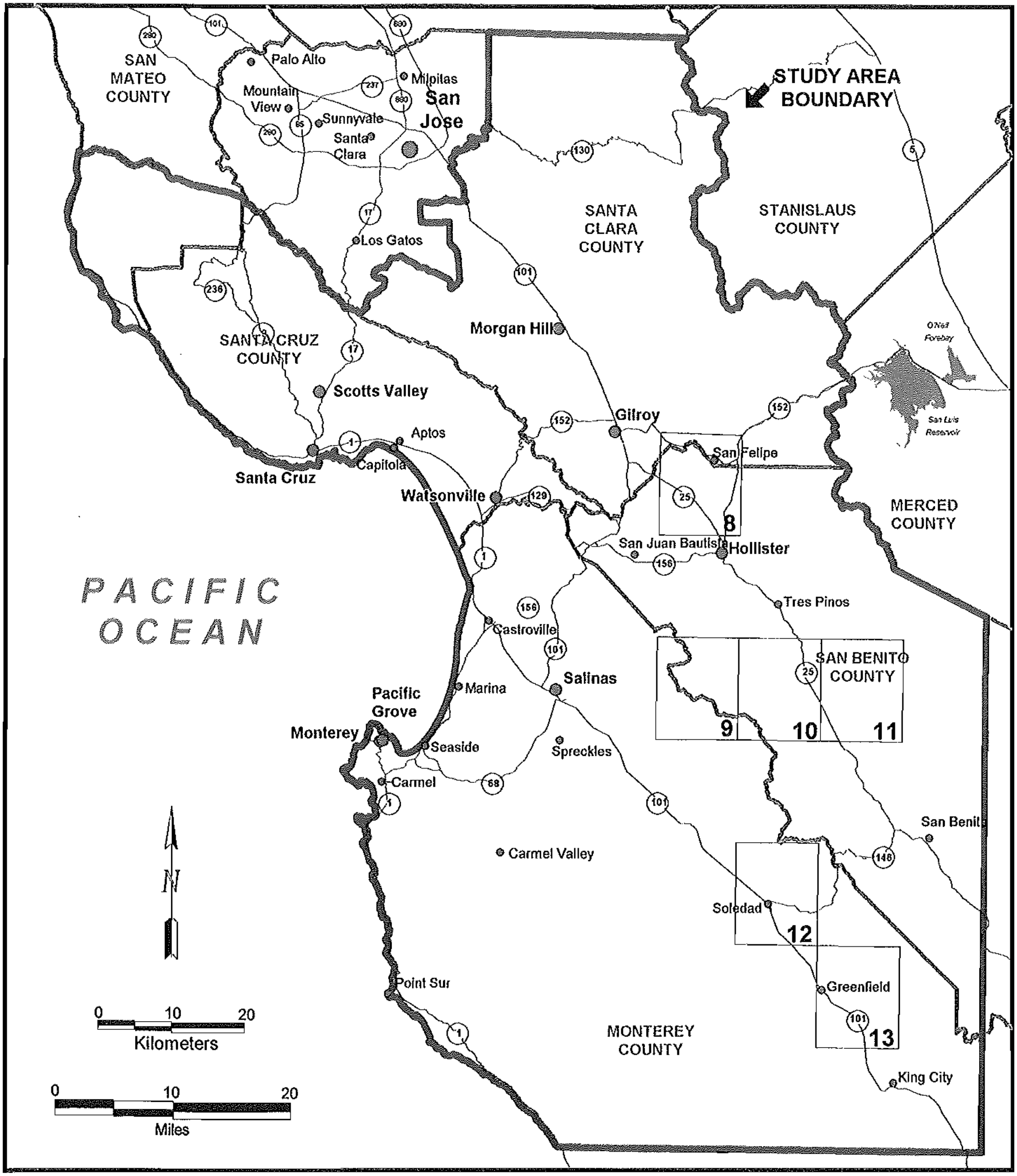

Figure 3. Index map of Plates 8-13; Newly Classified Mineral Resource Zone Maps

(Santa Clara County); 3) the Lomerias Muertas sandstone deposit (San Benito County); 4) the SCL/Bolsa sand and gravel deposit (San Benito County); 5) the Tres Pinos Creek sand and gravel deposit (San Benito County); 6) the Hollister Hills/Harris limestone deposits (San Benito County); 7) the San Benito Aggregate Inc's dolomite deposit (San Benito County); 8) the Stonewall Canyon Quarry area containing deposits of granitic rocks (Monterey County); and 9) the Chalone Creek extension (Monterey County).

The two classification revisions are: 1) the Wilson Quarry southeast expansion area in San Benito County (reclassified MRZ-2 from MRZ-3and MRZ-4) and 2) the Williams Quarry sandstone deposit, San Benito County, (reclassified MRZ-2 from MRZ-4).

The eleven newly classified and two reclassified areas all add aggregate resources to the Monterey Bay P-C Region. All of these newly identified resource areas lie in undesignated lands. They are discussed in more detail beginning on page 11, "Newly Classified and Reclassified MRZ-2 Areas."

REEVALUATION OF AGGREGATE RESOURCES IN THE MONTEREY BAY P-C REGION

Construction-grade aggregate resources were quantitatively reevaluated based on available resources classified as MRZ-2 (see Appendix). Construction aggregate is defined for this report as any aggregate material (sand and gravel and crushed rock) that meets specifications for Class III aggregate subbase or higher grades.

Concepts Used in Identifying Available Aggregate Resources

The State Geologist is responsible for calculating aggregate resources in areas classified as MRZ-2 for aggregate. There are lands within these areas that have already been urbanized and have a limited opportunity for mineral resource conservation and extraction. Therefore, the State Geologist has restricted the calculation to areas that have not been urbanized. These non urbanized MRZ-2 areas were identified as sectors in Special Report 146, Part IV (Stinson and others 1987). Most of the sectors were subsequently designated by the SMGB as being regionally significant. All designated sectors identified in SMARA Designation Report No. 7 (California Department of Conservation, 1987) were reevaluated for this update. Plates 14-30 (see Figure 4 for index to Plates) show areas of lost resources due to urbanization or other incompatible land uses since designation in October, 1986. The maps also show land owned or controlled by aggregate companies that lie within the designated land.

For purposes of identifying available aggregate resources, incompatible uses of land are defined as improvements of high cost such as high-density residential developments, intensive industrial developments, commercial developments, and major

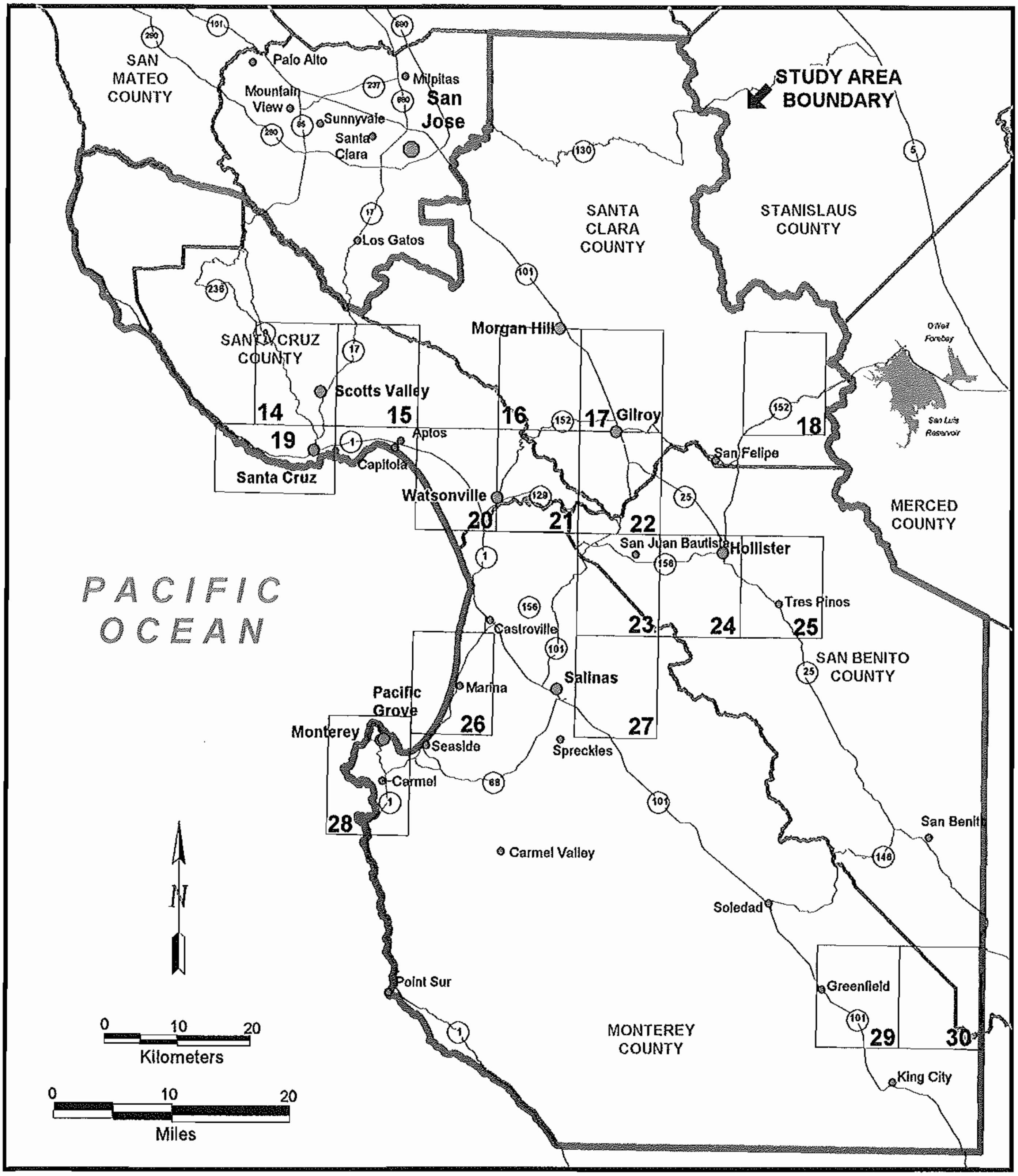

Figure 4. Index map of Plates 14-30; Designated Areas Update Maps

public facilities. Lands that have compatible uses are defined as those that are nonurbanized or that have very low density residential development (1 unit per 10 acres), lands that lack high-cost improvements, and lands used for agriculture, silviculture, grazing, or open space.

Updated information pertaining to land use for aggregate resource areas classified MRZ-2 was based on conditions as of January, 1999. Land use was determined by reviewing data from lead agencies, analyzing aerial photographs and photo-revised topographic maps, and field investigations.

The revised resource calculations of aggregate in the Monterey Bay P-C Region are compared with the State Geologist's new forecast of the 50-year demand on the region. The comparison of regional needs with available reserves and resources provides the opportunity to focus attention on the mineral resource issues confronting the region, such as the need to plan carefully for the use of any lands containing mineral resources, and the need to consider the permitting of additional mining operations in the region as currently mined deposits are depleted.

It is highly likely that all available aggregate resources calculated for this report will not ultimately be mined. There may be political constraints and other considerations confronting local government in making aggregate resources available for extraction that are not accounted for. Considering this, it becomes important for local governments to carefully review the estimated resources in order to ensure that adequate resources will be available for future development of the region's economy.

Calculation of Available Resources

Reserves and Resources

In this report, reserves are calculations of tonnages of aggregate that have been determined to be acceptable for commercial use, that exist within properties owned or leased by aggregate producing companies, and for which permits have been granted to allow mining and processing of the material. Permits may be required by agencies other than the county, as is the case in rivers where a permit may also be required by the Army Corps of Engineers. Resources include reserves as well as all potentially usable aggregate materials that may be mined in the future, but for which no permit allowing mining has been granted.

Factors Considered in Calculations

The calculations presented are for those aggregate resources in the sectors designated by the SMGB (California Department of Conservation, 1987) and additional resources in the thirteen reclassified and newly classified MRZ-2 areas. The changes in the areas available for mining, as identified in this study, are shown on Plates 3-30 (see Figures 2, 3, and 4 for index to Plates).

