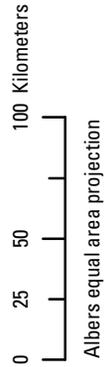
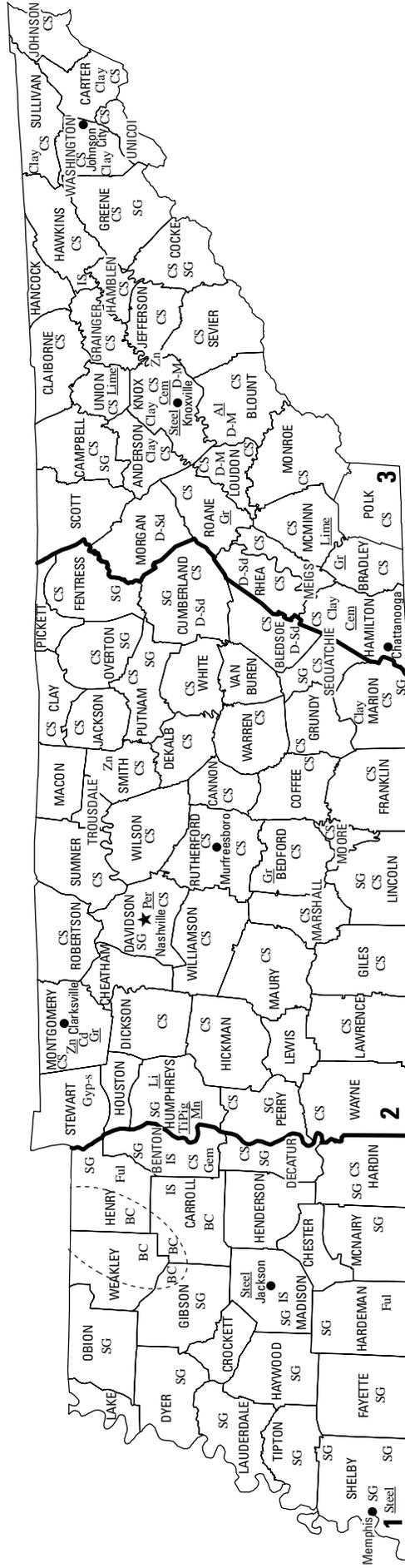




2007 Minerals Yearbook

TENNESSEE [ADVANCE RELEASE]

TENNESSEE



LEGEND

- County boundary
- ★ Capital
- City
- Crushed stone/sand and gravel district boundary

MINERAL SYMBOLS (Major producing areas)

- Al Aluminum plant
- BC Ball clay
- Cd Cadmium (byproduct)
- Cem Cement plant and quarry
- Clay Common clay
- CS Crushed stone
- D-M Dimension marble
- D-Sd Dimension sandstone
- Ful Fuller's earth
- Gem Gemstones
- Gr Graphite plant
- Gyp-s Synthetic gypsum
- IS Industrial sand
- Li Lithium plant
- Lime Lime plant and quarry
- Mn Manganese dioxide plant
- Per Perlite
- SG Construction sand and gravel
- Steel Steel plant
- TiPig Titanium dioxide pigment plant
- Zn Zinc
- Zn Zinc plant
- Concentration of mineral operations

Source: Tennessee Department of Environment and Conservation/U.S. Geological Survey (2007).

THE MINERAL INDUSTRY OF TENNESSEE

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Tennessee Department of Environment and Conservation, Division of Geology, for collecting information on all nonfuel minerals.

In 2007, Tennessee's nonfuel raw mineral production¹ was valued at \$975 million, based upon annual U.S. Geological Survey (USGS) data. This was an \$114 million, or 13.2%, increase from the State's total nonfuel mineral production value for 2006, following a \$90 million, or 11.7%, increase from 2005 to 2006. Tennessee, remained 25th in rank among the 50 States in total nonfuel mineral production value and accounted for 1.4% of the U.S. total.

