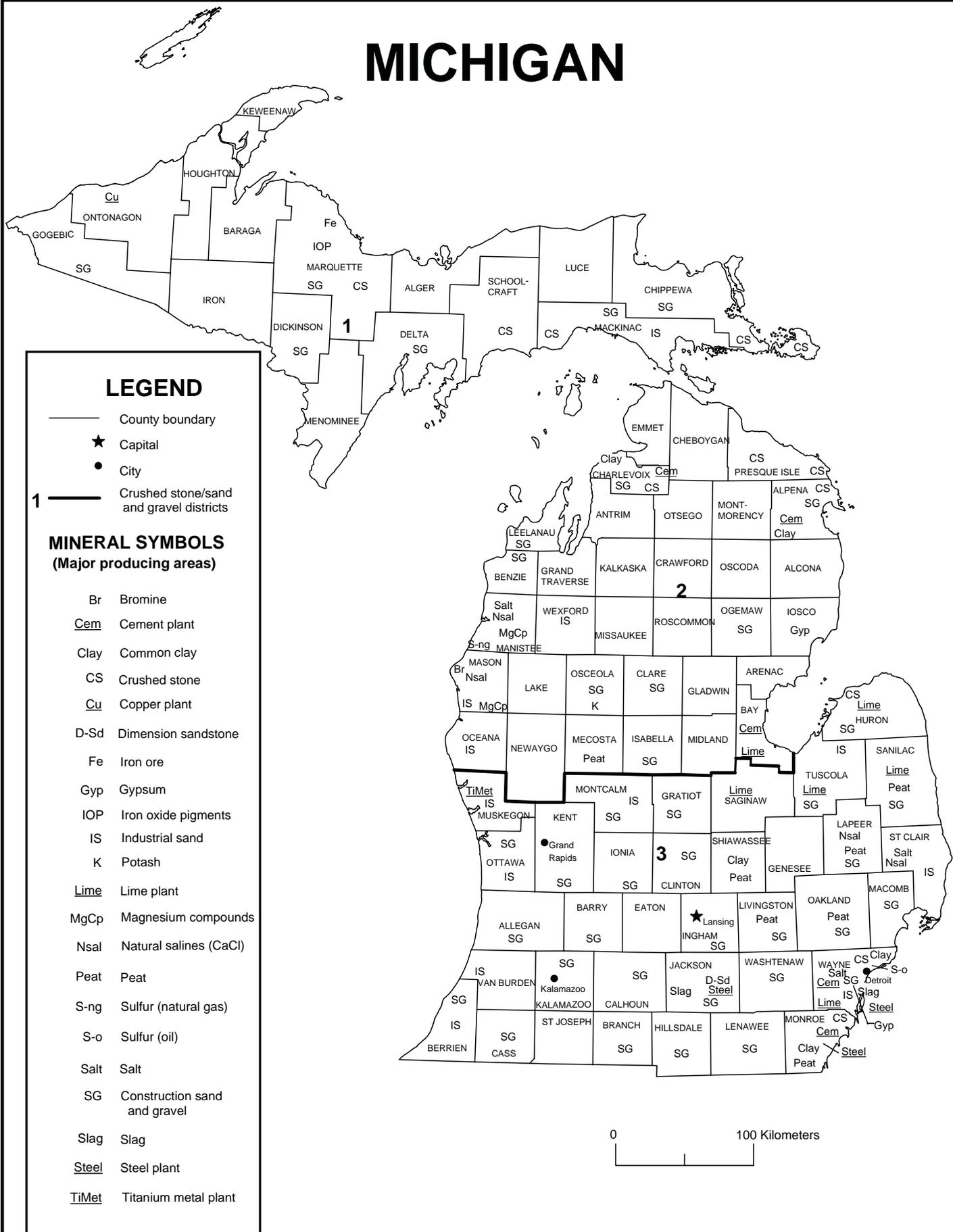




2005 Minerals Yearbook

MICHIGAN

MICHIGAN



Source: Michigan Department of Environmental Quality, Office of the Geological Survey/U.S. Geological Survey (2005)

THE MINERAL INDUSTRY OF MICHIGAN

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the Michigan Department of Environmental Quality, Office of the Geological Survey, for collecting information on all nonfuel minerals.

