



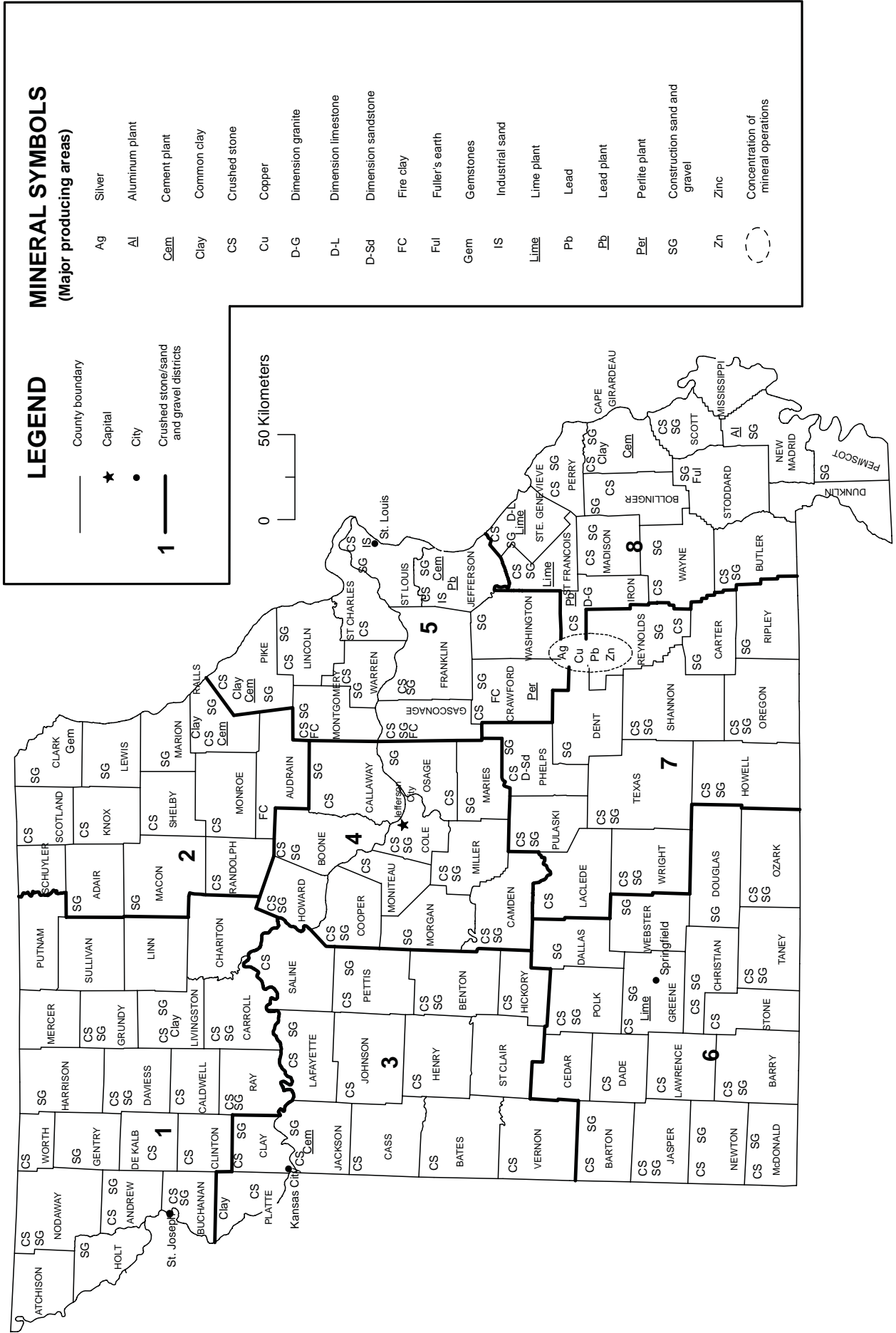
# 2005 Minerals Yearbook

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## MISSOURI

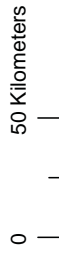
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# MISSOURI



## LEGEND

- County boundary
- ★ Capital
- City
- 1 — Crushed stone/sand and gravel districts