The factors used in this study to determine the areal extent and tonnage of aggregate resources remaining within the sectors are from those used in Special Report 146, Part IV (Stinson and others, 1987) with the exception of the in-place densities that were modified due to new information. They were as follows:

1. Resource tonnage calculations were based on measurements taken from 1:24,000 scale base maps or maps obtained from aggregate companies with varying scales.

2. Thicknesses of aggregate deposits were determined by analyzing water well-log data, examining active aggregate pits and natural outcrops, and reviewing information provided by persons who have knowledge about aggregate deposits in this region.

3. A standard setback of 100 feet from utility and rail lines and urban developments was used to determine the limits of areas available for mining, unless otherwise stipulated on individual mining plans.

4. Side slopes were generally calculated to have a 1:1 gradient, or, if the deposit was permitted for mining, the side slopes that were specified in the mining plan.

5. In-place densities of 0.04 to 0.08 tons per cubic foot were assumed in calculating sand and gravel resources and densities of 0.08 to 0.09 tons per cubic foot were assumed in calculating crushed stone resources.

Resource Sectors

All lands in the original Monterey Bay P-C Region classification report (Stinson and others, 1987) containing extractable aggregate deposits were divided into 21 sectors, covering 17 square miles of land. During the process of public and lead agency comment in response to the Environmental Impact Report (California Department of Conservation, 1985), it was determined that 4 of the 21 sectors should not be designated. All or parts of the remaining 17 sectors, covering 12 square miles, were designated by the SMGB in 1986 (California Department of Conservation, 1987). They are described below:

Sector A - Quartz diorite on Ben Lomond Mountain west of Felton in Santa Cruz County.

Sector B - Sandstone deposit divided into three large non-continuous parcels north and east of Felton in Santa Cruz County.

Sector C - Sandstone deposits near the Wilder Ranch west of the city of Santa Cruz in Santa Cruz County.

Sector D - Alluvial deposit in three separate but adjacent parcels in Uvas Creek west of Gilroy in southern Santa Clara County.

Sector E - Channel and floodplain deposits in a portion of the San Benito River west and south of Hollister, extending from lower Tres Pinos Creek west to State Highway 101 in central San Benito County.

Sector F - Two elongated deposits near the community of Aromas in western San Benito County, extending from State Highway 101 northwesterly to Pajaro Gap on Highway 129, a distance of approximately five miles.

Sector G - The Natividad Quarry which consists of marble and dolomite north of Salinas in Monterey County.

Sector H - Sand deposits in two separate but adjacent parcels along the southern portion of Monterey Bay north of the City of Marina, Monterey County.

Sector I - A large sand dune area on the northern edge of the City of Marina in Monterey County.

Sector J - Quartz diorite on Huckleberry Hill on the west side of the city of Monterey in Monterey County.

Sector K - Stream channel and floodplain deposit consisting of a one mile long portion of the lower Carmel River east of Highway 1 and south of the City of Carmel in Monterey County.

Sector L - Quartz diorite and siltstone on the east side of Sugarloaf Mountain in Santa Cruz County.

Sector M - Fluvial sand and gravel deposit on Freedom Boulevard approximately seven miles northwest of Watsonville in southern Santa Cruz County.

Sector N - Alluvial deposit at the confluence of the Chalone Creek with the Salinas River in southern Monterey County, approximately three miles southwest of the community of Greenfield, northeast of the Southern Pacific Railroad tracks.

Sector O - Alluvial deposit consisting of two separate but adjacent parcels at the confluence of Chalone Creek with the Salinas River in southern Monterey County, approximately three miles southwest of the community of Greenfield.

Sector P - Stream channel and floodplain deposits of the San Lorenzo Creek in the foothills of the Gabilan Range in southern Monterey County approximately six miles northwest of King City.

Sector U - Stream channel and floodplain deposits in three parcels along upper Pacheco Creek near Bells Station in southeastern Santa Clara County.

Newly Classified and Reclassified MRZ-2 Areas

Since the original classification and designation of the Monterey Bay P-C Region, thirteen additional areas have been identified as containing significant aggregate resources and have been classified MRZ-2.

The classification process followed requires:

1. The deposit be composed of material that is saleable as a marketable commodity (construction-grade aggregate)

2. The deposit meet a minimum value of **$13,200,000**, based on the gross selling price of the first marketable product (5,000,000 1978-dollars, when the guidelines were written).

Eleven of the thirteen areas are newly classified while the remaining two MRZ-2 areas have been reclassified from the original report. The additional resources from these areas total about 227 million tons. These 13 areas are discussed below.

San Bruno Canyon greenstone deposit: This area consists of two newly classified MRZ-2 sites totaling about 110 acres on the eastern flanks of the Santa Cruz Mountains in southern Santa Clara County, about 4 miles northwest of Morgan Hill (see Plate 3). The two sites are collectively referred to as the San Bruno Canyon greenstone deposit. The San Bruno deposit was classified MRZ-2 for aggregate (Jensen, 1988) in response to a petition accepted on May 13, 1988, by the SMGB from the A.J. Raisch Paving Company. The deposits were not classified for the original Monterey Bay P-C Region classification study (Stinson and others, 1987) because they were outside the limit of urbanization and there was insufficient data to indicate that the area contained significant aggregate resources.

The San Bruno Canyon greenstone deposits lie within northwest-trending, lenticular bodies of weakly metamorphosed mafic volcanic rocks (greenstone) belonging to the Late Jurassic to Cretaceous Franciscan Complex. Outcrops of greenstone at the two sites are weathered to a reddish-brown at the surface while fresh greenstone from drill cores is gray-green to green-black with white stringers of calcite and quartz. The greenstone deposit was estimated to have an average minimum thickness of 140 feet (Jensen,1988).

Aggregate test data provided by the petitioner and analyzed by DMG staff indicate that rock from the deposit meets the California Department of Transportation's (CalTrans) specifications for asphaltic concrete, base, and subbase. The San Bruno Deposit has not previously been mined. The A.J. Raisch Paving Company was denied a permit to mine the deposit in the late 1980s.

Olive Springs Quarry, Inc. western expansion area: The Olive Springs Quarry western expansion area comprises about 17 acres of newly classified MRZ-2 land underlain by Tertiary granitic conglomerate and sandstone. The land is at the top of Sugarloaf Mountain and adjacent to Olive Springs Quarry, Inc.'s existing quarry in Santa Cruz County (see Plates 4 and 15). The permit to mine the 17 acres, approved by Santa Cruz County in 1994, adds about 13 million tons of reserves to the Olive

Springs Quarry. Additional information about the deposit and Olive Springs Quarry Inc.'s mining operation is given in the Mining Operations section of this report.

Verne D. Freeman Sr. proposed quarry area: This newly classified MRZ-2 area covers roughly 60 acres, in Southern Santa Clara County about 3 miles south of the city of Gilroy (see Plate 5). The area is underlain by brecciated greenstone belonging to the Late Jurassic to Cretaceous Franciscan Complex. The deposit has recently been drilled and tested for construction-grade aggregate by West Coast Aggregates, Inc. Test data given to DMG staff indicates that the rock meets CalTrans specifications for PCC aggregate.

This newly classified area has never been mined. In September 1998, Santa Clara County issued a permit to West Coast Aggregates, Inc. to mine the property. Most of this rock will likely be shipped north to the San Jose metropolitan area in the adjacent South San Francisco Bay P-C Region.

Wilson Quarry southeast expansion area: The Wilson Quarry southeastern expansion area comprises about 52 acres which has been reclassified from MRZ-3 and MRZ-4 to MRZ-2 (see Plate 5). This reclassified area is a southeast extension of the hornblende gabbro deposit which is currently being mined for concrete aggregate at Granite Rock Company's Wilson Quarry, San Benito County (see Plates 21 and 22). Despite the probable existence of good quality gabbro at depth, this area was not classified MRZ-2 in the original report because of the excessive amount of overburden which in some areas exceeded 150 feet. Since then, the Granite Rock Company has designed an extensive overburden conveyor system that has made the removal of the underlying rock economic. A more detailed discussion of the geology and quality of rock at the Wilson Quarry is given under the Mining Operations section of this report.

Williams Quarry area: An area of approximately 25 acres about three miles northwest of the town of San Juan Bautista has been reclassified from MRZ-4 to MRZ-2 for aggregate resources (see Plate 5). This area includes the site of the Williams sand quarry (see Plate 22) which has been mined in the past mostly for fill sand. This deposit contains tan to light-brown pebbly sandstone beds of the Upper to Middle Pliocene Purisima Formation. Because the material mined at the site is not washed, the highest current use is for fill sand. Limited test data indicates that the sand at the Williams Pit would probably meet specifications for concrete aggregate if washed.

The Williams Quarry was acquired in 1961 and was opened in 1964. The property was operated under the name of Mel Williams Sand and Gravel from 1964 until the mid 1980s when South Bay Sand and Gravel took over the property. The quarry was idle from 1992 to 1995. R.G.W. Construction, Inc. operated the quarry in 1995 and 1996. In February of 1998, the current operator, Stevens Creek Quarry, Inc., began mining the property.

Lomerias Muertas Quarry area: This newly classified MRZ-2 area covers about 55 acres along a prominent ridge in the Lomerias Muertas Hills in San Benito County, about seven miles south of Gilroy (see Plates 5 and 22). The area is underlain by fine- to medium-grained, poorly consolidated, pebbly sandstone of the Upper to Middle Pliocene Purisima Formation. The sandstone generally trends N65°W to E-W, dips from 30°-55°S, and is roughly 400 feet thick at the quarry site. Siltstones and claystones of the Purisima Formation overlie and underlie the sandstone. The deposit is about 90% sand, 8-10% gravel, and less than 2% silt. The coarser sand and gravel meets specifications for PCC aggregate. The finer sands are suitable for fill sand. The silt is considered waste.

The Lomerias Muertas sandstone deposit was first mined in 1992 by the Hillsdale Rock Company that has mined the property continuously since then. The current permit allows the ridge elevation to be lowered by 360 feet. Aggregate mined at the Lomerias Muertas deposit is processed at Hillsdale Rock Company's San Juan Plant.

SCL/Bolsa sand and gravel mine area: This newly classified MRZ-2 area, totaling about 130 acres, occupies a low-lying northwest-trending hill just west of the Hollister airport and about two miles north of the city of Hollister (see Plate 8). The hill, a compression ridge formed along the San Andreas Fault Zone, is underlain by unconsolidated light grey sand, gravel, and silt belonging to the Quaternary San Benito Formation (Rogers, 1993). Portions of the hill are currently being selectively mined for sand and gravel. A field investigation indicated that roughly 40% of the deposit consists of massive well sorted fine sand and silt which is suitable only for fill. The remaining 60% of the deposit consists of coarser sands which meet specifications for concrete sand and gravel which is largely used for Class II aggregate base. These sand and gravel deposits occur in beds up to 5 feet thick. The gravel clasts are largely chert and graywacke derived from the Franciscan Complex and some granitic rocks. Clast size generally does not exceed 6 inches.

The deposit was not classified in the initial Monterey Bay aggregate classification study (Stinson and others, 1987) because it was outside the boundary of urbanization and because there was insufficient information as to the quality of the sand and gravel.

It is not known when the SCL deposit was first mined. The 1955 U.S. Geological Survey 7½' topographic map of the area shows a gravel pit at the locality. Some mining took place in the 1970s. By 1978, the mine was inactive and did not reopen until 1983 when Hillsdale Rock Company commenced operations. The property has been active since then. In August of 1998, the SCL /Bolsa Mine was sold to the Don Chapin Company.