In 2005, Michigan's nonfuel raw mineral production was valued¹ at \$1.75 billion, based upon annual U.S. Geological Survey (USGS) data. This was a \$70 million, or 4.2% increase from the State's total nonfuel mineral value for 2004, which then had increased by \$100 million, or up 6.3% from 2003 to 2004. The State was 11th in rank (ninth in 2004) among the 50 States in total nonfuel mineral production value, of which Michigan accounted for more than 3% of the U.S. total.

In 2005, Michigan continued to be the Nation's second leading iron ore-producing State, and, based upon value, iron ore remained Michigan's leading nonfuel mineral commodity, followed by portland cement. (After decades of iron ore being the State's leading nonfuel mineral commodity, portland cement led the State in total nonfuel mineral value from 1999-2003.) Following portland cement were, in descending order of value, construction sand and gravel, salt, crushed stone, magnesium compounds, masonry cement, and lime. The values of these nonfuel mineral commodities, combined, accounted for 96% of the State's nonfuel raw mineral production value (table 1).

In 2005, portland cement and iron ore led Michigan's increase in nonfuel mineral production value. Although portland cement production was down slightly, its value rose by more than \$50 million from that of 2004. The unit value of iron ore also rose. With a relatively small decrease in iron ore production, the value of iron ore shipments rose by more than \$15 million. Other mineral commodities with significant increases in value were those of magnesium compounds, lime, crude gypsum, and potash, all increases ranging from about \$15 million for magnesium compounds to about \$4 million for potash. The unit values of five of these six nonfuel mineral commodities had significant increases in unit value except for magnesium compounds, which was up only slightly, and crude gypsum. An increase in crude gypsum production of 130% resulted in a 90% increase in the commodity's value. The most substantial decreases in value were those of salt and construction sand and gravel, down about \$15 million and \$11 million, respectively (table 1).

In 2005, Michigan continued to be first in the quantities of magnesium compounds produced and second in iron ore, bromine (of two bromine-producing States), peat, and second of four States that produce iron oxide pigments (mineral commodities listed in descending order of value). The State also remained third of three States that produce potash, fourth in construction sand and gravel, sixth in industrial sand and gravel,

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 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>.

seventh in salt, and ninth in masonry cement. The State rose to 9th from 10th in gypsum production but decreased to 5th from 4th in the production of portland cement. Additionally, the State was a significant producer of crushed stone, lime, and common clays. Michigan rose to third from fourth in the Nation in the manufacture of raw steel, with an increase in output to 6.05 million metric tons (Mt) in 2005 from an output of about 5.84 Mt in 2004 (American Iron and Steel Institute, 2006, p. 76).

The following narrative information was provided by the Michigan Department of Environmental Quality (MDEQ), Office of the Geological Survey (MOGS), the Michigan Department of Natural Resources (MDNR), and the Forestry, Mineral, and Fire Management Division² (FMFM). Production and other data and information in the following text are those reported by the MOGS and the MDNR, based upon those agencies' own research, surveys, and estimates. Mineral production data may differ from some production figures reported to the USGS.

Exploration and Development

In 2005, metallic and nonmetallic minerals continued to be produced from Federal, State, and privately owned lands; their production remained an important business activity within the State. Mineral commodities produced from these lands were supplied to local, regional, and international markets.

Kennecott Minerals Co. (a subsidiary of London-based Rio Tinto Plc with headquarters in Salt Lake City, UT) continued to conduct prefeasibility studies in 2005 at its Eagle Project nickel-copper sulfide deposit. Studies included an assessment of the environmental, social, and economic impacts of a proposed mine, as well as a review of engineering proposals for the mine. Participating in the discussion and planning process associated with these studies was a community advisory group. The company planned to conclude these studies by the end of the year, and then enter into an advanced feasibility stage that would include submission of permit applications to further develop the mine. The proposed Eagle Mine in northern Marquette County could require an estimated investment of \$100 million and employ about 120 full-time workers (Kennecott Minerals Company, 2005).

