CEMENT

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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)

	1998					1999				
			Capacity 3/		Stocks 4/			Capacity 3/		Stocks 4/
District	Plants active 5/	Production 6/	Finish grinding	Percentage utilized	at mills, yearend	Plants active 5/	Production 6/	Finish grinding	Percentage utilized	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			1999		
	Plants active	Production 3/	Stocks 2/ at mills, yearend	Plants active	Production 3/	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 maintenance	Apparent annual capacity 2/ (thousand metric tons)	Production (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							Average consumption (kilowatt-hours per ton of cement produced)
	Generated at plant		Purchased		Total		Finished cement 2/ produced (thousand metric tons)	
Plant process	Number of plants	Quantity (million kilowatt-hours)	Number of plants	Quantity (million kilowatt-hours)	Quantity (million kilowatt-hours)	Percentage		
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		Masonry cement	
	1998	1999	1998	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		Masonry cement	
	1998	1999	1998	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				Masonry cement			
	Thousand metric tons		Percentage of U.S. total		Thousand metric tons		Percentage of U.S. total	
	1998	1999	1998	1999	1998	1999	1998	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/

District 5/ 6/	1998 Quantity (thousand metric tons) 7/	1998 Value 4/ Total (thousands)	1998 Value 4/ Average per metric ton	1999 Quantity (thousand metric tons) 7/	1999 Value 4/ Total (thousands)	1999 Value 4/ 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			1999		
		Value			Value	
	Quantity	Customs 2/	C.i.f. 3/	Quantity	Customs 2/	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)

Customs district and country	1998			1999		
		Value			Value	
	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)

Customs district and country	1998			1999		
		Value			Value	
	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)

Customs district and country	1998			1999		
		Value			Value	
	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)

Customs district and country	1998			1999		
		Value			Value	
	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)

Customs district and country	1998			1999		
		Value			Value	
	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)

Country	1998			1999		
		Value			Value	
	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)

Country	1998			1999		
		Value			Value	
	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)

Country	1998			1999		
		Value			Value	
	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.