Pearce Quarry area: The Pearce Quarry area comprises about 70 acres in the northern Gabilan Mountains about 5 miles southwest of Hollister in San Benito County (see Plate 6). The quarry site was classified MRZ-2 for aggregate (Clinkenbeard, 1988) in response to a petition received by the SMGB from the Hillsdale Rock Company on March 16, 1988. The area is underlain by high quality aggregate resources composed of crystalline limestone and granitic rocks. The limestone is light grey to white, fine- to coarse-grained and is part of a northeast-trending body of metasedimentary rocks belonging to the pre-Cretaceous Sur Series. The limestone at the quarry site trends from N75°W to E-W and dips from 35°-45° south. The granitic rocks range in composition from quartz diorite to quartz monzonite. The unweathered limestone and granitic rocks meet CalTrans specifications for PCC and asphaltic aggregate while the weathered rocks are potential sources for base and subbase aggregate.

The Pearce Quarry area was previously operated by the Pacific Portland Cement Company in the early 1940s to supply limestone to their San Juan Bautista cement plant. The company was bought out by the Ideal Cement Company in 1952. Limestone for cement manufacturing was last mined at the site in 1973. The quarry was not active again until 1984-85 when the U.S. Bureau of Reclamation mined rock for riprap and drain gravel. The quarry has not been mined since then, although some material was removed from stockpiles in the winter of 1998 for use in storm damage repair. In the late 1980s, Hillsdale Rock Company tried unsuccessfully to obtain a mining permit for the property. The Pearce Quarry site is not currently owned or controlled by any mining company.

Hollister Hills/Harris limestone deposits: Four small exposures of crystalline limestone totaling about 11 acres in the Hollister Hills State Vehicular Recreational Area have been newly classified as MRZ-2 for aggregate (see Plate 6). These limestone bodies were mapped by Rogers (1993). The four MRZ-2 areas lie within a 630-acre parcel of land for which Granite Rock Company currently owns the mineral rights. The limestone is part of the pre-Cretaceous metasedimentary rocks of the Sur Series. It occurs as coarsely crystalline greyish-white and medium-grained bluish-grey rock outcropping in a series of discontinuous masses trending from about N65°W to E-W to N55°E (Bowen and Gray, 1959). The beds generally dip south from 30°-80°. The limestone is at least 100 feet thick in some of the larger exposures. Parts of the limestone are brecciated.

The Hollister Hills/Harris limestone deposits were likely explored for their lime content in the late 1890s and early 1900s. More recent exploration took place in the 1950s, 1960s, and 1970s. In 1965, Granite Rock Company purchased the mineral rights to the 630-acre parcel from Howard Harris. In 1977, San Benito County granted Granite Rock Company a use permit allowing mining of limestone and related rock within the 630-acre site. The only known aggregate mining within the 630 acres occurred from 1986 to 1987. During this time, a small quantity of rock (probably less than 50,000 tons) was mined by Granite Rock Company. No mining of the property has taken place since then. The highest known use of the mined rock has been for Class II aggregate base, although Granite Rock Company provided DMG with one set of test data indicating that the limestone meets CalTrans specifications for PCC aggregate.

Tres Pinos Creek and terrace area: An eleven-mile stretch of the Tres Pinos Creek in San Benito County has been newly classified MRZ-2 for sand and gravel. This resource area includes a segment of Tres Pinos Creek beginning at Southside Road and continuing upstream for eleven miles to the confluence of Los Muertos Creek (see Plates 7, 10, and 11). The area also includes 128 acres of an alluvial terrace deposit on the north side of the creek just west of the town of Tres Pinos. Tres Pinos Creek is a major tributary to the San Benito River.

The last mining to take place in Tres Pinos Creek was done by San Benito Supply, which shut down in May of 1988 (see Plate 11 and Mining Operations section, San Benito Supply, Paicines Ranch). Historic mining has taken place along three miles of the creek channel to the south and southeast of the town of Tres Pinos. Granite Rock Company's Southside operation (see Plate 25) is currently mining sand and gravel from the 128-acre alluvial terrace deposit just north of the active channel (see Mining Operations section, Granite Rock Company, Southside). Granite Rock Company also controls an unpermitted half-mile segment of the channel at the southeastern boundary of the Tres Pinos Creek MRZ-2 area. This point marks the upstream limit of test pit data which was provided to DMG staff by the company. This data indicates alluvial sand and gravel to depths of at least 18 feet.

Although the alluvial gravels along this part of Tres Pinos Creek are believed to exceed 20 feet in depth, it is not feasible to consider resources below 10 feet because of the serious problem of infrastructure loss due to instream mining.

San Benito Aggregates, Inc. dolomite deposit: About 92 acres, 11 miles south of Hollister in San Benito County, has been newly classified MRZ-2 for aggregate (see Plate 9). The area defines a deposit of dolomite which is currently being mined by San Benito Aggregates, Inc. for aggregate. The dolomite body is one of many pendants in the Gabilan Range lying on top of Mesozoic granitic rocks and schist. These pendants are strongly metamorphosed sedimentary rocks of probable Paleozoic age. The dolomite occurs in an east-west trending lens-like body measuring about 1,600 by 600 feet with beds dipping 30-40° to the west. It is nearly pure white, medium-grained, and runs about 21% MgO (Bowen and Gray, 1959). Because the deposit is close to the San Andreas Fault Zone, much of the rock is highly fractured.

Small tonnages of dolomite were mined from this deposit as early as 1915. The Food Machinery and Chemical Corporation (F.M.C.) purchased the property in 1946 and operated the property from 1947 to 1984 when the current owner, San Benito Aggregates, Inc. took over the operation. The dolomite mined from the deposit was mainly used for glass manufacturing until the early 1980s, after which base rock and other construction aggregate products were produced. No dolomite from the quarry has been sold for glass manufacturing since 1996.

Stonewall Canyon Quarry area: This newly classified MRZ-2 area covers about 50 acres along the southwestern flank of the Gabilan Range, about two miles northeast of the city of Soledad in Monterey County (see Plate 12). The area is underlain by Mesozoic granitic rock, consisting of highly weathered surface rock used for subbase and less weathered material at depth used for road base, drain rock and riprap.

The deposit has been mined since the 1920s. The existing quarry has been mined since 1985. The quarry was purchased by Syar Industries, the current owner, in August of 1989 from William Baldwin.

Chalone Creek area: About 8 acres of land in the active channel of Chalone Creek has been newly classified MRZ-2. This land is about 2.5 miles to the northeast of Greenfield in Monterey County (see Plate 13). This newly classified area contains coarse-grained sand and gravel derived largely from the weathering of volcanic rocks to the east. Mineralogy of the sand and gravel is similar to material mined at the adjacent Metz operation (see Granite Construction Company, Metz/Chalone Creek in the Mining Operations section). Recharge of the alluvium occurs during winter floods. The aggregate meets specifications for PCC aggregate. Swift Tectonics, Inc. has an active permit to mine this newly classified area of the creek along with an area of about three acres which makes up the central part of Sector O (see Plate 29). The area was not being mined at the time of the site visit for this report (December 1998).

Aggregate Resources in the Monterey Bay P-C Region

Aggregate resources of construction-grade aggregate for all designated land in the Monterey Bay P-C Region are shown on Table 2. This table also includes resources for the above mentioned lands which have been newly classified or reclassified MRZ-2. The resources shown on Table 2 are current as of January, 1998.

As shown on Table 2, construction-grade aggregate resources within the Monterey Bay P-C Region currently total 1,210 million tons, a decrease of 164 million tons from the 1,374 million tons available at the time of designation in 1986.

Permitted resources (reserves) available in the P-C region total 269 million tons, a decrease of 517 million tons from the 1980 original calculations and 482 million tons since designation occurred in 1986.

Table 2. Data on designated sectors and newly classified resource areas of the Monterey Bay P-C Region (as of January, 1998).

County	**Designated Sector/New MRZ-2 Area	SAND AND GRAVEL		CRUSHED ROCK	
		Reserves	Resources	Reserves	Resources
SANTA CRUZ	A			*	*
	B	*	*		
	C	*	*		
	L Olive SpringsQuarry Expansion Area			*	*
	M	*	*		
Santa Cruz County Total		15	15	*	*
SANTA CLARA (Monterey Bay P-C Region)	D		23		
	U		19		
	San Bruno Canyon				20
	V.D. Freeman Proposed Quarry			*	19
Santa Clara County Total			42	*	39
SAN BENITO	E	*	54		
	F Wilson Quarry Expansion Area			*	331
	Williams Quarry	*	*		
	Lomerias Muertas Quarry	*	*		
	SCL/Bolsa Mine	*	*		
	Pearce Quarry				49
	Hollister Hills			*	*
	Tres Pinos Creek	*	30		
	San Benito Aggregate Dolomite Quarry			*	*
San Benito County Total		33	113	*	386

Table 2 (Continued)

County	Designated Sector/New MRZ-2 Area	SAND AND GRAVEL		CRUSHED ROCK	
		Reserves	Resources	Reserves	Resources
MONTEREY	H	*	40		
	I	*	171		
	J			*	29
	K		2		
	N	*	*		
	O	*	*		
	P	*	*		
	Stonewall Canyon			*	*
Monterey County Total		8	217	12	40
P-C REGION TOTAL		56	387	213	823

Total Reserves = 269 million tons
Total Resources = 1,210 million tons

*Cannot be shown individually due to confidentiality, amount is included in total at bottom of page.

** All designated lands are shown by letters. New MRZ-2 areas have names.

About 56 million tons (21%) of the total 269 million tons of reserves available in the P-C Region as of January 1998 are sand and gravel. The remaining 213 million tons (79%) are crushed stone reserves. In 1980, 33% of the aggregate reserves within the P-C Region were sand and gravel and 67% were crushed stone. Of the 1,210 million tons of resources available in the P-C Region, 387 million tons (32%) are sand and gravel and 823 million tons (68%) are crushed stone. In 1980, the sand and gravel to crushed stone ratio was 30/70.

Resource Decreases

Decreases in non-permitted aggregate resources were caused by urbanization in aggregate resource areas since designation, and by reevaluation of non-permitted resources for the update. Since designation in 1986, less than one percent of the designated areas have been made unavailable for mining due to urbanization, amounting to about 4 million tons of lost resources. Reevaluation of non-permitted aggregate resources considered new instream mining depth constraints caused by loss of infrastructure, and new information on aggregate quality, overburden depth, and other economic constraints. Resource reevaluation has caused a decrease of about 369 million tons. New resource calculations in the San Benito River are a good example of such reevaluations. In the original report, resources in the San Benito River were calculated down to 40 feet while a 10 foot depth was used in this updated report. Because mining in the San Benito River has caused a considerable amount of loss of infrastructure with San Benito County, resources to 10 feet represent a more realistic estimate of the sand and gravel that will be mined.

Decreases in permitted aggregate resources (reserves) were caused by aggregate consumption since 1980 and by reevaluation of aggregate reserves. Since 1980 roughly 121 million tons of aggregate resources in the Monterey Bay P-C Region have been consumed. Reserve reevaluation resulting in a decrease of 623 million tons, was based on new information provided from mine reclamation plans, which were not available for the original study.

Newly Permitted or Newly Classified Aggregate Resources

Since 1980, about 227 million tons of construction-grade aggregate reserves have been added to the Monterey Bay P-C Region. This includes reserves added through new or expanded permits and also those added in the newly classified areas. Permits were granted for mining aggregate in previously unmined areas as well as for mining deeper in areas already permitted. Sand and gravel reserves added to the P-C Region amounted to 30 million tons, most of which are in San Benito County. Crushed stone reserves for the P-C Region were increased by 197 million tons.

Instream Resources

The loss of infrastructure due to mining in the San Benito River and Tres Pinos Creek has caused the county of San Benito to put constraints on instream mining. Environmental and other regulatory constraints are also expected to make future extraction of instream resources more difficult in the future. To assess the impacts of such constraints, a separate measurement was made of instream aggregate resources in the Monterey Bay P-C Region.

The term "instream" does not yet have a commonly agreed on definition. Two of the most appropriate definitions are 1) the area of the ordinary high water flow of a stream or river, and 2) the area within the 100-year floodplain. Calculations were made based on each of these definitions. These areas are shown on Plates 31-42.