## MINERAL SYMBOLS (Major producing areas)

- Ag Silver
- Al Aluminum plant
- Cem Cement plant
- Clay Common clay
- CS Crushed stone
- Cu Copper
- D-G Dimension granite
- D-L Dimension limestone
- D-Sd Dimension sandstone
- FC Fire clay
- Ful Fuller's earth
- Gem Gemstones
- IS Industrial sand
- Lime Lime plant
- Pb Lead
- Pb Lead plant
- Per Perlite plant
- SG Construction sand and gravel
- Zn Zinc
- Concentration of mineral operations

# THE MINERAL INDUSTRY OF MISSOURI

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

In 2005, Missouri's nonfuel raw mineral production was valued<sup>1</sup> at \$1.94 billion, based upon annual U.S. Geological Survey (USGS) data. This was a 19.8% increase from the State's total nonfuel mineral value of \$1.62 billion<sup>2</sup> for 2004, which followed a 20.9% increase from 2003 to 2004. The State rose to 8th from 10th in rank among the 50 States in total nonfuel mineral production value, of which Missouri accounted for 3.5% of the U.S. total.

Crushed stone, cement (portland and masonry), lead, and lime, in descending order of value, accounted for nearly 90% of Missouri's total nonfuel mineral production value in 2005. Even though Missouri did continue to be the top lead-producing State in the Nation, producing significantly more than one-half of the Nation's output, by value, crushed stone and cement, by a significant margin, remained the State's leading nonfuel minerals in 2005, having surpassed lead in 1997 and 1999, respectively. Prior to 1997, lead had been Missouri's leading nonfuel mineral since 1969, except for several years in the mid-1980s and during 1993-95, when crushed stone was ranked first.

In 2005, in descending order of change, increases in the values of crushed stone, portland cement, lead, and lime led Missouri's increase in total nonfuel mineral production value for the year, with increases of nearly \$170 million, \$76 million, more than \$40 million, and nearly \$15 million, respectively. The unit values of each also increased significantly. With a 7% increase in production, the value of crushed stone rose nearly 30%, and a marginal increase in portland cement production resulted in a nearly 20% increase in the commodity's total value. Similarly, those of lead and lime also rose. Smaller yet significant increases took place also in the values of the mineral commodities of zinc, silver, copper, construction sand and gravel, and fire clay with increases in the unit values of each (table 1).

In 2005, Missouri continued to be first in the quantities of lead and lime produced, first of four fire clay-producing States, second in fuller's earth, and sixth in the production of silver. The State was third in the production of cadmium (a byproduct of zinc production), but decreased to third from second in that

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<sup>1</sup>The 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 2005 USGS mineral production data published in this chapter are those available as of December 2006. 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>.

<sup>2</sup>This figure is a revision to the previously published \$1.34 billion in The Mineral Industry of Missouri chapter in the U.S. Geological Survey Minerals Yearbook, Area Reports: Domestic 2004 Volume II; the value of crushed stone was revised to \$564 million from \$426 million resulting from a revision in the quantity produced to 92.6 million metric tons (Mt) from 69.1 Mt (table 1).

of zinc and to sixth from fifth in portland cement. Missouri remained 10th in the production of masonry cement, and continued to be a significant producer of construction sand and gravel, industrial sand and gravel, common clays, and gemstones (gemstones based upon value).

The Missouri Department of Natural Resources, Division of Geology and Land Survey<sup>3</sup> (DGLS), provided the following narrative information. Some data or information as reported by the DGLS may differ from USGS estimates and production figures.

## Commodity Review

### *Industrial Minerals*

**Cement.**—In Missouri, cement was produced at five separate cement plants in 2005, one of which was undergoing an upgrade to increase its capacity; also, work had begun toward the building of a sixth plant. From north to south along the Mississippi River; Continental Cement Co. LLC operated the Hannibal plant in Ralls County; Holcim (US) Inc. operated the Clarksville plant in Pike County; and Buzzi Unicem USA operated a plant at Selma in Jefferson County and a plant at Cape Girardeau in Cape Girardeau County. In western Missouri, Lafarge North America operated the Sugar Creek plant in Jackson County.

The capacity of cement production in Missouri was projected to increase in the next several years, in part because Buzzi Unicem USA began a project to upgrade its Selma, MO, plant to increase the cement capacity from 1.3 million metric tons (Mt) to 2.3 Mt. Also, Holcim had begun work on its new cement plant in northeastern Ste. Genevieve County along the Mississippi River. The plant was due to come on line in 2009 with an annual capacity of 4 Mt of cement.