Crushed stone has been Tennessee's leading nonfuel mineral commodity, by value, for nearly 5 decades (except in 1981 when zinc was first); crushed stone went ahead of cement (portland and masonry) in 1957. In 2007, crushed stone accounted for 56% of the State's total nonfuel mineral production value. Cement was the second-leading nonfuel mineral commodity by value, followed by zinc, construction sand and gravel, industrial sand and gravel, ball clays, and lime. In 2007, increases in the mineral production values of zinc, crushed stone, and cement (portland and masonry), in descending order of change, led Tennessee's increase in total nonfuel mineral production value, with increases taking place in the unit values of each. With the resumption of zinc mining and production, that mineral commodity had the largest increase in value, followed by crushed stone and cement. Despite a more than 5%, or 3.5-million-metric-ton (Mt), decrease in crushed stone production, the mineral commodity's total production value rose by nearly 5%, or up by \$24 million. Data on zinc and cement are withheld—company proprietary data. Smaller yet significant increases took place in the values of industrial sand and gravel, up by slightly more than \$3 million, and lime (table 1). The largest decrease in value took place in construction sand and gravel; a 16% decrease in production led to a 12%, or \$7 million decrease in value.

In 2007, Tennessee continued to be the leading ball clay- and gemstone-producing State (gemstones based upon value), as well as 8th in the quantity of fuller's earth produced and 10th in the production of crushed stone. The State rose to 10th from 12th in the production of industrial sand and gravel, was 4th of seven States in the production of zinc and cadmium-in-zinc concentrates, and remained a producer of substantial quantities of portland cement, industrial sand and gravel, lime, and common clays (in descending order of value). Primary aluminum and raw steel were produced in Tennessee but were processed from materials obtained from other domestic and

¹The terms "nonfuel mineral production" and related "values" encompass variations in meaning, depending upon the mineral products. Production may be measured by mine shipments, mineral commodity sales, or marketable production (including consumption by producers) as is applicable to the individual mineral commodity.

All 2007 USGS mineral production data published in this chapter are those available as of June 2009. All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—can be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

foreign sources. The State ranked eighth (seventh in 2006) in the production of primary aluminum.

The Tennessee Division of Geology² (TDG) provided the following narrative information. Data and information in the following text are those reported by the TDG, based upon its own surveys and estimates.

Based upon a review of the Tennessee Division of Water Pollution Control Mining Section's database used in the U.S. Environmental Protection Agency National Pollutant Discharge Elimination System (NPDES), there were approximately 329 active permits for nonfuel mineral operations in 82 counties across the State. The active permits represented quarry sites and plant sites, some of which may not have had production during 2007. As authorized by the Clean Water Act, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or manmade ditches (U.S. Environmental Protection Agency, 2009). Aside from the reopening of the mid-State and eastern Tennessee zinc mines, overall, there was little change in the State's nonfuel mineral industry from that of the previous year.

Commodity Review

Industrial Minerals

Clay and Shale.—Ball clay and kaolin clay were mined from the Eocene Age Claiborne and Wilcox Formations in Carroll, Gibson, Henry, and Weakly Counties in northwestern Tennessee. Companies operating in the State were Boral Bricks Inc., H.C. Spinks Clay Co. Inc. (owned by Franklin Minerals Inc.), Kentucky-Tennessee Clay Co. (a member of IMERYS Minerals Ltd.), Old Hickory Clay Co., and United Clays Inc. (owned by Unimin Corp.). Fuller's earth clay (montmorillonite) was mined in Hardeman County by Moltan Co. and in Henry County by American Colloid Co.

General Shale Brick Inc. (a U.S. subsidiary of Wienerberger AG of Vienna, Austria), the Nation's largest brick manufacturer, based out of Johnson City, TN, operated eight shale mines in Anderson, Carter, Knox, Sullivan, and Washington Counties in east Tennessee to supply its brick production plants. In 2007, General Shale Brick Inc. acquired Modern Concrete, a full-service masonry supplier headquartered in Louisville, KY, and Arriscraft International, a leading North American stone producer based in Toronto, Ontario, Canada (General Shale Brick, Inc., 2009). Because of high inventory that built up resulting from slumping housing starts, which were at a 10- to 15-year low, General Shale Brick Inc. planned the closing

²Peter Lemiszki, Chief Geologist with the Tennessee Division of Geology in Knoxville authored the text of the State mineral industry information provided by that agency.

of its Riverside Drive brick production plant in Knoxville, Knox County, at yearend; the layoff affected 65 employees in Knoxville (Silence, 2007a).