Bitterroot Resources Ltd., West Vancouver, British Columbia, Canada, announced plans for the first phase of its joint venture with Cameco Corp., Saskatoon, Saskatchewan, Canada, to determine availability of mineral resources in the Upper Peninsula of Michigan. Ground-based electromagnetic surveys

²The text of the State mineral industry information was compiled and edited by Milton A. Gere, Jr., Geologist and Supervisor, Metallic and Nonmetallic Minerals and Underground Gas Storage Leasing Unit, Minerals and Land Management Section, Forest, Mineral, and Fire Management Division, Michigan Department of Natural Resources, and Joseph R. Maki, Geologist, Office of the Geological Survey, Michigan Department of Environmental Quality.

were to be used to test near-surface conductive zones previously identified by an airborne geophysical survey conducted in 2004. The extent of test drilling of the lands was to be determined following receipt of the geophysical survey results. According to the joint-venture agreement, Cameco was to provide all funding for the 2005 exploration program and Bitterroot would remain the project operator (Bitterroot Resources Ltd., 2005).

JML Resources Ltd., Toronto, Ontario, Canada, announced in late August an agreement to acquire Aquila Resources Inc., a Toronto-based, privately held company. Aquila's principal asset was the Back Forty, a project to develop a volcanogenic massive sulfide resource in Menominee County, Michigan. Previous exploration results from the Back Forty project identified an inferred resource of 3.1 Mt grading 6.8% zinc, 0.25% copper, 32 grams per metric ton (g/t) silver, and 2.0 g/t gold (JML Resources Ltd., 2005).

Commodity Review

Industrial Minerals

Industrial Sand and Gravel.—Nugent Sand Co. applied for an MDEQ permit to continue its sand-mining operation at Norton Shores through 2012. Nugent planned to dredge 1.6 million cubic meters (2.1 million cubic yards) of sand and enlarge a 21-hectare (ha) (53-acre) manmade lake by another 8.5 ha (21 acres). The company had stopped mining on part of their property and had proposed to develop home sites around the manmade lake. A regional environmental group, however, opposed the issuance of the permit until a decision was made on Nugent's request for a permit to install a wastewater pipeline through a shoreline sand dune (Alexander, 2005). The request for the pipeline was denied by the MDEQ in early December. The pipeline, as proposed, would have allowed Nugent to discharge the water from its high-grade sand processing plant into Lake Michigan. In addition, the pipeline would have allowed for regulation of water levels in the manmade lake (Alexander and Burns, 2005).

The Ottawa County commissioners approved the purchase of a 3.2-kilometer (2-mile) long North Ottawa Dune property from Construction Aggregates Corp. in October. The price paid for the property was \$7 million, a figure that was about \$2.5 million below the property's appraised value. Closing costs of \$100,000 were also incurred by the County in completing the purchase transaction. Funds for the purchase were provided through the Michigan Natural Resources Trust Fund, the County, and private fundraising. The County planned to begin a master plan for its use of the property in 2006 (Chandler, 2005).

Construction Sand and Gravel.—In January 2005, Rieth-Riley Construction Co. objected to the use of aerial photos prior to a vote by the Ada Township (Kent County) Zoning Board of Appeals that rejected Rieth-Riley's request for expansion of their operation. The photos reportedly revealed certain company violations, one of which included stockpiling of materials beyond designated areas. The company's attorney stated that they were not aware the photos would be presented prior to the vote. Thus, they could not prepare an appropriate response to the zoning commissioner's determination that Rieth-Riley

had unlawfully expanded their local operation. The Township Board subsequently passed a resolution to further investigate the company's operations (Cunningham, 2005).

Holcim Ltd., Zurich, Switzerland, announced an agreement to purchase Aggregate Industries Plc, Markfield, United Kingdom. Aggregate Industries has numerous aggregate operations in the United States, and operates several sand and gravel, and related businesses in Michigan. Holcim operates the Dundee Cement Co. in western Monroe County. The agreement would give Holcim additional presence in the United States and United Kingdom aggregate and cement markets and would make Holcim the world's second leading cement producer (Rock Products, 2005a³).