The ordinary high water flow channel is the definition used by the U.S. Army Corps of Engineers in regulating the waters of the United States. Geologic mapping was used to define the boundaries of the high water channels in the San Benito River, Tres Pinos Creek, and Pacheco Creek. Boundaries were drawn along areas mapped as Qg (gravel and sands of stream channels) by Dibblee (1975), Dibblee and Brabb (1978), Dibblee (1979 a, b, and c),and Dibblee and others (1979). High water channels for Uvas, Chalone, and San Lorenzo Creeks and the Carmel River were determined using the most up-to-date U.S. Geological Survey 1:24,000 topographic maps.

Within the alluvial areas designated or newly classified MRZ-2, about 88 million tons of aggregate resources lie within the boundaries of the high water channels, amounting to about 40% of the total sand and gravel resources for the Monterey Bay P-C Region. In these channels, about 13.5 million tons of aggregate resources were identified in the Uvas Creek (Sectors D-1, D-2 and D-3, on Plates 31, 32, and 34, Figure 5 for index to plates), 8.2 million tons in the Pacheco Creek (Sectors U-1, U-2, and U-3 on Plate 33), 61 million tons in the San Benito River and Tres Pinos Creek (Sectors E-1 to E-6 on Plates 34-39), 2.3 million tons in the Carmel River (Sector K on Plate 40), less than one million tons in the Chalone Creek (Sectors N and O on Plate 41), and 2.5 million tons in the San Lorenzo Creek (Sector P on Plate 42). Reserves lying within the high water channel total 3.7 million tons and only occur in the San Benito River, Tres Pinos Creek, Chalone Creek and San Lorenzo Creek. This is 46% of the regions sand and gravel reserves and 7% of the total aggregate reserves for the Monterey Bay P-C Region.

The area within the 100-year floodplain is not yet used for regulatory purposes but may in the future as it includes considerable riparian habitat. The digital Q3 Flood Data produced by the Federal Emergency Management Agency were used to delineate the areas of the 100-year floodplain of the seven above mentioned creeks and rivers. There are 15 million tons of aggregate resources within the 100-year floodplain of the Uvas Creek, 8.2 million tons in the Pacheco Creek , 71 million tons in the San Benito

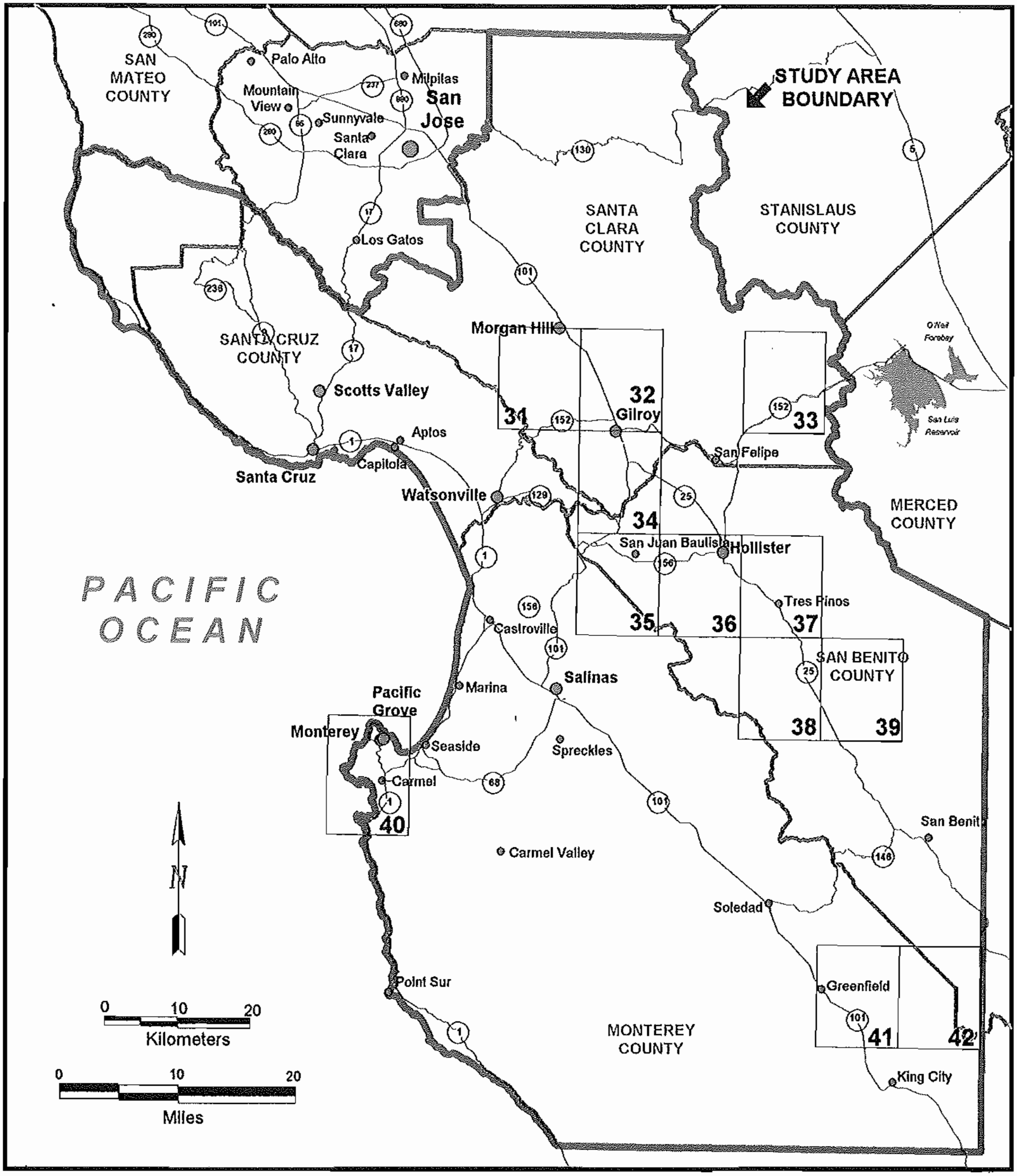

Figure 5. Index map of Plates 31-42; Instream Areas Maps

River and Tres Pinos Creek, 2 million tons in the Carmel River, less than one million tons in the Chalone Creek, and 3 million tons in the San Lorenzo Creek. This is 46% of the sand and gavel resources in the region. Reserves within the 100-year floodplain total 4.3 million tons and are present only in the San Benito River, Tres Pinos Creek, Chalone Creek, and San Lorenzo Creek. This is 54% of the total sand and gravel reserves and 8% of the total aggregate reserves lying within the Monterey Bay P-C Region.

Recycled Aggregate

Recycled construction and demolition waste material is used to a limited extent in the Monterey Bay P-C Region for Class II aggregate base. In 1997, about 220,000 tons of recycled aggregate was produced from seven sites within the Monterey Bay P-C Region which amounts to about 3% of the total aggregate produced in the P-C Region.

Due to the heterogeneous nature of recycled construction and demolition waste, it cannot now be used to make PCC aggregate or asphaltic aggregate. Its use is limited to Class II aggregate base and some Recycled Asphalt Pavement (RAP)—old asphalt which is torn up and mixed in small percentages with new asphalt paving at the batch plant. The increased use of recycled material will lead to an extended life of virgin aggregate reserves and resources in the Monterey Bay P-C Region.

PART II - AGGREGATE PRODUCTION IN THE MONTEREY BAY P-C REGION

The historical aggregate production data for the Monterey Bay P-C Region were obtained from mining records of the U.S. Department of the Interior, Bureau of Mines (this function is now within the U.S. Geological Survey); the California Department of Conservation, Office of Mine Reclamation; and the aggregate companies. The U.S. Bureau of Mines records were compiled from responses to voluntary questionnaires sent annually or biannually to all known mining operators. Each producer was requested to divulge the production from each of his producing properties for the preceding year. The accuracy of these figures depends on the producer's response. DMG staff checked current and past production where possible, and modified the data accordingly.

MINING OPERATIONS

As of January 1998, 27 mines and one proposed mine had permits to extract aggregate in the Monterey Bay P-C Region. These properties, owned or operated by 16 companies, are shown on Plates 1 and 2 and Figure 6. Six of the 27 mines and the Verne D. Freeman Sr. proposed mine have already been described in the section "Newly Classified and Reclassified MRZ-2 areas." The remaining mines are described below.

Granite Rock Company, Quail Hollow Quarry:

The Quail Hollow Quarry comprises about 190 acres of land in the Santa Cruz Mountains about 1.5 miles north of Mount Herman in Santa Cruz County (see Plate 14). Fine- to coarse- grained light tan marine sandstone of the Upper Miocene Santa Margarita Formation is mined at the quarry. The sandstone occurs as massive, poorly consolidated beds that lie nearly horizontal. Maximum thickness of the sandstone in the region is reported to be 430 feet in the vicinity of Olympia (Clark, 1966). Only the upper 15-20 feet (about 20%) of the deposit consists of sand which is coarse enough to be used for concrete sand. The remaining finer sands are used for glass manufacturing.

The Quail Hollow Quarry is owned by the Granite Rock Company that acquired the property in the late 1950s. The site was hydraulically mined in the 1960s for coarse construction sand by Limestone Products, Inc. In 1972, the property was leased to Santa Cruz Aggregates Company that mined the quarry until 1997 when Granite Rock Company took over the operation.

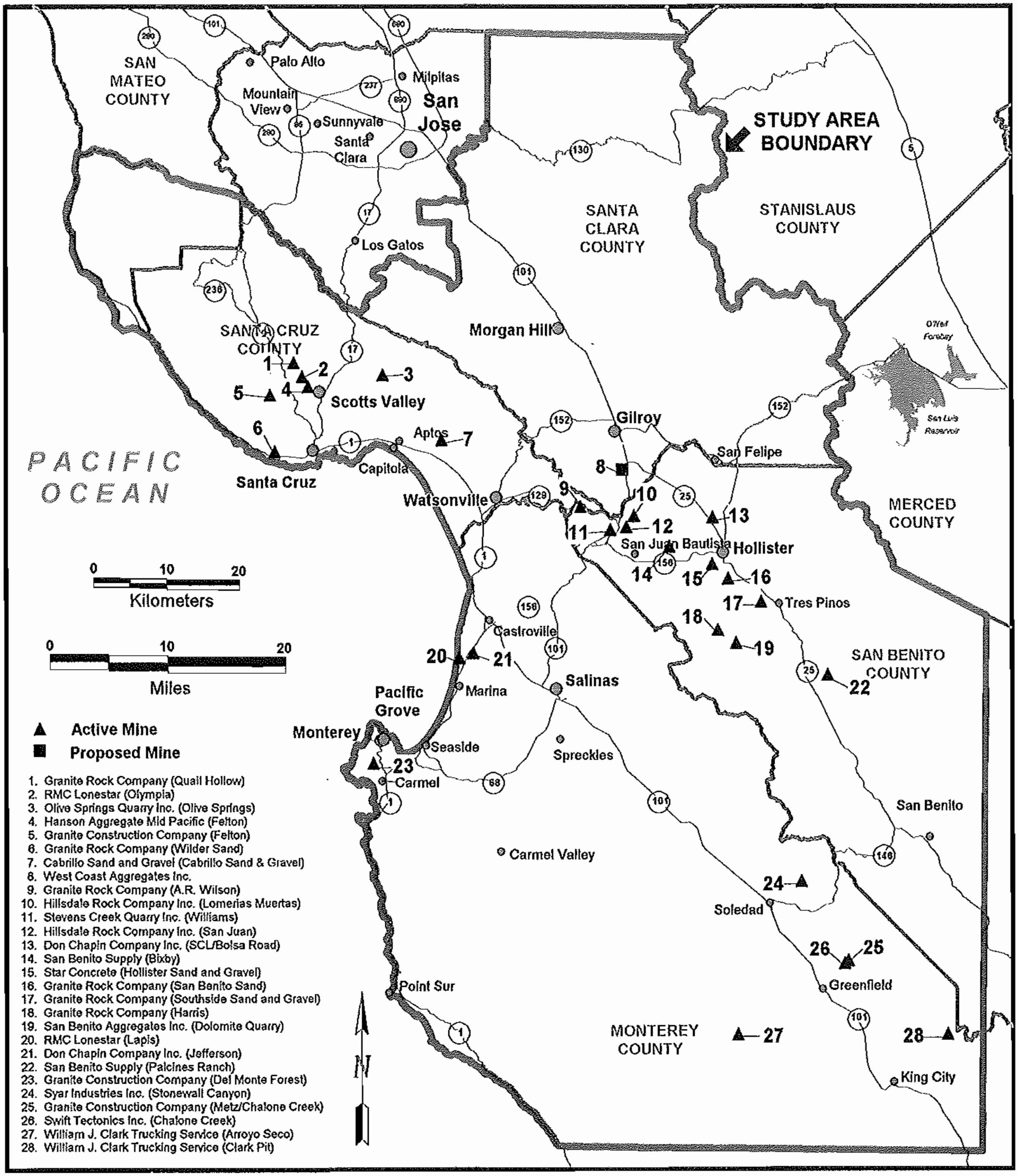

Figure 6. Locations of aggregate mines or proposed mines in the Monterey Bay Production-Consumption Region having current permits as of January, 1999.