Gemstones.—The American Pearl Co. in Benton County operated the only freshwater pearl farm in North America; the freshwater pearl was designated as Tennessee's Official State Gem in 1979. American Shell Co., Tennessee Shell Co., and The American Pearl Co. exported mollusk shells from the Tennessee River to pearl-producing countries. Approximately 90% of all cultured pearls begin with a mother-of-pearl nucleus taken from the shell of a Tennessee mussel.

Sand and Gravel, Construction.—There were 87 construction sand and gravel operations in 28 counties managed by 54 different companies and 2 county highway departments. Companies operating at least five sites each were: Ford Construction Co., Memphis Stone and Gravel Co., and Standard Construction Co., which are located in western Tennessee crushed stone/sand and gravel (aggregate) district 1 (Information can be found on the Tennessee mineral production map).

Sand and Gravel, Industrial.—Industrial sand was mined in Hawkins County by Fine Sands, LLC and Short Mountain Silica Co. Unimin Corp. operated two industrial sand mines in Benton and Carroll Counties, and Teague Transports, LLC. operated one mine in Madison County.

Stone, Crushed.—In 2007, there were 154 permitted crushed stone industry operations. Dolomite and limestone were produced at approximately 151 quarries and underground mines located primarily in mid-Tennessee aggregate district 2 and eastern Tennessee aggregate district 3. Three quarries in far eastern Johnson County produced either crushed granite or quartzite. In 65 counties, 44 different companies and 15 county highway departments produced crushed dolomite and limestone. The top three producers were Vulcan Materials Co., which operated 44 quarries in 30 counties; Rogers Group Inc., which operated 32 quarries in 27 counties; and Rinker Materials Corp., which operated 12 quarries in 7 counties.

Stone, Dimension.—The Ordovician Age Holston Limestone was quarried for dimension marble in Blount, Knox, and Loudon Counties by the Tennessee Marble Co. and Tennessee Valley Marble Inc. Six companies operated eight dimension sandstone quarries in the Pennsylvanian Age Crab Orchard Sandstone in Bledsoe, Cumberland, Morgan, and Rhea Counties.

Other Industrial Minerals.—Synthetic gypsum was produced from Tennessee Valley Authority byproducts at the Allied Custom Gypsum Co. plant in Stewart County. Lime plants operated by AbitibiBowater Inc. in McMinn County produced high-calcium quicklime, and Global Stone Tenn-Luttrell Inc. (owned by O-N Minerals, a division of Oglebay Norton Co.) in Union County produced high-calcium quicklime and hydrated lime.

Metals

Zinc.—In 2007, the zinc mining industry in Tennessee was revived with the rehabilitation and reopening of the mines in eastern and middle sections of the State leading to hundreds of new jobs. The East Tennessee Zinc Co.'s (parent company Swiss

conglomerate Glencore International AG) Young Mine and Coy Mine in Jefferson County and Immel Mine in Knox County were fully operational in 2007. Glencore purchased the three mines in 2006 from Asarco LLC (Tucson, AZ) for \$65 million. The mines had been closed since 2001, when zinc prices dropped to less than \$1.10 per kilogram (kg) (\$0.50 per pound). In January, the company hit the 300-employee level after it spent much of 2006 rehabilitating the three mines; not long thereafter it reached the 400-employee level by about the time that prices were hovering at nearly \$2.76 per kg (\$1.25 per pound). The company used several underground mining methods to extract the ore at depths ranging from 150 meters (m) (500 feet) to more than 500 m (about 1,700 feet). As of July, the reported zinc production from the Young, Coy, and Immel mines since the company reopened its Knoxville area mines in 2006 was nearly 226,000 metric tons (t) (nearly 249,000 short tons), 95,300 t (105,000 short tons), and 2,900 t (3,200 short tons), respectively (Silence, 2007b).