Limestone and Dolomite.—Oglebay-Norton Co., Cleveland, OH, emerged from bankruptcy protection effective January 31, 2005 (Rock Products, 2005b[§]). Later the company announced that all of its limestone and lime operations would operate under the name O-N Minerals, effective May 1, 2005. The new division included all the Michigan Limestone Operations and Global Stone locations (Skillings Mining Review, 2005b). In October, the company announced that O-N Minerals had entered into an agreement allowing Western Lime Corp. lease land at O-N's Port Inland, MI, operation to construct and operate a lime kiln. O-N would supply the stone and Western would produce high-calcium lime for the environmental and industrial markets. Operation of the kiln was planned to begin in 2007 (Oglebay-Norton Co., 2005[§]).

Metals

Iron.—Cleveland-Cliffs Inc., (CCI), Cleveland, OH, continued to produce iron ore pellets at its partially owned Tilden Mine and Empire Mine operated in Marquette County, Michigan. Iron and steel producer Stelco Inc., Hamilton, Ontario, Canada, partial owner of the Tilden Mine and user of a significant quantity of iron ore pellets from the mine each year, remained under bankruptcy protection during the year. After filing several restructuring plans during the year, Stelco, in December, received final approval from creditors of restructuring plans (Daily Commercial News, 2006[§]).

Copper.—HudBay Minerals Inc., Winnipeg, Manitoba, Canada, announced in October that it had exercised an option to acquire 100% ownership of White Pine Copper Refinery Inc., White Pine, MI. The U.S. \$13 million purchase was to close in late 2005 or early 2006. White Pine has been refining copper anodes produced from HudBay's operations in northern Manitoba, and will continue to do so upon completion of the acquisition (Hudbay Minerals, Inc., 2005).

Government Activities, Legislation, and Programs

Metallic mineral leases issued during fiscal year 2005 ending September 30, 2005, totaled 118 and covered 11,190 ha (27,650 acres) of land. An additional 85 leases covering 8,500 ha (21,000 acres) were awaiting issuance, pending finalization of a revised lease document expected to be completed in 2006.

³References that include a section mark (§) are found in the Internet References Cited section.

Another three lease applications covering 1,330 ha (3,280 acres) were still under field review at the end of the year. Fees obtained from the various metallic mineral leases provided revenue of \$172,633 to the State in fiscal year 2005 (Thomas B. Hoane, Senior Geologist, MDNR, FMFM, Mineral and Land Management Section (MLMS), Metallic Mineral Leasing Program, unpublished Fiscal Year 2005 Annual Report, January 2006).

Nonmetallic mineral leases issued during fiscal year 2005 totaled 31 and extended over 1,000 ha (2,470 acres). The leases issued pertained to a variety of mineral commodities, including boulders, clay, cobblestone, construction sand, gravel, limestone and dolomite, and salt. Twenty of the leases went to County Road Commissions for sand and gravel, the result of converting short-term permits to multiyear leases. Six nominations for conversion to multiyear leases also were received in fiscal year 2005. The remaining permits and the various leases provided revenue of \$333,167 to the State for fiscal year 2005 (Thomas B. Hoane, Senior Geologist, MDNR, FMFM, MLMS, Nonmetallic Mineral Leasing Program, unpublished Fiscal Year 2005 Annual Report, January 2006).

The MDEQ, MOGS, in late 2004 announced new language for metallic mining permits that included the potential mining of metallic sulfide-bearing minerals. The permitting process as described in "Michigan's Nonferrous Metallic Mine Regulations," falls within the provisions of the Natural Resources Protection Act, Act 451 of 1994, Part 632, as amended. Specific rules for the new permitting process were developed in 2005 as a result of the combined input, review, and consensus by a large committee of representatives of numerous stakeholders. The rules were scheduled to be completed and promulgated in early 2006. The comprehensive, progressive mining law covering such new mining permits had been incorporated into Public Act Number 449 of 2004, granting exclusive authority to the MDEQ to regulate underground and surface mining and reclamation for nonferrous metals. This law contains a permitting process that requires a baseline assessment, detailed plans for mining, reclamation, and responding to accidents; a provision for public input; and assurance of financial support to cover remediation and reclamation costs in the event the MDEQ must take over those activities. Also, upon completion of mining, the site and surrounding area must be reclaimed to establish a self-sustaining ecosystem that does not require perpetual care or post-closure monitoring. The law includes strict, comprehensive, civil and criminal enforcement tools (Skillings Mining Review, 2005a).