RMC Lonestar, Olympia Quarry:

The Olympia Quarry comprises about 168 acres in the Santa Cruz Mountains about 0.5 miles north of Mount Hermon in Santa Cruz County (see Plate 14). Sand mined at the quarry consists of light tan, pebbly, silty marine sandstone of the Upper Miocene Santa Margarita Formation. Sand size ranges from coarse at the bottom of the deposit to fine at the top. The finest sands are considered overburden because they are not saleable. These fine sands are generally less than a foot thick. The basal part of the Santa Margarita Formation contains 15-20 feet of red sand at the property site. Most of the sand mined from the Olympia site is sold for blend sand for concrete. Some concrete sands are produced by washing fines out of the sand. The finer sands are sold as masonry sands. Roughly 90% of the sand mined at the Olympia Quarry is consumed outside of the Monterey Bay P-C Region, largely in the San Jose area.

The Olympia Quarry has been owned and operated since 1928 by the present owner, RMC Lonestar (formerly Pacific Coast Aggregates, Pacific Cement and Aggregates, Inc., and Lone Star Industries, Inc.).

Olive Springs Quarry, Inc., Olive Springs Quarry:

The Olive Springs Quarry site is in the Santa Cruz Mountains on the east slope of Sugarloaf Mountain, about four miles to the east of Scotts Valley in Santa Cruz County (see Plate 15). The quarried rock consists of Cretaceous diorite and quartz diorite overlain by Tertiary granitic conglomerate and sandstone. The primary commodities currently being produced from the quarry are Class II base and Class IV subbase. PCC concrete and asphaltic aggregate has been produced from the deposit in the past.

The Olive Springs Quarry was first mined in 1932 by the county of Santa Cruz on land leased from the Monterey Bay Redwood Company. The quarry lease was sold in 1946 to Poley Millsap who operated the quarry until 1954 when it was sold to Vic Maddock. Olive Springs Quarry, Inc. acquired control of the quarry in 1963 and has operated the quarry since. An area of about 17 acres located adjacent to the existing quarry, has been newly classified MRZ-2 (see Newly Classified and Reclassified MRZ-2 Areas, Olive Springs Quarry, Inc. western expansion area).

Hanson Aggregate Mid Pacific, Felton Quarry:

This MRZ-2 area comprises about 260 acres in the Santa Cruz Mountains about 0.5 mile east of the city of Mount Hermon (see Plate 14). The deposit consists of light gray to white, pebbly, poorly consolidated, well-sorted Middle Miocene Santa Margarita Sandstone. The sand grains range in size from fine- to medium-grained and are predominately quartz (80%) and feldspar (15%). The sandstone rests on thinly bedded shale of the Miocene Monterey Formation. Overburden, consisting of fine sands, averages about 18-20 feet thick. Waste is largely silt and averages about 5%.

Kaiser Sand and Gravel began operations at the Felton Quarry in 1959 and operations have been continuous since then. In 1991, Hanson Aggregates purchased Kaiser Sand and Gravel. The main products produced at the mine are concrete sand (about 55%), plaster sand (about 30%), and fill sand (about 15%). Roughly 90% of the sand produced at Hanson's Felton operation is exported out of the Monterey Bay P-C Region, primarily to the San Jose area.

Granite Construction Company, Felton Quarry:

The Felton Quarry is on the southeastern flank of Ben Lomond Mountain in the Santa Cruz Mountains (see Plate 14). The property consists of about 270 acres of land underlain by Cretaceous quartz diorite ranging from very hard, relatively unweathered rock, to highly weathered decomposed granite. Extensive faulting and fracturing at the quarry site has contributed to the alteration of the rock. This altered rock, typically golden brown in color, is sold as decorative stone. The quartz diorite generally is less altered with increasing depth. Overburden, consisting of silty sand, averages about 90 feet with a maximum depth of up to 150 feet. Durable, non-weathered quartz diorite is suitable for PCC aggregate. Other aggregate products from the quarry include asphaltic aggregate, base, subbase, and fill.

The Felton quarry was first mined for decomposed granite in the early 1940s by the County of Santa Cruz. The production of crushed stone began in 1952 when the current owners, C.O. Hansen, E.B. Sinnott, and Silvey, installed and operated an asphalt plant at the site. Granite Construction Company leased the land in the late 1970s and has operated the quarry since then.

Granite Rock Company, Wilder Sand Quarry:

The Wilder Sand Quarry area consists of 296 acres about 1.5 miles west of Santa Cruz in Santa Cruz County (see Plate 19). The quarry area is underlain by Upper Miocene Santa Margarita Sandstone. The sandstone is clayey, medium- to fine-grained, poorly consolidated, and yellowish-gray to white. Beds dips about 10° to the south. The depth of the sandstone at the quarry is not known but is believed to be at least 100 feet at the southernmost extent of the deposit. A very thin layer of topsoil (generally less than a foot) overlies the sandstone at the site.

The Wilder Quarry land was leased from the D.D. Wilder copartnership in 1966 and later purchased by the Granite Rock Company. Santa Cruz County granted a mining permit for the property in 1967. The property was mined continuously from 1967 to 1990 when mining ceased until a reclamation plan was approved for the mine site. The sand was mined by hydraulic methods until December of 1989. Mining resumed at the Wilder Sand Quarry in 1998. Products from the quarry include blend sand for concrete aggregate, fill sand, golf coarse sand, and clay which is harvested from the settling ponds.

Cabrillo Sand and Gravel, Cabrillo Sand and Gravel Quarry:

The Cabrillo sand and gravel deposit comprises about 24 acres in the southern part of Santa Cruz Mountains about 6.5 miles to the northwest of Watsonville in Santa Cruz County (see Plate 20). Since the original report, the quarry has been depleted of construction grade aggregate. The quarry is still active but the only material left is fill. The processing plant has not been in operation since 1990.

Granite Rock Company, A.R. Wilson Quarry:

The Wilson Quarry is in San Benito County about one mile northeast of Aromas (see Plates 21 and 22). The quarry has been owned and operated continuously since 1895 by the Granite Rock Company. Formerly known as the Logan Quarry, in 1988 it was renamed after the company's founder, Arthur R. Wilson. The Wilson Quarry is the largest crushed stone operation in California.

The quarry is over 1.5 miles long, up to 2,000 feet wide, and in places exceeds 600 feet in depth. The quarry is being developed to the southeast (see Newly Classified and Reclassified MRZ-2 Areas, Wilson Quarry southeast expansion area). The mined rock is Cretaceous hornblende gabbro and is overlain on the southwest by a thick blanket of sedimentary strata of the Pliocene Purisima Formation and Pleistocene Aromas Formation. These sedimentary units thicken to the southwest and dip in that direction. Prior to mining, these two units are stripped off and moved to areas south of the quarry by an extensive conveyor belt system. The quarried gabbro is bounded on the north by the San Andreas Fault Zone. Tertiary movement along the fault zone has fractured and crushed much of this rock so that it is easily quarried by bulldozers. Blasting is needed only a few times a month and is reserved for small, less-fractured masses.

The Wilson Quarry produces several million tons per year and markets its products by truck and train primarily in the San Francisco Bay Area as far north as San Francisco. Most of the products from this plant are used in concrete, asphalt, and as base aggregate. Other products include drain rock, fill sand, railroad ballast, and riprap.

Hillsdale Rock Company, Inc., Lomerias Muertas: (see Newly Classified and Reclassified MRZ-2 Areas, Lomerias Muertas Quarry area).

Stevens Creek Quarry, Inc., Williams Quarry: (see Newly Classified and Reclassified MRZ-2 Areas, Williams Quarry area).

Hillsdale Rock Company, Inc., San Juan:

The San Juan operation includes 3.7 miles of active channel of the San Benito River, about 2.5 miles to the north of the historic town of San Juan Bautista in

San Benito County (see Plates 22-24). The deposit consists of Quaternary sand and gravel which is at least 25 feet deep in this part of the river. The deposit contains about 85% sand and 15% gravel. The sand ranges from fine- to coarse- grained and is subrounded to well rounded. The finer fraction consists largely of quartz and feldspar while the coarser fraction consists of lithic fragments derived largely from serpentine, chert, and graywacke. The gravel is well-rounded pebbles up to 3 inches in diameter and consists of chert, glaucophane schist, serpentine, granite, gneiss, marble, graywacke, and metasiltstone.

The San Juan site has been mined since 1961. The current operator, Hillsdale Rock Company, took over the operation in 1971. Mining is restricted to replenished sand and gravel from winter storms. The winter storms of 1997-98 left about 4-5 feet of sand and gravel in the river at the San Juan site. Most of the mining takes place during the dry season when there is no water flowing in the channel. The main products sold at the San Juan rock plant are concrete sand, fill sand, pea gravel, 3/4" drain rock, and 1"x No. 4 gravel. Roughly 40% of the aggregate processed mined from the San Juan site is exported out of the Monterey Bay P-C Region, largely to the San Jose area.

Don Chapin Company, Inc., SCL/Bolsa Road: (see Newly Classified and Reclassified MRZ-2 Areas, SCL/Bolsa sand and gravel mine area).

San Benito Supply, Bixby:

The Bixby operation comprises about 17 acres within the active channel of the San Benito River, about four miles west of Hollister in San Benito County (see Plate 24). The deposit consists of Quaternary sand and gravel similar to Hillsdale Rock's San Juan operation about 0.5 miles downstream (see Hillsdale Rock Company, Inc., San Juan).

The county first issued a permit to mine replenished gravel (gravel bar skimming) at the site in 1978; although, removal of sand and gravel took place several years prior. In 1979, San Benito Supply (Evergreen Supply) gained control of the property. Intermittent mining took place at the site until 1991. The operation has been idle since then. In October, 1998, San Benito County granted San Benito Supply a use permit to mine 20,700 tons of material (subject to replenishment) annually. Mining had not started as of July, 1999.

Star Concrete, Hollister Sand and Gravel:

This mine is just west of the City of Hollister in San Benito County in the active stream channel of the San Benito River and along the west bank (see Plate 24). The deposit consists of Quaternary alluvium that is similar in mineralogy to that mined at Hillsdale Rock Companies San Juan operation about six miles downstream (see Hillsdale Rock Company, Inc., San Juan). The aggregate at this location in the

San Benito River is about 70% sand and 30% gravel. The sand and gravel meets standards for PCC aggregate.

Hillsdale Rock Company mined at this site from the early 1930s up until 1986 when the mine was sold to Star Concrete. The mine was closed in 1996.

Granite Rock Company, San Benito Sand:

Granite Rocks' San Benito Sand operation is an inactive sand and gravel mine along the San Benito River about one mile south of the city of Hollister in San Benito County (see Plate 24). Some sand and gravel is still stockpiled and sold at the site. The site has a valid mining permit but no reserves remain. The County of San Benito has recently started negotiations with Granite Rock Company to reclaim the property. Mining at the site ceased around 1995-96.