**Clays.**—Total clay mine production in Missouri increased by as much as 7% from 2004 to 2005 according to the State's mine inspector, mainly owing to increased demand for common clay by the cement industry (table 1 shows "sales or used" rather than production—fire clay and fuller's earth withheld). The three types of clay produced were common clay, fire clay, and fuller's earth. The majority of the common clay mined was used in the production of portland cement. Production of common clay was expected to increase significantly with the opening and expansion of the cement plants previously mentioned. Production of fire clay had decreased for the year. Though the number of mines operating in the Northern and Southern

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<sup>3</sup>Edith Starbuck, a Missouri Registered Geologist and a Geologist II with the Missouri Department of Natural Resources, Division of Geology and Land Survey, Geologic Resources Section, authored the text of Missouri mineral industry information.

Fire Clay Districts decreased during the past several years, production from several individual mines appeared to have increased from 2004 to 2005. Fuller's earth was mined by Nestle Purina Petcare Co. from Paleocene-age Porter's Creek Clay in Stoddard County and was used to make absorbent pet litter.

**Construction Sand and Gravel.**—New State rules on sand and gravel extraction from streams became effective in October 2004. Production of construction sand and gravel appeared unaffected by implementation of the new rules because tonnage increased by about 12% more than 2004, according to the State's mine inspector. The Land Reclamation Program permitted 390 sand and gravel operations in 61 Missouri counties during 2005.

**Crushed Stone.**—For Missouri, 2005 was a fairly active year for the crushed stone industry with an increase in production of about 6.8% (production data reported to the USGS indicated about a 7.3% increase—table 1). High demand was stimulated by increased road construction as well as a robust economy, which resulted in increases in both residential and commercial construction. The Land Reclamation Program had 379 crushed limestone or dolomite quarries in 96 Missouri counties under permit during 2005. Four granite or traprock quarries were permitted in Iron and Wayne Counties.

**Dimension Stone.**—Missouri Red Quarries, Inc. produced dimension granite from the Graniteville Quarry in Iron County. According to the State's mine inspector, production decreased significantly during the last half of calendar year 2005.

**Gemstones.**—Quartz geodes from the Mississippian-age Warsaw Formation in extreme northeastern Missouri constituted the only substantial gemstone production in Missouri during 2005.

**Industrial (Silica) Sand.**—Silica sand was mined from the Ordovician-age St. Peter Sandstone in St. Louis and Jefferson Counties by Buzzi Unicem, USA, Unimin Corp., and U.S. Silica Company.

**Lime.**—Quicklime and hydrated lime were manufactured in Greene and Ste. Genevieve Counties by Mississippi Lime Co., and quicklime was produced by Chemical Lime Co. in Ste. Genevieve County. Vessell Mineral Products Co., in St. Francois County, produced dolomitic lime for the steel industry. Work was in progress to close down Mississippi Lime's Springfield plant in Greene County. The kiln was shut down in December 2005 and the plant ran off inventory on into 2006. Thirty-four employees faced layoff and one person was to be transferred to the Ste. Genevieve operation. To replace capacity lost by the closure of the Springfield plant, Mississippi Lime commissioned a new vertical shaft kiln at its Ste. Genevieve plant in August. Another kiln of similar design was scheduled for installation in 2006.

## Metals

**Copper, Lead, Silver, and Zinc.**—All production of metals in Missouri came from Doe Run Co.'s underground mines in the Viburnum Trend on the west side of the St. Francois Mountains in the southeastern portion of the State. Ore minerals were galena, sphalerite, chalcopyrite, and bornite, in order of decreasing abundance, with small amounts of silver associated

with the galena. The company's Viburnum, Buick, Brushy Creek, Fletcher, and Sweetwater Mines were operating in 2005.

## Legislation and Government Programs

New rules affecting sand and gravel extraction from streams became effective in October 2004, as cited at Missouri Code of State Regulations, Rules of Department of Natural Resources, Division 40 - Land Reclamation Commission, Chapter 10 – Permit and Performance Requirements for Industrial Mineral Open Pit and In-Stream Sand and Gravel Operations (10 CSR 40-10.020 and 050) (Missouri Department of Natural Resources, 2005§<sup>4</sup>). The rules, enforced by the Missouri Department of Natural Resources Land Reclamation Program, basically required operators to stay out of the flowing water of a stream and to leave protective bank vegetation intact. The rules were implemented to provide a fair and consistent set of standards for stream protection targets and are requirements under the permitting of mining operations. Private landowners that mine these products for personal use are exempt from the law, as are the military and any political subdivision.