The five mid-Tennessee zinc mines in Smith County were now owned by Mid-Tennessee Zinc Corp. (a wholly owned subsidiary of Strategic Resource Acquisition Corp. (SRA) based in Toronto, Ontario, Canada). In December 2006, SRA had acquired the Middle Tennessee zinc mining complex from Mossy Creek Mining, LLC. Pasmenco Ltd. had ceased mining operations at the complex in May 2003 primarily owing to low zinc prices. Mossy Creek acquired the property in August 2003 to continue the agricultural-lime recovery business that was in place at the mines. The total project, located approximately 80 km east of Nashville, included a complex of five underground zinc mines—Carthage, Cumberland, Elmwood, Gordonsville, and Stonewall—and the Gordonsville mill. In October, the company reported that its dewatering program at the Gordonsville Mine was completed allowing access to the crusher level and further allowing the mine to be the company's first mine to be brought back into production. Additionally, the dewatering of the Elmwood, South Carthage, and Cumberland Mines was on schedule. Full production was anticipated for 2008 at an annualized rate of 2.2 million metric tons (2.4 million short tons) of ore producing nearly 57,000 t (125 million pounds) of zinc in concentrate (Strategic Resource Acquisition Corp., 2007). The resumption of mining at the Gordonsville Mine in early 2008, was to be followed by mining at the Cumberland Mine in the second quarter of 2008, and at the Elmwood Mine in mid-2008. At full production, the complex was expected to produce 66,700 metric tons per year (t/yr) of zinc in concentrate. The life of the mining operation was expected to be 6 years based on indicated mineral resources, although mine life could be significantly extended by upgrading current inferred mineral resources (Tolcin, 2009, p. 84.2–84.3).

In November, Strategic Resource Acquisition Corp. announced that it entered into an agreement in principle with Nyrstar for the sale of a major portion of the zinc production from its middle Tennessee zinc mines. The 5-year agreement provides for the sale of up to 82,000 t/yr for processing of the zinc concentrate and to return the residue complete with valuable germanium and gallium (Strategic Resource Acquisition Corp., 2008).

SRA aligned agreements in principle with Nyrstar N.V. to process the zinc concentrates. SRA also aligned agreements in principle with Teck Metals and MG Rohstoffhandel (owner of the Rohr-Zinc refinery in Germany), for the same. The owner of the zinc smelting and alloying operation in Clarksville (Montgomery County) was now Nyrstar N.V., which was created in August from the zinc and lead smelting and alloying assets of Umicore and Zinifex Limited (Umicore, 2007). Since the closing of the Tennessee zinc mines, the Clarksville smelter sourced the majority of its concentrates from mines in Australia, Central America, Ireland, and South America. The main products are Special High Grade zinc and galvanizing alloys, and byproducts include cadmium metal, an intermediate copper cementate, leach product, sulphuric acid, and synthetic gypsum. Production in 2007 was 121,000 t (133,000 short tons) and was affected by a 19-day planned shutdown to complete refractory repairs to the roaster. Key environmental initiatives completed in 2007 included replacement of the acid plant preheater and the recovery and sale of a germanium byproduct material stored in onsite impoundments (Nyrstar N.V., 2008, p. 22–29).

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TABLE 1
 NONFUEL RAW MINERAL PRODUCTION IN TENNESSEE^{1,2}

(Thousand metric tons and thousand dollars)