Granite Rock Company, Southside Sand and Gravel:

Granite Rock's Southside sand and gravel operation is about four miles southeast of Hollister in Tres Pinos Creek and its flood plain (see Plate 25). Sand and gravel from the creek consists of arkosic sands and gravels composed of quartz diorite, quartz mica schist, quartzite, dacite, rhyolite, andesite, and minor fragments of limestone and dolomite. The Southside site was first mined by Granite Rock Company in 1972. In the 1970s and 1980s, sand and gravel was excavated to a depth of 10 feet in the active creek channel. In 1991, a reclamation plan was approved by San Benito County to mine sand and gravel from a terrace deposit of the creek. The plan allowed excavation of the terrace to a depth of 30 feet below the existing ground surface. Granite Rock is currently trying to amend this permit to allow an additional 50 feet of excavation in the terrace that would be contingent on giving up its rights to mine sand and gravel in the active channel. No excavation of the active creek channel has taken place since 1997.

Granite Rock Company, Hollister Hills Harris Quarry: (see Newly Classified and Reclassified MRZ-2 Areas, Hollister Hills/Harris limestone deposits).

San Benito Aggregates, Inc., Dolomite Quarry: (see Newly Classified and Reclassified MRZ-2 Areas, San Benito Aggregates, Inc. dolomite deposit).

RMC Lonestar, Lapis Sand:

The Lapis sand mining operation is about one mile north of the city of Marina along the southeastern edge of Monterey Bay (see Plate 26). RMC Lonestar mines Quaternary beach and dune sands which are used for specialty sand. The sands are tan to light brown, range in size from fine- to coarse-grained, and average about 80% quartz and 20% feldspar. Sand size becomes finer with increasing distance inland. Similar material mined about six miles south of the Lapis at RMC Lonestar's Prattco operation (closed in 1987) has been blended with decomposed granite to produce concrete sand.

The Lapis site was first mined in 1906 by E.B. and A.L. Stone. In 1918, Bay Development Company took over the operations, then sold the property in 1928 to Pacific Coast Aggregates (Pacific Cement and Aggregates, Lone Star Industries, Inc., RMC Lonestar). Although, RMC Lonestar is permitted to mine 90 acres of sand dunes, the only mining currently taking place at the Lapis site is suction dredging of beach sands.

Don Chapin Company, Inc., Jefferson Pit:

The Jefferson Pit is about 3 miles north of the city of Marina in Monterey County (see Plate 26). Mining takes place on about 19 acres of Quaternary dune sand at the edge of the floodplain of the Salinas River. The sands are light brown to orange and are mostly fine grained. The grains are predominately quartz. Because of the fineness, the sands are only suitable for fill. Some coarser sands which were probably suitable for PCC sand if washed, were mined from the Jefferson Pit in the past. These coarser sands are largely depleted at the mine site.

Operations at the site began in the early 1920s. Intermittent mining has taken place since then. The land is currently owned by Martin Jefferson and is leased and operated by the Don Chapin Company, Inc.

San Benito Supply, Paicines Ranch:

San Benito Supply's Paicines Ranch sand and gravel mine includes roughly 43 acres within the active channel of Tres Pinos Creek which has been newly classified MRZ-2 for aggregate (see Newly Classified and Reclassified MRZ-2 Areas, Tres Pinos Creek and terrace area). The mine site is about 2.5 miles southeast of the community of Paicines in San Benito County (see Plate 11). The deposit consists of Quaternary alluvial sand and gravel which is at least 20 feet deep in this part of the creek.

The first use permit to mine at the Paicines Ranch site was issued to owner Paul Bertuccio in 1973. The property was operated by Leo Piazza Paving Company in the early 1980s. San Benito Supply mined the property from about 1983 to May of 1998. The property has been inactive since then. Sand and gravel mined at the site has been used for PCC aggregate and base rock.

Granite Construction Company, Del Monte Forest:

The Del Monte Forest Quarry is on the Monterey Peninsula about two miles south of Pacific Grove (see Plate 28). The deposit consists of Cretaceous quartz diorite ranging from highly altered to unaltered. The altered granite is a light orange color while fresh material is light gray and white. The main products produced at the site are Class II aggregate base, decomposed granite, and decorative rock.

It is not known when the first mining of the Del Monte Quarry took place. A 1947 U.S.G.S. topographic map shows a quarry at the site. The current operator, Granite Construction Company, leased the property from the Pebble Beach Company in 1975 and has operated the quarry since then. Since its opening, the Del Monte Quarry has supplied much of the decorative rock in the local area. Reserves at the Del Monte Quarry are almost depleted. The Quarry is scheduled to close in the year 2001.

Syar Industries, Inc., Stonewall Canyon: (see Newly Classified and Reclassified MRZ-2 Areas, Stonewall Canyon Quarry Area).

Granite Construction Company, Metz/Chalone Creek:

The Metz operation is on Chalone Creek about 3 miles to the northeast of Greenfield in Monterey County (see Plate 29). The site includes about 36 acres of stream channel and flood plain, which has been classified MRZ-2. The deposit consists of Quaternary sand and gravel which is predominately rhyolite (about 85%), with minor amounts of quartzite, limestone, sandstone, schist, and siliceous shale. The sand to gravel ratio for the deposit is about 70/30. Products at the site are PCC aggregate, plaster sand, and fill sand.

Mining at the Metz site first took place about 1950 under the name of Metz Aggregate Company. A concrete batch plant was built on the property in 1962 or 1963, at which time the company was operated by Hugo and Lucio Borzini under the name of Metz Sand and Gravel Company. Lew Borzini took over the operation in 1966 and changed the mine name to King City Transit Mix in 1976. He operated the mine until 1981 when the current operator, Granite Construction Company, took control.

The County of Monterey currently allows an annual extraction of 75,000 tons of sand and gravel at the site. The sand and gravel is replenished during winter storms.

Swift Tectonics, Inc., Chalone Creek:

This sand and gravel mine is just southwest of Granite Construction Company's Metz operation in the active channel of Chalone Creek (see Plate 29). The site has been mined intermittently since the 1960s. From 1975-1981, Lew Borzini operated the mine. Granite Construction Company bought the site in 1981 and operated it until the late 1980s. The property was sold back to the current owner, Lew Borzini in 1992. John D. Cedarquist, president of Swift Tectonics, Inc., currently controls the property and operates it intermittently. The operation was idle at the time of the site visit for this report in June of 1998. The current use permit issued by Monterey County allows Swift Tectonics, Inc. to extract a maximum annual tonnage of 25,000 cubic yards from the site. Mining depth cannot exceed 9 feet below the current stream bed channel as measured in March, 1995. About 8 acres of the permitted mining site has been newly classified MRZ-2. (see Areas Newly Classified or Reclassified MRZ-2, Chalone Creek).

William J. Clark Trucking Service, Arroyo Seco:

William J. Clark Trucking, Inc. has mined sand and gravel in Arroyo Seco Creek channel, Monterey County, since 1981 (see Plate 2). No mining has previously taken place on the property. The channel contains a shallow deposit (about 10 feet) of alluvial sand and gravel. The sand is clean and medium grained. The gravel clast are mostly well-rounded granitics which are predominately quartz monzonite. Reserves and resources are limited to natural replenishment of the creek. Material from the deposit is used for asphaltic aggregate, concrete aggregate, base, subbase, and fill. An asphalt plant is currently operated on the property by Granite Construction Company. This deposit was not classified because reserves do not meet the minimum threshold value of $13,200,000.

William J. Clark Trucking Service, Clark Pit:

The Clark Pit is an instream mining operation in San Lorenzo Creek about five miles northeast of King City, in Monterey County (see Plate 30). The deposit consists of poorly sorted sand and gravel. Clasts consist of Franciscan-derived serpentinite, chert, glaucophane schist, gabbro, and metagraywacke and pre-Franciscan rocks including marble, granite, and biotite schist. Depth of sediments in the San Lorenzo Creek is at least 20 feet.

The Clark family has mined sand and gravel at this site since 1963. Mining in the creek is restricted to gravel bar skimming and mainly takes place in the summer months when there is no water flowing in the creek. Material mined from this deposit is used mainly for asphaltic aggregate, base, subbase, and fill.

CLOSURES OF AGGREGATE OPERATIONS

Since 1980, (the latest data base year in the original mineral land classification report), several aggregate operations have closed and no longer have valid mining permits. These include Granite Rock Company's Polak Quarry in Santa Clara County, closed in 1996; San Juan Asphalt Company's Bertuccio property in San Benito County, closed in 1983; the Rider pit in San Benito County, closed in 1993; Hillsdale Rock Company's Paicines/Almadine operation in San Benito County, closed about 1993; RMC Lonestar's Pratco operation in Monterey County, closed about 1987; Western Tile and Supply's operation on Uvas Creek in Santa Clara County, closed in the early 1980s; Granite Rock Company's Marina Sand in Monterey County, closure date unknown; and Valley Rock and Sand Company's Darsch Pit in Monterey County, closure date unknown.

PART III - ESTIMATED 50-YEAR DEMAND OF AGGREGATE AND COMPARISON WITH AGGREGATE RESERVES FOR THE MONTEREY BAY P-C REGION

The SMGB, as specified in its guidelines for classification and designation of mineral land Division of Mines and Geology, 2000 requires that mineral land classification reports for regions containing construction materials classified as MRZ-2 include "*An estimate of the total quantity of each such construction material that will be needed to supply the requirements of both the county and the marketing region in which it occurs for the next 50 years. The marketing region is defined as the area within which such material is usually mined and marketed. The amount of each construction material mineral resource needed for the next 50 years shall be projected using past consumption rates adjusted for anticipated changes in market conditions and mining technology.*" The SMGB guidelines also specify that the State Geologist periodically review (every 10 years or less) the information in the reports to determine if a revision is warranted.

FORECASTING METHOLOGY

A 50-year forecast of construction aggregate demand for the Monterey Bay P-C Region was made on the basis of reported aggregate production for 1965-1997. Production data from 1965-1980 was used from Special Report 146, Part IV with some modifications to reflect additional data which became available after the completion of the study. Updated production data was collected for the years 1981-1997 (see Figure 7).

To estimate the future demand of aggregate, a linear best fit trend, using the least squares method, was calculated for aggregate production from the years 1965-1997. This line was then projected out to the year 2047, which is 50 years from the last production data year of 1997. The results of this analysis are shown on Figure 8 and will be discussed under the "Comparison of the 50-year forecast with aggregate reserves" section.

The forecasting method used for the Monterey Bay P-C Region was not based on per capita consumption (the method used for most of the Mineral Land Classifications done previously throughout the state). The per capita consumption method was not used because roughly 50% of the aggregate produced in the Monterey Bay P-C Region is exported into the South San Francisco Bay P-C Region. Consequently, a forecast based on the Monterey Bay P-C Region's population would not have properly represented the P-C Region's future demand.