The reorganization in State government that took place in 2005 affected the Missouri Department of Natural Resources in 2005. The Department's Geological Survey and Resource Assessment Division was renamed the Division of Geology and Land Survey (DGLS). The staff of the Water Resources Section was reassigned to the Water Resources Center, a part of the Department's Office of the Director, and the Wellhead Protection Section was reassigned to the Division of Environmental Quality. The staff whose primary job description was information technology was reassigned to the Information Technology Services Division in the Missouri State government's Office of Administration.

The DGLS continued bedrock and surficial materials geologic mapping in the Fulton 30' × 60' quadrangle, northeast of Jefferson City, at the 1:24,000 scale and a compilation of the bedrock geologic mapping done for the Festus 30' × 60' quadrangle, south of St. Louis, was produced at the 1:100,000 scale. Near the end of 2005, the DGLS published the Paleozoic Succession in Missouri, Part 5 – Pennsylvanian Subsystem, the definitive work on the stratigraphy of the Pennsylvanian Subsystem in Missouri.

DGLS staff also completed a collection of samples for the Missouri portion of the National Geochemical Survey. "The USGS, in collaboration with other Federal and State government agencies, industry, and academia, is conducting the National Geochemical Survey (NGS) to produce a body of geochemical data for the United States based primarily on stream sediments, analyzed using a consistent set of methods. These data will compose a complete, national-scale geochemical coverage of the United States, and will enable construction of geochemical maps, refine estimates of baseline concentrations of chemical elements in the sampled media, and provide context for a wide variety of studies in the geological and environmental sciences" (U.S. Geological Survey, 2007§). The DGLS staff's goal of the 2-year project was to collect 500 samples of stream sediment

<sup>4</sup>References that include a section mark (§) are found in the Internet References Cited section.

or soil or that of both. The staff collected a total of 575 samples based upon a predetermined sampling grid that covered nearly 13 million hectares (about 50,000 square miles), including all of the State north of the 38th parallel and about three-eighths of the State south of the 38th parallel. The work was done under a cooperative agreement with the USGS.

The DGLS began development of its Missouri Geologic Map Index on the Internet in late 2004 and continued development of the Internet site throughout 2005 (Missouri Division of Geology and Land Survey, 2007§).

## Internet References Cited

- Missouri Department of Natural Resources, 2005, Rules of Department of Natural Resources, Division 40—Land Reclamation Commission, Chapter 10—Permit and performance requirements for industrial mineral open pit and in-stream sand and gravel operations, accessed December 6, 2007, at URL <http://www.sos.mo.gov/adrules/csr/current/10csr/10c40-10.pdf>.
- Missouri Division of Geology and Land Survey, 2007 (August 8), Missouri geologic map index, accessed December 6, 2007, at URL <http://www.dnr.mo.gov/geology/statemap/missouri-maps.htm>.
- U.S. Geological Survey, 2007, The national geochemical survey—Database and documentation, accessed December 6, 2007, at URL <http://tin.er.usgs.gov/geochem/doc/home.htm>.

TABLE 1  
NONFUEL RAW MINERAL PRODUCTION IN MISSOURI<sup>1,2</sup>

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2003		2004		2005	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, portland	5,180	352,000 <sup>c</sup>	5,260	388,000 <sup>c</sup>	5,330	464,000 <sup>c</sup>
Clays:						
Common	970	3,660	911	3,290	822	3,400
Fire	307	7,230	W	W	W	W
Sand and gravel:						
Construction	10,600	49,400	12,200	60,000	12,200	61,600
Industrial	586	12,800	589	14,200	559	14,500
Stone, crushed	71,500	426,000	92,600 <sup>r</sup>	564,000 <sup>r</sup>	99,400	733,000
Combined values of cadmium (byproduct of zinc concentrates [2004-05]), cement (masonry), clays (fuller's earth), copper, gemstones (natural), lead, lime, silver, stone (dimension granite), zinc, and values indicated by symbol W	XX	488,000	XX	593,000 <sup>r</sup>	XX	666,000
Total	XX	1,340,000	XX	1,620,000 <sup>r</sup>	XX	1,940,000

<sup>c</sup>Estimated. <sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data. Withheld values included in "Combined values" data. XX Not applicable.

