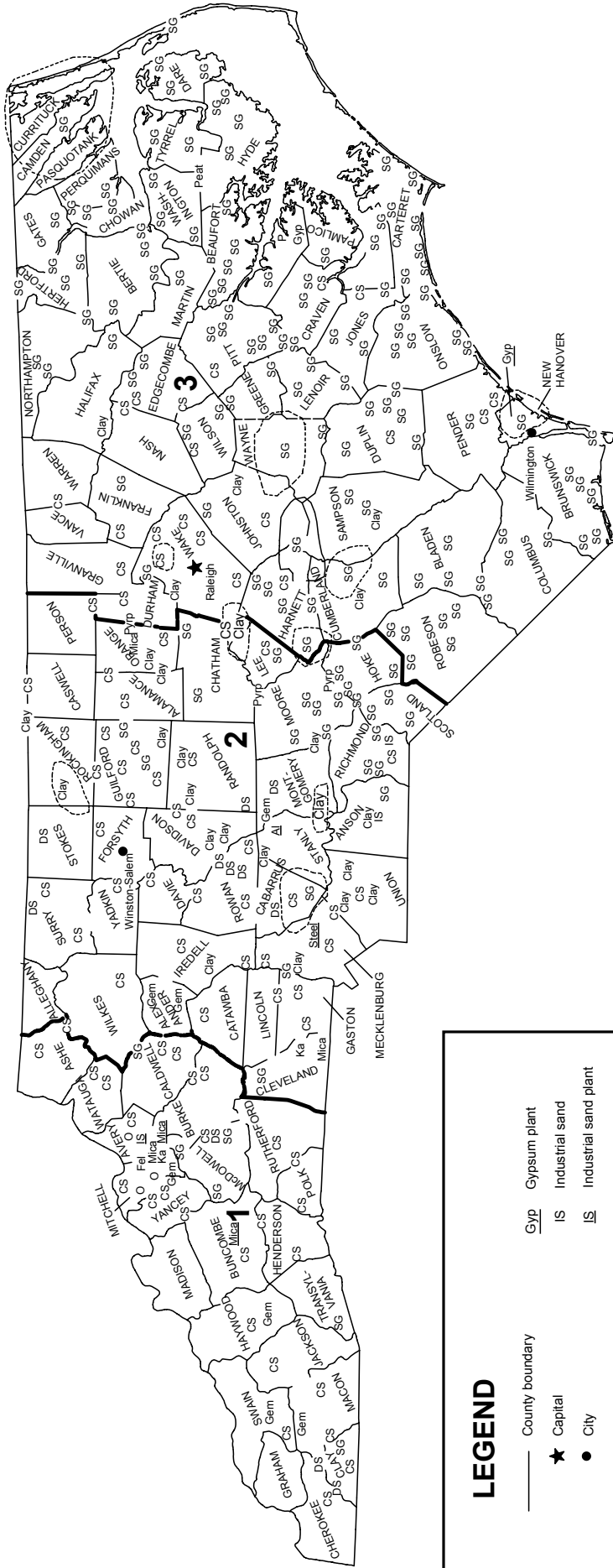


NORTH CAROLINA



LEGEND

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

MINERAL SYMBOLS (Major producing areas)

Al	Aluminum plant	Gyp	Gypsum plant
Clay	Common clay	IS	Industrial sand
CS	Crushed stone	IS	Industrial sand plant
DS	Dimension stone	Ka	Kaolin
Fel	Feldspar	Mica	Mica
Gem	Gemstones	Mica	Mica plant
Gyp	Gypsum	O	Olivine
		P	Phosphate rock
		Peat	Peat
		Pyrp	Pyrophyllite
		SG	Construction sand and gravel
		Steel	Steel plant
		(Dashed circle)	Concentration of mineral operations

THE MINERAL INDUSTRY OF NORTH CAROLINA

This chapter has been prepared under a Memorandum of Understanding between the U.S. Geological Survey and the North Carolina Geological Survey for collecting information on all nonfuel minerals.

In 2003, the estimated value¹ of nonfuel raw mineral production for North Carolina was \$676 million, based upon preliminary U.S. Geological Survey (USGS) data, about a 2% decrease from that of 2002² and followed a 6.8% decrease from 2001 to 2002. The State was 21st in rank (20th in 2002) among the 50 States in total nonfuel mineral production value, of which North Carolina accounted for about 2% of the U.S. total.