Three exploration plans were approved in fiscal year 2005 and one was pending completion of review and approval in early fiscal year 2006 by the MDNR for work on State metallic mineral leases located in the western half of the Upper Peninsula (Thomas B. Hoane, Senior Geologist, MDNR, FMFM, MLMS, Metallic Mineral Leasing Program, unpublished Fiscal Year 2005 Annual Report, January 2006).

U.P. Steel, located at the former Eagle Mills Manufacturing, LLC facility, Negaunee, MI, was selected to receive a \$530,000 Michigan Energy Efficiency Grant from the State Public Service Commission. The company planned to further develop the commercial conversion of iron ore to steel using a microwave

process. The initial microwave process is under license from Michigan Technological University, (MTU)- Houghton. Two MTU Institute of Material Sciences professors developed the microwave process. The process could possibly make high phosphorus iron ore usable and involve fewer steps and lower costs than using conventional iron ore processing (Grand Rapids Press, The, 2005).

A retired MTU professor received a contract from the MDNR to continue efforts to update the Abandoned Underground Mine Inventory. Minesite visitations and meetings with several county mine inspectors and interested parties were held to record changes in site conditions resulting from new subsidence and discoveries, and site safety repairs on mines of all ownerships. The MDNR also continued the process to make safety repairs at old mine sites located on State-owned mineral rights areas.

More information about the MDNR is available on the Web site at URL <http://www.michigan.gov/dnr>; information and maps related to State-owned lands and minerals and leasing are available on the site. Information and maps related to State environmental and mining regulations, geological programs, and offered publications are available on the MDEQ Web site at URL <http://www.michigan.gov/deq>.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2003		2004		2005	
	Quantity	Value	Quantity	Value	Quantity	Value
Cement, masonry	237	24,300 ^e	231	27,100 ^e	228	27,500 ^e
Clays, common	588	3,050	605	3,070	334	514
Gemstones	NA	1	NA	1	NA	1
Gypsum, crude	500	6,130	452	5,660	1,050	10,700
Peat	125	3,460	122	3,360	117	3,300
Sand and gravel:						
Construction	71,000	253,000	69,500	254,000	64,800	243,000
Industrial	2,130	31,400	1,690	25,200	1,610	24,500
Stone, crushed	33,600 ³	123,000 ³	36,700 ^{r,3}	143,000 ^{r,3}	36,100	141,000
Combined values of bromine, cement (portland), iron ore (usable shipped), iron oxide pigments (crude), lime, magnesium compounds, potash, salt, stone (crushed marl and miscellaneous [2003], crushed marl [2004], dimension dolomite and sandstone)	XX	1,140,000	XX	1,210,000 ^r	XX	1,300,000
Total	XX	1,580,000	XX	1,680,000 ^r	XX	1,750,000

^eEstimated. ^rRevised. NA Not available. XX Not applicable.

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.

³Excludes certain stones; kind and value included with "Combined values" data.

TABLE 2
MICHIGAN: CRUSHED STONE SOLD OR USED, BY KIND¹

Kind	2004			2005		
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Number of quarries	Quantity (thousand metric tons)	Value (thousands)
Limestone	22	27,900	\$105,000	25	27,900	\$108,000
Dolomite	5	7,860	35,300	5	7,380	31,200
Calcareous marl	1	W	W	1	(2)	(2)
Miscellaneous stone	1	941	3480	2	(2)	(2)
Total	XX	36,700 ^r	143,000 ^r	XX	36,100	141,000

^rRevised. W Withheld to avoid disclosing company proprietary data. XX Not applicable.

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

²Withheld to avoid disclosing company proprietary data; included in "Total."