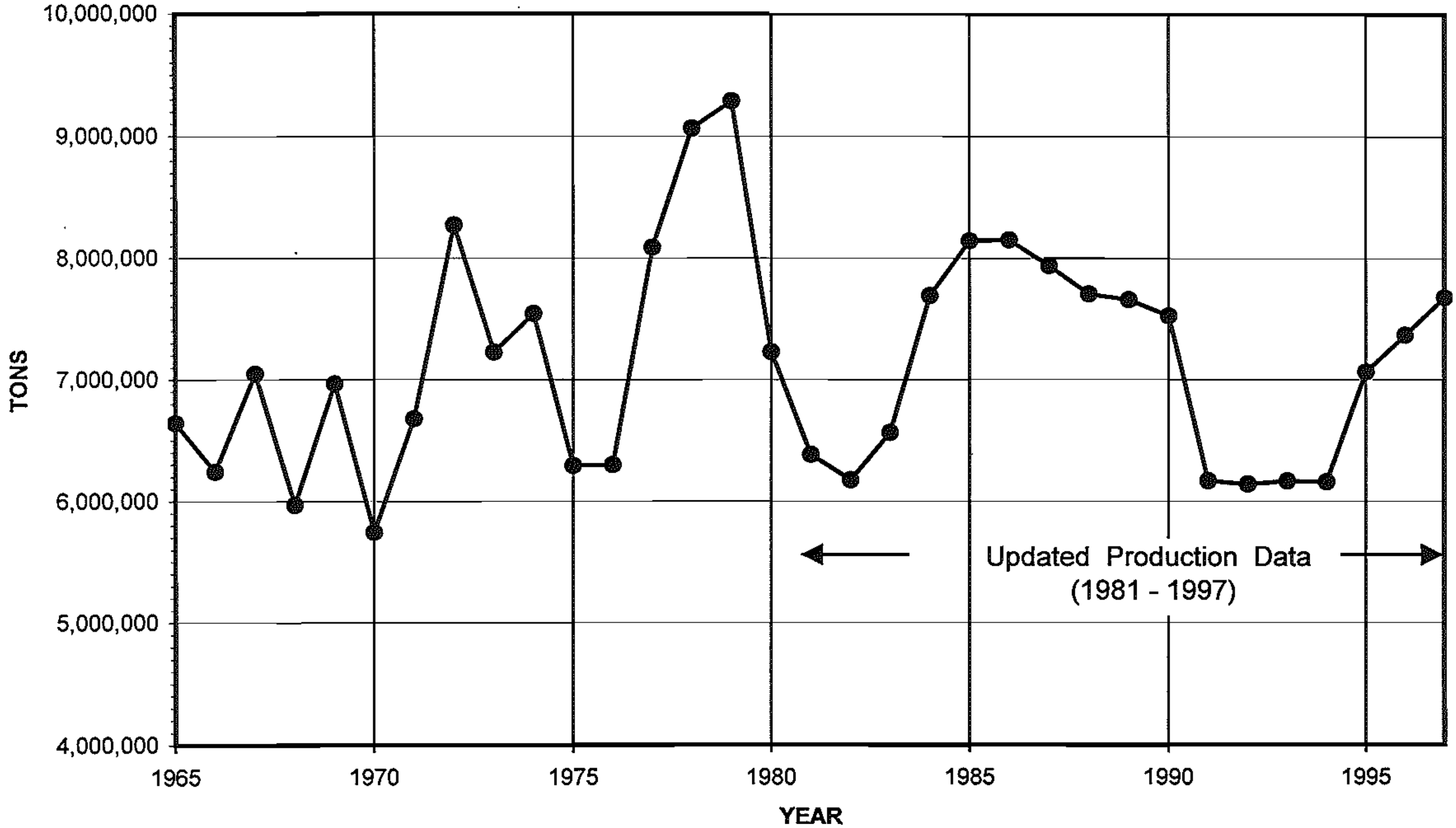

Figure 7. Annual production of aggregate in the Monterey Bay Production-Consumption Region for the years 1965-1997.

FACTORS AFFECTING PRODUCTION DATA

The variations from year to year in the historic aggregate consumption rate (see Figure 7) probably reflect, to a large degree, intermittent large construction projects (for example: freeways, dams, and canals). In part, these variations also result from incompleteness and inaccuracies in the production records supplied by the U.S. Bureau of Mines, the Office of Mine Reclamation, and company data. Certainly, economic events such as a major recession, can greatly influence aggregate demand. Also, major unforeseen events such as disaster reconstruction in the wake of an earthquake would cause aggregate demand to change radically.

COMPARISON OF THE 50 YEAR FORECAST WITH AGGREGATE RESERVES

The forecast shown on Figure 8 indicates that an estimated 379 million tons of aggregate will be needed to satisfy the future demand on the Monterey Bay P-C Region through the year 2047. Current aggregate reserves available in the Monterey Bay P-C Region total 269 million tons. If no additional reserves are permitted, and the projections are accurate, the Monterey Bay P-C Region will be depleted of aggregate reserves in the year 2033. This amounts to about a 35-year supply of aggregate (measured from the beginning of 1998 to the end of 2033).

According to the production statistics for the years 1980 to 1997, about 30% of the total aggregate consumed was used in PCC aggregate. This estimate is based only on the records that contained separate figures for PCC aggregate production. This percentage equates to 114 million tons of PCC aggregate that will be needed within the next 50 years.

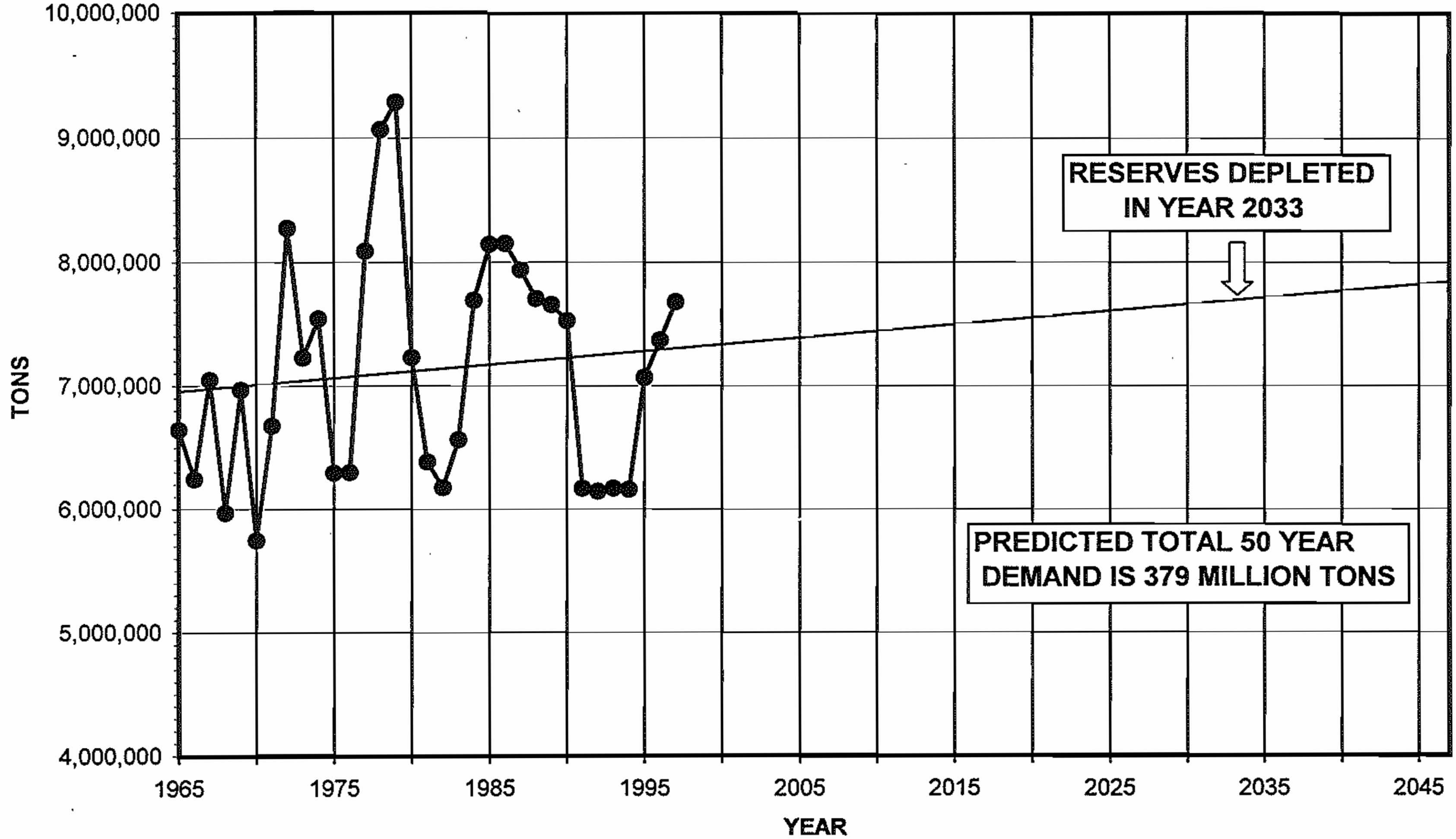

Figure 8. Projected aggregate demand on the Monterey Bay Production-Consumption Region to the year 2047.

PART IV - ALTERNATIVE SOURCES OF AGGREGATE

The potential sources of construction aggregate, in addition to the deposits classified as MRZ-2, which exist within and near the Monterey Bay P-C Region were discussed in Special Report 146, Part IV. Included were potential resources within the P-C Region that were classified as MRZ-3, marine sand and gravel deposits in the San Francisco Bay area, and aggregate production districts in the neighboring South San Francisco Bay P-C Region.

Another alternative source of aggregate for the Monterey Bay P-C Region is the Los Banos Creek alluvial fan deposit. The deposit is in Merced County about 30 miles east of the Monterey Bay P-C Region. A small amount of sand and gravel currently is being imported from the deposit into the P-C Region. The Los Banos Creek Fan will be classified in Special Report 99-08, Mineral Land Classification of the Merced County (report in progress).

PART V - COMPARISON OF 1980 WITH 1997 STATISTICS AND FORECAST IN THE MONTEREY BAY P-C REGION

All statistical data for the original mineral land classification of aggregate resources in the Monterey Bay P-C Region (Stinson and others, 1987) was current to the end of 1980. Updated statistical data for this report is current as of the end of 1997. In 1980, the Monterey Bay P-C Region's projected aggregate demand for the 17-year period (1981-1998) amounted to 118 million tons. This is within 3% of the 121 million tons actually produced within the P-C Region for that time period.

In 1980, the fifty year projected aggregate demand for the Monterey Bay P-C Region totaled 374 million tons. Aggregate reserves at that time totaled 786 million tons, more than double the projected demand. The updated 50-year projected aggregate demand for the P-C Region through the year 2047 totals 379 million tons. Updated reserves as of January 1, 1998 are 269 million tons, a 35-year supply. It is important to note that the updated 50-year forecast is based on past production while the 50-year projection done in 1980 was determined using a per capita consumption model.

Aggregate resources within the Monterey Bay P-C Region in 1997 total 1,210 million tons, a considerable decrease from the 3,081 million tons of resources considered available at the end of 1980. A decrease of 1,707 million tons resulted from not designating 5 square miles of land classified MRZ-2 and sectorized. Also, a large portion of this decrease (369 million tons) can be attributed to reevaluation of the resources for the update process. (See Resource Decreases section for reevaluation considerations). Other factors for the decrease are the 17 years of aggregate consumption (121 million tons) and resources lost due to irreversible land use since 1980 (4 million tons).

In 1980, 16 companies produced about 7.2 million tons of aggregate from 22 mines in the Monterey Bay P-C Region. About 51% of the aggregate produced in the P-C Region was consumed by the 648,000 people living in the region; the remainder was exported to consumers in the San Jose and San Francisco areas. In 1997, 16 companies produced a total of 7.7 million tons aggregate from 27 mines. About 48% of this aggregate was consumed by the 937,000 people that populate the Monterey Bay P-C Region and the other 52% was exported.

PART VI - CONCLUSIONS

Within the Monterey Bay P-C Region, 21 aggregate resource sectors have previously been classified, two areas have been reclassified, and eleven areas have been newly classified as containing significant resources of construction-grade aggregate. Of the 21 aggregate resource Sectors that were originally classified, all or portions of 17 were designated by the SMGB as being regionally significant. A reevaluation of construction-grade aggregate resources (both permitted and unpermitted resources) shows that the designated areas and the newly classified areas combined contain an estimated 1,210 million tons of geologically and technologically available construction-grade aggregate resources.

The projected 50-year aggregate demand (to the year 2047) for the Monterey Bay P-C Region is 379 million tons, of which approximately 30%, or 114 million tons, must be suitable for use in PCC. Existing reserves totaling 269 million tons are enough to meet the demand on the Monterey Bay P-C Region for the next 35 years (until the year 2033). If a major earthquake or similar unforeseen catastrophic event strikes the San Francisco Bay area and necessitates reconstruction, existing reserves will be depleted sooner. Permitting of new reserves, utilization of alternative resources, or an increase in the production of recycled aggregate, could extend the life of the existing aggregate reserves.