Crushed stone remained North Carolina's leading nonfuel raw mineral in 2003, accounting for about two-thirds of the State's total value of nonfuel raw mineral production. It was followed by phosphate rock, construction sand and gravel, industrial sand and gravel, feldspar, dimension stone, common clays, mica, and kaolin. The largest increases in value for the year were in crushed stone and mica, and the most significant drop in value was in phosphate rock. In 2002, except for relatively small increases in phosphate rock, common clays, and olivine, most of the State's nonfuel minerals showed decreases in production and value. The largest decreases were in the production and related values of crushed stone (down \$34 million) and construction sand and gravel (down nearly \$11 million) (table 1).

Based upon 2003 USGS estimates of the quantities of minerals produced in the 50 States, North Carolina continued to lead the Nation in feldspar, common clays, mica, olivine, and pyrophyllite, the latter two of which were produced in only two States. While North Carolina continued to be 3d in the production of phosphate rock and 10th in gemstones (based upon value), the State rose to 4th from 7th in industrial sand and gravel and to 8th from 9th in crushed stone. Additionally, significant quantities of dimension stone were produced in the State. Metal production in the State, especially that of primary aluminum and raw steel, resulted from the processing of recycled materials or raw materials received from other domestic and foreign sources.

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 2003 USGS mineral production data published in this chapter are preliminary estimates as of July 2004 and are expected to change. Construction sand and gravel and crushed stone estimates are updated periodically. To obtain the most current information, please contact the appropriate USGS mineral commodity specialist. Specialist contact information may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals/contacts/comdir.html>; alternatively, specialists' names and telephone numbers may be obtained by calling USGS information at (703) 648-4000 or by calling the USGS Earth Science Information Center at 1-888-ASK-USGS (275-8747). All USGS Mineral Industry Surveys and USGS Minerals Yearbook chapters—mineral commodity, State, and country—also may be retrieved over the Internet at URL <http://minerals.usgs.gov/minerals>.

²Values, percentage calculations, and rankings for 2002 may differ from the Minerals Yearbook, Area Reports: Domestic 2002, Volume II, owing to the revision of preliminary 2002 to final 2002 data. Data for 2003 are preliminary and are expected to change; related rankings also may change.

The following narrative information was provided by the North Carolina Geological Survey³ (NCGS).

Exploration and Development Activities

North American Emerald Mines, Inc. (NAEM) unearthed an emerald crystal weighing 1,861.9 carats at its mine in Hiddenite, NC. This crystal was thought to be the largest emerald found in North America (Mining Engineering, 2004). The previous record emerald, weighing 1,686 carats, was found on the same property in the 1980s before NAEM gained access to the property. Three matched pieces of a high-quality emerald with a combined estimated weight of 1,800 carats were found the same day as the record emerald.

NAEM first discovered high-quality emeralds on the property in 1998 and began small-scale operations in November 2003. The property produced 3,000 carats in 1999, including an 858-carat stone known as the Empress Caroline. Another 71-carat stone produced two finished pieces—the Carolina Prince, 7.85 carats that sold for \$500,000 and the Carolina Queen, 18.88 carats that is currently for sale for \$1 million (Mining Engineering, 2004).

Commodity Review

Industrial Minerals

Zemex Corp., a producer of feldspar, mica, and quartz, announced in March 2003 that it had entered into an agreement with Peru's Cementos Pacasmayo S.A.A. for a Pacasmayo subsidiary to acquire all of the outstanding shares of Zemex for a cash price of \$8.80 a share. The value of the transaction, including Zemex's debt, was about \$100 million. The transaction became effective at the end of May 2003.

Clays.—Robots have become important elements in the trend toward modernization of brickmaking and the construction of new brick manufacturing plants in North Carolina. Industrial minerals companies continued to be restructured and change ownership.

In 2003, the North Carolina brick industry shipped about 1 billion standard brick units and continued as a leading State in brick production. Nationally, about 8 billion standard brick units were produced (Pete Cieslak, Executive Director of The Brick Association of the Carolinas, oral commun., October 2004). Small- to medium-sized brick companies in North Carolina continue to thrive along with larger brick companies.

In 2003, Hanson Brick & Tile (a subsidiary of Hanson Brick North America), headquartered in Charlotte, NC, embarked

³Jeffrey C. Reid, Senior Geologist for Minerals and Geographic Information Systems, authored the text of the State mineral industry information provided by the North Carolina Geological Survey.

on a project to integrate and rebrand its seven brick businesses into one unified company—Hanson Brick. Nationally, Hanson sells more than 1.6 billion bricks per year and has 22 plants in Canada, Kentucky, Michigan, North Carolina, South Carolina, and Texas, excluding the Athens Brick Co., Inc. that it acquired in May 2004. Boren Brick, a North Carolina unit, is part of Hanson Brick. Hanson Brick North America (owned by Hanson PLC) claimed that it is the largest brick manufacturer in North America (Hanson Brick North America, 2004§⁴).