| Mineral | 2005 | | 2006 | | 2007 | |
|--|----------|---------|---------------------|----------------------|----------|---------|
| | Quantity | Value | Quantity | Value | Quantity | Value |
| Clays: | | | | | | |
| Ball | 740 | 32,500 | 713 ^r | 30,800 ^r | 677 | 30,600 |
| Common | 372 | 3,210 | 231 | 1,530 | 199 | 1,360 |
| Fuller’s earth | 91 | W | W | W | W | W |
| Kaolin | 1 | W | W | W | -- | -- |
| Sand and gravel: | | | | | | |
| Construction | 7,570 | 51,500 | 8,500 | 57,900 | 7,140 | 50,900 |
| Industrial | 985 | 26,500 | 1,010 | 29,300 | 1,070 | 32,400 |
| Stone, crushed | 66,500 | 483,000 | 65,500 ^r | 523,000 ^r | 62,000 | 547,000 |
| Combined values of cadmium [byproduct from zinc concentrates (2007)], cement, gemstones (natural), lime, salt, stone (dimension marble), zinc (2007), and values by symbol W | | | | | | |
| | XX | 174,000 | XX | 218,000 | XX | 313,000 |
| Total | XX | 771,000 | XX | 861,000 ^r | XX | 975,000 |

^rRevised. W Withheld to avoid disclosing company proprietary data. Withheld values included in “Combined values” data. XX Not applicable. -- Zero.

¹Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

²Data are rounded to no more than three significant digits; may not add to totals shown.

TABLE 2
TENNESSEE: CRUSHED STONE SOLD OR USED, BY TYPE¹

| Type | 2006 | | | 2007 | | |
|------------------------|--------------------|---------------------------------|------------------------|--------------------|---------------------------------|-------------------|
| | Number of quarries | Quantity (thousand metric tons) | Value (thousands) | Number of quarries | Quantity (thousand metric tons) | Value (thousands) |
| Limestone ² | 115 ^r | 64,200 ^r | \$513,000 ^r | 118 | 60,600 | \$533,000 |
| Granite | 1 | 429 | 3,450 | 1 | 378 | 3,340 |
| Sandstone | 5 ^r | 856 ^r | 6,980 ^r | 6 | 972 | 10,400 |
| Total | XX | 65,500 ^r | 523,000 ^r | XX | 62,000 | 547,000 |

^rRevised. XX Not applicable.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes limestone-dolomite reported with no distinction between the two.

TABLE 3
TENNESSEE: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2007, BY USE¹

(Thousand metric tons and thousand dollars)

| Use | Quantity | Value |
|--|----------|---------|
| Construction: | | |
| Coarse aggregate (+1½ inch): | | |
| Riprap and jetty stone | 468 | 4,260 |
| Filter stone | 213 | 1,650 |
| Other coarse aggregate | 1,540 | 14,700 |
| Coarse aggregate, graded: | | |
| Concrete aggregate, coarse | 568 | 3,540 |
| Bituminous aggregate, coarse | 1,730 | 14,900 |
| Bituminous surface-treatment aggregate | W | W |
| Railroad ballast | W | W |
| Other graded coarse aggregate | 15,600 | 151,000 |
| Fine aggregate (¾ inch): | | |
| Stone sand, concrete | 338 | 5,060 |
| Stone sand, bituminous mix or seal | W | W |
| Screening, undesignated | 295 | 2,410 |
| Other fine aggregate | 3,860 | 38,300 |
| Coarse and fine aggregates: | | |
| Graded road base or subbase | 1,450 | 8,290 |
| Unpaved road surfacing | W | W |
| Crusher run or fill or waste | 775 | 5,270 |
| Roofing granules | W | W |
| Other coarse and fine aggregates | 14,300 | 113,000 |
| Other construction materials | 466 | 3,810 |
| Agricultural, limestone | W | W |
| Chemical and metallurgical: | | |
| Cement manufacture | W | W |
| Lime manufacture | W | W |
| Sulfur oxide removal | W | W |
| Special: | | |
| Mine dusting or acid water treatment | W | W |
| Other fillers of extenders | W | W |
| Other miscellaneous uses and specified uses not listed | 17 | 35 |
| Unspecified:² | | |
| Reported | 11,900 | 98,400 |
| Estimated | 5,500 | 49,000 |
| Total | 62,000 | 547,000 |

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

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Reported and estimated production without a breakdown by end use.