The Monterey Bay P-C Region exports about 50% of its aggregate to the adjacent South San Francisco Bay P-C Region. Consequently, a projection of aggregate need was based on a past production rather than on a per-capita consumption model as is used in the majority of the mineral land classifications throughout the state.

The forecast of aggregate demand of 118 million tons (Stinson and others, 1987) for the period 1981 through 1997, was within 3% of the actual aggregate production of 121 million tons for this same period. This level of accuracy is not expected from the simplistic forecast technique used.

Based upon the findings for this updated report, designation appears to have been highly effective in preserving significant aggregate resources. Only about 4 million tons of the designated aggregate resources were lost due to urbanization since designation in 1986, in spite of an influx of more than 300,000 people into the Monterey Bay P-C Region.

Reserve Summary

At the end of 1980, construction-grade aggregate reserves available within the Monterey Bay P-C Region amounted to 786 million tons. Subtracting reserves that were mined and decreases from reserve reevaluation (see Resource Decreases section), and adding newly permitted or newly classified reserves, the total reserves available at the end of 1997 amount to 269 million tons. This is a net decrease of 517 million tons. Table 3 summarizes construction grade aggregate reserves in the Monterey Bay P-C Region.

RESERVE SUMMARY (all totals in million tons)	
786	1980 Reserves
-623	Reevaluation of reserves
-121	Reserves mined
+227	Newly permitted or newly classified reserves
269	1997 Reserves

Total decrease in reserves (1980-1997) = 517 million tons

Table 3. Summary of construction grade aggregate reserves for the Monterey Bay P-C Region.

Resource Summary

In 1986, the total construction-grade aggregate resources available in designated areas amounted to 1,374 million tons. Since then, mining, urbanization, and reevaluation of resource calculations (see Resource decreases section) have reduced these resources to 880 million tons. Updated mineral land classification has identified an additional 330 million tons of aggregate resources in non-designated areas that have been reclassified or newly classified. By adding this 330 million tons to the existing 880 million tons, the total 1997 resources for the Monterey Bay P-C Region amounts to 1,210 million tons. This is a net decrease of 164 million tons. Table 4 summarizes construction-grade aggregate resources in the Monterey Bay P-C Region.

RESOURCE SUMMARY (all totals in million tons)	
*1,374	Total resources in designated areas 1986
-121	Resources mined
- 4	Resources lost due to urbanization
-369	Reevaluation of resources
+880	Total resources available in designated areas 1997
+330	Resources added in reclassified and newly classified lands
1,210	1997 Resources in designated and non-designated areas

Total net decrease in resources (1986-1997) = 164 million tons

* Does not include 1,707 million tons of resources in non-designated areas.

Table 4. Summary of construction grade aggregate resources in the Monterey Bay P-C Region.

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APPENDIX

CALIFORNIA MINERAL LAND CLASSIFICATION SYSTEM

MINERAL RESOURCE ZONE CATEGORIES

DMG has classified the Monterey Bay P-C Region according to the presence or absence of significant concrete-grade aggregate deposits. The land classification is presented in the form of Mineral Resource Zones, or MRZs. Directions for the identification of Mineral Resource Zones are set forth in DMG's Special Publication 51 in the section "Guidelines for Classification and Designation of Mineral Lands" (Division of Mines and Geology, 2000).

The guidelines for establishing the Mineral Resource Zones are as follows:

MRZ-1: Areas where available geologic information indicates that little likelihood exists for the presence of significant mineral resources.

MRZ-2a: Areas underlain by mineral deposits where geologic data indicate that significant measured or indicated resources are present. As shown on the California Mineral Land Classification Diagram (Figure 9), MRZ-2 is divided on the basis of both degree of knowledge and economic factors. Areas classified MRZ-2a contain discovered mineral deposits that are either measured or indicated reserves as determined by such evidence as drilling records, sample analysis, surface exposure, and mine information. Land included in the MRZ-2a category is of prime importance because it contains known economic mineral deposits.

MRZ-2b: Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present. For this report, areas classified MRZ-2b contain discovered mineral deposits that are significant inferred resources as determined by their lateral extension from proven deposits or their similarity to proven deposits. Further exploration work could result in upgrading areas classified MRZ-2b to MRZ-2a.

MRZ-3a: Areas containing known mineral occurrences of undetermined mineral resource significance. Further exploration work within these areas could result in the reclassification of specific localities into a MRZ-2a or MRZ–2b category. As shown on the California Mineral Land Classification Diagram, MRZ-3 is divided on the basis of knowledge of economic characteristics of the resources.

MRZ-3b: Areas containing inferred mineral occurrences of undetermined mineral resource significance. Land classified MRZ-3b represents areas in geologic settings that appear to be favorable environments for the occurrence of specific mineral deposits. Further exploration work could result in the reclassification of all or part of these areas into the MRZ-2a or MRZ-2b category.

MRZ-4: Areas of no known mineral occurrences where geologic information does not rule out either the presence or absence of significant mineral resources.

The distinction between the MRZ-1 and the MRZ-4 categories is important for land-use considerations. It must be emphasized that MRZ-4 classification does not imply that there is little likelihood for the presence of mineral resources, but rather there is a lack of knowledge regarding mineral occurrence. Further exploration work could well result in the reclassification of land in MRZ-4 areas to a MRZ-3 or MRZ-2 category.

MINERAL RESOURCE/RESERVE CLASSIFICATION NOMENCLATURE

Following are definitions of the nomenclature associated with the California Mineral Land Classification Diagram (see Figure 9). It is important to refer to these definitions when studying the different resource categories shown on the California Mineral Land Classification Diagram. Particular attention should be given to the distinction between a mineral deposit and a resource and to how a mineral deposit may relate to resources.

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MINERAL DEPOSIT: A mass of natural occurring mineral material, e.g. metal ores or nonmetallic minerals, usually of economic value, without regard to mode of origin. The mineral material may be of value for its chemical and/or physical characteristics.

MINERAL OCCURRENCE: Any ore or economic mineral in any concentration found in bedrock or as float; especially a valuable mineral in sufficient concentration to suggest further exploration.

ECONOMIC: This term implies that profitable extraction or production under defined investment assumptions has been established, analytically demonstrated, or assumed with reasonable certainty.

MINERAL RESOURCE: A concentration of naturally occurring solid, liquid, or gaseous material in or on the Earth's crust in such form and amount that economic extraction of a commodity from the concentration is currently or potentially feasible. The terms resource and mineral resource are synonymous in this report.

RESERVES: That part of the resource base which could be economically extracted or produced at the time of determination. For the purposes of this report, the term reserves has been further restricted to include only those deposits for which a valid mining permit has been granted by the appropriate lead agency.

IDENTIFIED MINERAL RESOURCES: Resources whose location, grade, quality, and quantity are known or estimated from specific geologic evidence. Identified mineral resources include economic, marginally economic, and subeconomic components. To reflect varying degrees of geologic certainty, these economic divisions can be subdivided into demonstrated and inferred.

DEMONSTRATED: A term for the sum of measured plus indicated.

MEASURED: Quantity is computed from dimensions revealed in outcrops, trench workings, or drill holes; grade and/or quality are computed from the results of detailed sampling. The sites for inspection, sampling, and measurement are spaced so closely and the geologic character is so well defined that size, shape, depth, and mineral content of the resource are well established.

INDICATED: Quantity and grade and/or quality are computed from information similar to that used for measured resources, but the sites for inspection, sampling, and measurement are farther apart or otherwise less adequately spaced. The degree of assurance, although lower than that for measured resources, is high enough to assume continuity between points of observation.

INFERRED: Estimates are based on an assumed continuity beyond measured and/or indicated resources, for which there is geologic evidence. Inferred resources may or may not be supported by samples or measurements.

MARGINAL RESERVES: That part of the demonstrated reserve base that, at the time of determination, borders on being economically producible. The essential characteristic of this term is economic uncertainty. Included are resources that would be producible, given postulated changes in economic or technologic factors.

MARGINAL RESOURCES: That part of the inferred resource base that, at the time of determination, would be economically producible, given postulated changes in economic or technologic factors.

SUBECONOMIC RESOURCES: The part of identified resources that does not meet the economic criteria of marginal reserves and marginal resources.

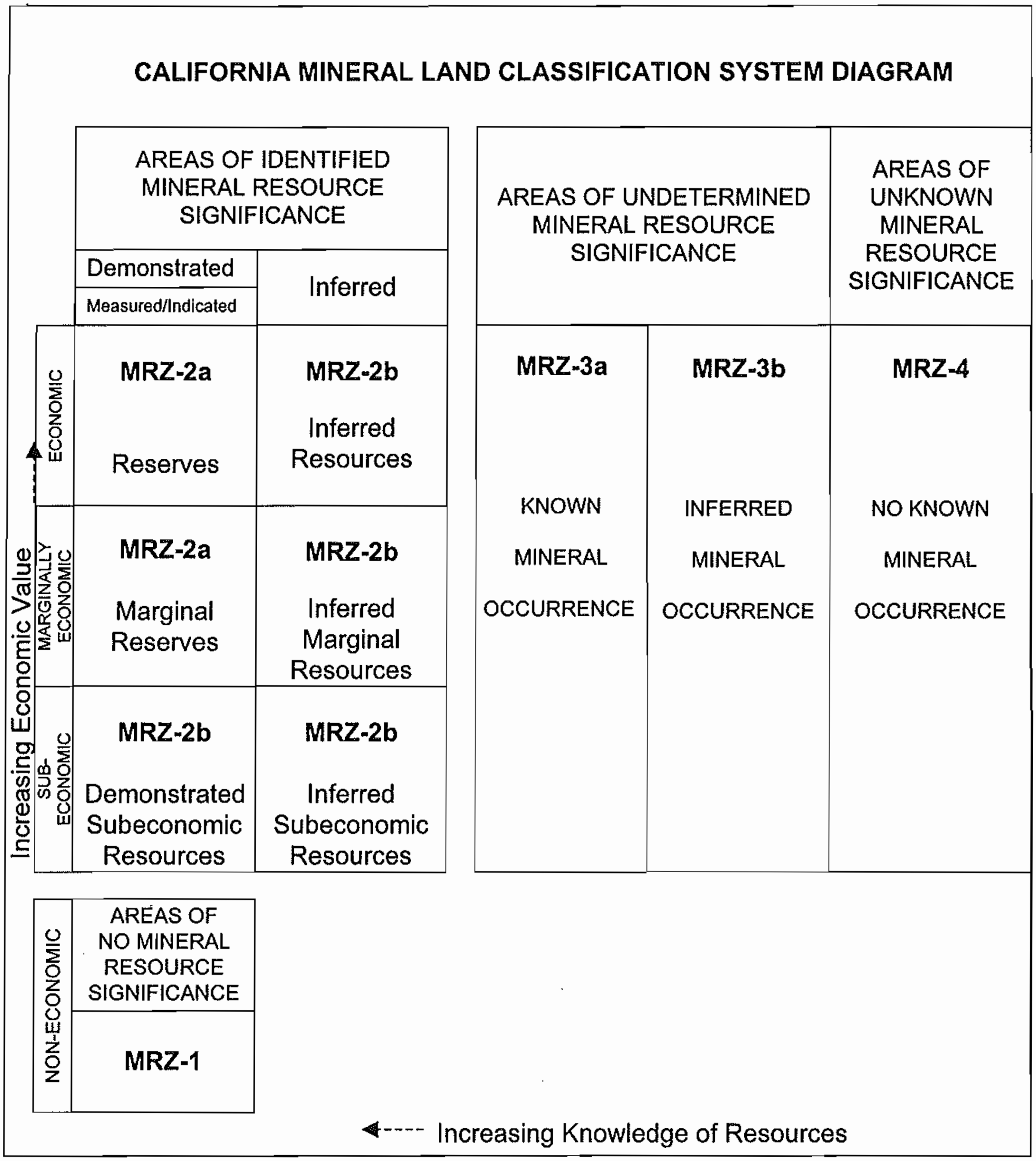

Figure 9. Diagrammatic Relationship of MRZ categories to the resource/reserve classification system. *Adapted from U.S. Bureau of mines/USGS (1980)*