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

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

TABLE 2  
MISSOURI: CRUSHED STONE SOLD OR USED, BY KIND<sup>1</sup>

Kind	2004			2005		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone <sup>2</sup>	167 <sup>r</sup>	87,800 <sup>r</sup>	\$484,000 <sup>r</sup>	155	93,300	\$631,000
Dolomite	18	3,060	16,800	18	3,860	26,400
Granite	2	W	W	2	W	W
Traprock	2	W	W	1	W	W
Sandstone	1	W	W	--	--	--
Total	XX	92,600 <sup>r</sup>	564,000 <sup>r</sup>	XX	99,400	733,000

<sup>r</sup>Revised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable. -- Zero.

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

<sup>2</sup>Includes limestone-dolomite reported with no distinction between the two.

TABLE 3  
MISSOURI: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2005, BY USE<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
<b>Construction:</b>		
Coarse aggregate (+1½ inch):		
Macadam	310	2,180
Riprap and jetty stone	1,670	6,200
Filter stone	368	2,650
Other coarse aggregates	1,360	8,870
Total	3,710	19,900
Coarse aggregate, graded:		
Concrete aggregate, coarse	2,690	19,600
Bituminous aggregate, coarse	1,210	9,040
Bituminous surface-treatment aggregate	101	895
Railroad ballast	1,330	6,560
Other graded coarse aggregates	5,860	39,700
Total	11,200	75,800
Fine aggregate (-¾ inch):		
Stone sand, concrete	320	2,590
Stone sand, bituminous mix or seal	95	566
Screening, undesignated	516	1,380
Other fine aggregates	1,680	13,700
Total	2,620	18,300
Coarse and fine aggregates:		
Graded road base or subbase	4,920	22,600
Unpaved road surfacing	553	3,410
Terrazzo and exposed aggregate	W	W
Crusher run or fill or waste	455	2,500
Roofing granules	W	W
Other coarse and fine aggregates	9,340	59,100
Total	15,900	155,000
Other construction materials	591	4,190
Agricultural, limestone	(2)	(2)
Chemical and metallurgical:		
Cement manufacture	(2)	(2)
Lime manufacture	(2)	(2)
Special, asphalt fillers or extenders	(2)	(2)
Unspecified: <sup>3</sup>		
Reported	18,100	132,000
Estimated	40,000	298,000
Total	58,500	431,000
Grand total	99,400	733,000

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

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

<sup>2</sup>Withheld to avoid disclosing company proprietary data; included in "Grand total."

<sup>3</sup>Reported and estimated production without a breakdown by end use.

TABLE 4  
MISSOURI: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2005, BY USE AND DISTRICT<sup>1</sup>

(Thousand metric tons and thousand dollars)

Use	District 1		District 2		District 3		District 4	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction:								
Coarse aggregate (+1½ inch) <sup>2</sup>	W	W	W	W	31	188	W	W
Coarse aggregate, graded <sup>3</sup>	W	W	W	W	W	W	W	W
Fine aggregate (-¾ inch) <sup>4</sup>	W	W	W	W	W	W	--	--
Coarse and fine aggregates <sup>5</sup>	W	W	W	W	W	W	W	W
Other construction materials	--	--	--	--	--	--	--	--
Agricultural <sup>6</sup>	30	153	W	W	9	50	W	W
Chemical and metallurgical <sup>7</sup>	W	W	W	W	8	31	2	8
Special <sup>8</sup>	--	--	--	--	--	--	--	--
Unspecified: <sup>9</sup>								
Reported	2,720	19,600	1,870	13,700	5,550	40,700	266	1,970
Estimated	663	4,900	1,200	9,100	2,400	17,000	2,400	18,000
Total	4,490	34,300	4,790	31,000	10,800	78,800	5,080	33,800
	District 5		District 6		District 7		District 8	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Construction:								
Coarse aggregate (+1½ inch) <sup>2</sup>	1,280	8,430	W	W	W	W	W	W
Coarse aggregate, graded <sup>3</sup>	W	W	1,920	15,700	W	W	2,110	10,500
Fine aggregate (-¾ inch) <sup>4</sup>	W	W	W	W	W	W	62	372
Coarse and fine aggregates <sup>5</sup>	5,720	35,600	1,830	10,500	W	W	3,800	80,100
Other construction materials	521	3,720	48	336	22	129	--	--
Agricultural <sup>6</sup>	W	W	239	1,600	W	W	W	W
Chemical and metallurgical <sup>7</sup>	W	W	W	W	--	--	W	W
Special <sup>8</sup>	--	--	--	--	--	--	W	W
Unspecified: <sup>9</sup>								
Reported	2,810	20,500	2,280	16,900	--	--	2,580	19,000
Estimated	3,600	27,000	4,300	31,000	1,200	8,600	25,000	183,000
Total	22,100	146,000	11,600	82,400	2,100	13,500	38,400	313,000