TABLE 4
 TENNESSEE: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2007, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

| Use | District 1 | | District 2 | | District 3 | |
|--|------------|--------|------------|---------|------------|---------|
| | Quantity | Value | Quantity | Value | Quantity | Value |
| Construction: | | | | | | |
| Coarse aggregate (+1½ inch) ² | W | W | 1,310 | 11,000 | W | W |
| Coarse aggregate, graded ³ | W | W | W | W | W | W |
| Fine aggregate (-¾ inch) ⁴ | W | W | 1,600 | 16,300 | W | W |
| Coarse and fine aggregate ⁵ | W | W | 11,000 | 81,300 | W | W |
| Other construction materials | -- | -- | 192 | 1,570 | 274 | 2,240 |
| Agricultural ⁶ | W | W | W | W | W | W |
| Chemical and metallurgical ⁷ | -- | -- | W | W | W | W |
| Special ⁸ | -- | -- | -- | -- | W | W |
| Other miscellaneous uses | -- | -- | 7 | 15 | 10 | 20 |
| Unspecified: ⁹ | | | | | | |
| Reported | 546 | 4,920 | 5,250 | 41,500 | 6,100 | 52,000 |
| Estimated | -- | -- | 3,500 | 31,000 | 2,000 | 18,000 |
| Total | 3,400 | 36,800 | 33,000 | 272,000 | 25,600 | 238,000 |

W Withheld to avoid disclosing company proprietary data; included in "Total." -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes filter stone, riprap and jetty stone, and other coarse aggregates.

³Includes bituminous aggregate (coarse), bituminous surface-treatment aggregate, concrete aggregate (coarse), railroad ballast, and other graded coarse aggregates.

⁴Includes screening (undesigned), stone sand (bituminous mix or seal), stone sand (concrete), and other fine aggregates.

⁵Includes crusher run or fill or waste, graded road base or subbase, roofing granules, unpaved road surfacing, and other coarse and fine aggregates.

⁶Includes agricultural limestone.

⁷Includes cement and lime manufacture and sulfur oxide removal.

⁸Includes mine dusting or acid water treatment and other fillers or extenders.

⁹Reported and estimated production without a breakdown by end use.

TABLE 5
 TENNESSEE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2007,
 BY MAJOR USE CATEGORY¹

| Use | Quantity (thousand metric tons) | Value (thousands) | Unit value |
|---|---------------------------------------|----------------------|---------------|
| Concrete aggregate and concrete products ² | 2,820 | \$21,300 | \$7.55 |
| Asphaltic concrete aggregates and other bituminous mixtures | 285 | 1,750 | 6.14 |
| Road base and coverings | 400 | 2,100 | 5.24 |
| Fill | 94 | 1,020 | 10.83 |
| Unspecified: ³ | | | |
| Reported | 1,160 | 8,170 | 7.02 |
| Estimated | 2,400 | 17,000 | 7.00 |
| Total or average | 7,140 | 50,900 | 7.14 |

¹Data are rounded to no more than three significant digits, except unit value; may not add to totals shown.

²Includes plaster and gunite sands.

³Reported and estimated production without a breakdown by end use.

TABLE 6
 TENNESSEE: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2007, BY USE AND DISTRICT¹

(Thousand metric tons and thousand dollars)

| Use | District 1 | | District 2 | | District 3 | |
|---|------------|--------|------------|--------|------------|-------|
| | Quantity | Value | Quantity | Value | Quantity | Value |
| Concrete aggregate and concrete products ² | 1,780 | 11,500 | W | W | W | W |
| Asphaltic concrete aggregates and road base materials | 535 | 2,860 | W | W | W | W |
| Fill | 94 | 1,020 | -- | -- | -- | -- |
| Unspecified: ³ | | | | | | |
| Reported | 748 | 6,020 | 415 | 2,150 | -- | -- |
| Estimated | 1,280 | 8,960 | 918 | 6,420 | 178 | 1,250 |
| Total or average | 4,430 | 30,300 | 1,900 | 12,900 | 800 | 7,710 |

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

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Includes plaster and gunite sands.

³Reported and estimated production without a breakdown by end use.