TABLE 3
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2005, BY USE¹

(Thousand metric tons and thousand dollars)

Use	Quantity	Value
Construction:		
Coarse aggregate (+1½ inch):		
Macadam	W	W
Riprap and jetty stone	126	2,020
Filter stone	W	W
Other coarse aggregate	77	497
Total	235	2,830
Coarse aggregate, graded:		
Concrete aggregate, coarse	4,250	20,200
Bituminous aggregate, coarse	439	3,390
Bituminous surface-treatment aggregate	W	W
Railroad ballast	W	W
Other graded coarse aggregate	1,140	5,220
Total	5,930	29,700
Fine aggregate (-¾ inch):		
Stone sand, concrete	W	W
Stone sand, bituminous mix or seal	450	1,880
Screening, undesignated	W	W
Other fine aggregate	336	1,520
Total	1,300	5,290
Coarse and fine aggregates:		
Graded road base or subbase	1,910	9,500
Unpaved road surfacing	77	416
Crusher run or fill or waste	169	649
Other coarse and fine aggregates	370	1,730
Total	2,520	12,300
Other construction materials	1	3
Agricultural:		
Limestone	W	W
Other agricultural uses	W	W
Total	106	984
Chemical and metallurgical:		
Cement manufacture	W	W
Lime manufacture	W	W
Flux stone	W	W
Total	7,570	19,800
Special, other fillers or extenders	W	W
Other miscellaneous uses and specified uses not listed	889	1,330
Unspecified:²		
Reported	16,000	62,200
Estimated	1,600	6,200
Total	17,600	68,400
Grand total	36,100	141,000

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
MICHIGAN: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2005, 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	W	W	154	2,310
Coarse aggregate, graded ³	W	W	W	W	W	W
Fine aggregate (-¾ inch) ⁴	W	W	W	W	W	W
Coarse and fine aggregate ⁵	W	W	W	W	1,650	8,290
Other construction materials	--	--	1	3	--	--
Agricultural ⁶	W	W	W	W	W	W
Chemical and metallurgical ⁷	W	W	W	W	--	--
Special ⁸	--	--	W	W	--	--
Other miscellaneous uses	889	1,330	--	--	--	--
Unspecified: ⁹						
Reported	--	--	9,320	36,300	6,670	25,900
Estimated	--	--	116	457	1,500	5,700
Total	10,500	41,300	13,700	43,300	11,900	56,000

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, macadam, riprap and jetty stone, and other coarse aggregate.

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

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

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

⁶Includes agricultural limestone and other agricultural uses.

⁷Includes cement manufacture, flux stone, and lime manufacture.

⁸Includes other fillers or extenders.

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TABLE 5
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2005,
BY MAJOR USE CATEGORY¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	7,570	\$34,000	\$4.49
Plaster and gunite sands	32	358	11.14
Concrete products (blocks, bricks, pipe, decorative, etc.)	243	723	2.97
Asphaltic concrete aggregates and other bituminous mixtures	3,780	15,100	4.00
Road base and coverings	5,050	20,400	4.03
Road and other stabilization (cement and lime)	296	1,360	4.60
Fill	6,810	16,000	2.35
Snow and ice control	346	1,390	4.02
Filtration	36	294	8.21
Other miscellaneous uses ²	108	626	5.80
Unspecified: ³			
Reported	7,320	28,100	3.84
Estimated	33,200	124,000	3.75
Total or average	64,800	243,000	3.75

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

²Includes railroad ballast.

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

TABLE 6
MICHIGAN: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2005, 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	305	2,400	833	3,280	6,710	29,400
Asphaltic concrete aggregates and other bituminous mixtures	128	484	1,070	4,170	2,590	10,500
Road base and coverings ³	725	2,660	1,950	7,280	2,670	11,800
Fill	168	288	461	1,050	6,180	14,700
Snow and ice control	57	124	161	431	128	837
Other miscellaneous uses ⁴	17	85	15	122	111	714
Unspecified: ⁵						
Reported	28	103	118	560	7,170	27,500
Estimated	1,150	4,320	3,600	13,500	28,500	107,000
Total	2,580	10,500	8,200	30,400	54,000	202,000

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

²Includes plaster and gunite sands.

³Includes road and other stabilization (cement and lime).

⁴Includes filtration and railroad ballast.

⁵Reported and estimated production without a breakdown by end use.