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

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

<sup>2</sup>Includes filter stone, macadam, riprap and jetty stone, and other coarse aggregate.

<sup>3</sup>Includes concrete aggregate (coarse), bituminous aggregate (coarse), bituminous surface-treatment aggregate, railroad ballast, and other graded coarse aggregate.

<sup>4</sup>Includes screening (undesignated), stone sand bituminous mix or seal, stone sand (concrete), and other fine aggregate.

<sup>5</sup>Includes crusher run or fill or waste, graded road base or subbase, roofing granules, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.

<sup>6</sup>Includes agricultural limestone.

<sup>7</sup>Includes cement and lime manufacture.

<sup>8</sup>Includes asphalt fillers or extenders.

<sup>9</sup>Reported and estimated production without a breakdown by end use.



TABLE 5  
MISSOURI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2005,  
BY MAJOR USE CATEGORY<sup>1</sup>

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	6,950	\$33,600	\$4.84
Concrete products (blocks, bricks, pipe, decorative, etc.) <sup>2</sup>	351	2,510	7.14
Asphaltic concrete aggregates and other bituminous mixtures	397	2,750	6.94
Road base and coverings <sup>3</sup>	223	900	4.04
Fill	366	1,910	5.22
Snow and ice control	24	124	5.08
Other miscellaneous uses <sup>4</sup>	266	1,920	7.23
Unspecified: <sup>5</sup>			
Reported	1,140	5,520	4.85
Estimated	2,460	12,300	5.02
Total or average	12,200	61,600	5.06

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

<sup>2</sup>Includes plaster and gunite sands.

<sup>3</sup>Includes road and other stabilization (lime).

<sup>4</sup>Includes roofing granules.

<sup>5</sup>Reported and estimated production without a breakdown by end use.

TABLE 6  
MISSOURI: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2005, BY USE AND DISTRICT<sup>1,2</sup>

(Thousand metric tons and thousand dollars)

Use	Districts 1 and 2		District 3		Districts 4 and 5	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products <sup>3</sup>	384	2,160	--	--	5,650	29,200
Asphaltic concrete aggregates and road base materials <sup>4</sup>	W	W	--	--	321	2,050
Fill	21	70	--	--	321	1,750
Snow and ice control	W	W	--	--	W	W
Other miscellaneous uses <sup>5</sup>	11	60	--	--	247	1,800
Unspecified: <sup>6</sup>						
Reported	118	657	(7)	2	756	4,030
Estimated	462	2,320	410	2,060	1,310	6,540
Total	996	5,260	410	2,060	8,600	45,400
Use	Districts 6 and 7		District 8		Unspecified districts	
	Quantity	Value	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products <sup>3</sup>	143	849	275	1,430	848	2,500
Asphaltic concrete aggregates and road base materials <sup>4</sup>	52	298	W	W	--	--
Fill	24	88	--	--	--	--
Snow and ice control	12	70	--	--	--	--
Other miscellaneous uses <sup>5</sup>	28	154	239	1,260	--	--
Unspecified: <sup>6</sup>						
Reported	20	116	--	--	243	717
Estimated	255	1,280	28	141	--	--
Total	535	2,860	542	2,830	1,090	3,220

W Withheld to avoid disclosing company proprietary data; included in "Other miscellaneous uses." -- Zero.

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

<sup>2</sup>Districts 1 and 2, 4 and 5, and 6 and 7 are combined to avoid disclosing company proprietary data.

<sup>3</sup>Includes plaster and gunite sands.

<sup>4</sup>Includes road and other stabilization (lime).

<sup>5</sup>Includes roofing granules.

<sup>6</sup>Reported and estimated production without a breakdown by end use.

<sup>7</sup>Less than ½ unit.