On January 28, 2004, Triangle Brick Co., which is based in Durham, NC, announced the selection of a new brick-manufacturing site in Wadesboro, NC. According to its president and chief executive officer, with its \$35 million investment, Triangle Brick Co. continued to react to the increasing popularity of brick in the United States; to the anticipated continuation of the building boom, especially in North Carolina; and to the growing demand resulting from the company's marketing efforts (Triangle Brick Co., 2004§). It will build a new manufacturing plant that will increase its annual production capacity to 500 million standard brick units.

Construction of the new 28,000-square-meter plant has begun and was scheduled for completion in late 2004. It will be located off U.S. Highway 52 in Anson County. The new plant will be adjacent to the existing plant, which opened in 2001. When completed, the new plant will have a production capacity of 110 million bricks per year (Triangle Brick Co., 2004§). The new plant will employ about 50 people, and it will have the most technologically advanced production and packaging equipment, including industrial robots. The computer-controlled kiln will be one of the largest in the United States. It will produce brick in a variety of colors, textures, and sizes. The company's products are sold through distributors and directly to builders throughout the United States. About one-half of the products made by Triangle Brick Co. were sold and used in North Carolina (News and Observer, 2003).

Gypsum and Sulfur.—The Clean Air Act of 2002 required utility companies burning high-sulfur coal and releasing sulfur dioxide into the atmosphere to reduce their sulfur dioxide emissions. As a result, utility companies have formed partnerships with wallboard companies to convert the byproduct sulfur into synthetic gypsum, which can be used in the manufacture of wallboard. In the past, synthetic gypsum would have been sent to landfills as a combustion byproduct from the burning of coal. North Carolina's two major electric utilities, Progress Energy, Inc. and Duke Energy Corp., have announced plans to sell byproduct gypsum rather than sending it to a landfill.

BPB plc, a manufacturer and marketer of wall and ceiling products throughout North America, announced on February 13, 2004, that it had completed a long-term agreement with Progress Energy to supply synthetic gypsum to a new gypsum wallboard plant in Roxboro, NC. The plant will generate more than 200 new jobs in the Roxboro area. Under the agreement, BPB will commission in 2007 a \$100 million gypsum wallboard

plant to be located in Person County, NC, adjacent to Progress Energy's coal-fired power generator. The new facility will operate at world-class manufacturing standards and will produce 65 million square meters per year of gypsum wallboard to meet expected sales volume growth. The agreement will provide BPB's new facility with a secure source of high-quality synthetic gypsum.

National Gypsum Co. also planned to build a high-speed wallboard plant in the Charlotte area that will use byproduct gypsum generated at Duke Energy Corp.'s coal-fired plants in the region. The Charlotte-based company, a leading supplier of wallboard to the construction industry, has not selected a site. The \$100 million facility will employ 200 workers. The proposed plant will recycle rather than landfill byproduct gypsum generated from sulfur dioxide scrubber projects at Duke Energy Corp.'s plants. The company has signed an agreement with Duke Energy Corp. to develop the project, with sites under consideration in North Carolina and South Carolina. The plant is expected to begin production in 2007.

Duke Power expects to begin operating its first sulfur dioxide scrubber at the company's Marshall Steam Station in Catawba County by 2007. Duke's \$1.5 billion investment in sulfur dioxide scrubber projects at four of its largest coal-fired plants will significantly reduce emissions in compliance with North Carolina's clean air legislation (Duke Power, 2004§).

Lime and Mica.—On September 22, 2003, Oglebay Norton Co. announced its intention to sell the company's lime and mica operations as part of its ongoing business restructuring to reduce long-term debt (Oglebay Norton Co., 2003§).

Oglebay Norton's mica operations have contributed approximately \$15 million in sales and \$2.3 million in earnings before interest, taxes, depreciation, and amortization annually during the past several years. Mica is used as filler in joint compound and other building materials, coatings and paint, automotive sound-deadening materials, plastics, and cosmetics. Oglebay Norton is currently the Nation's largest producer of muscovite mica. The company's mica facilities are located in Kings Mountain, NC, and Velarde, NM.

On February 25, 2004, Oglebay Norton announced that its common stock was to be delisted from the NASDAQ Stock Exchange at the opening of its business on March 3, 2004, subject to the company's right to appeal (Oglebay Norton Co., 2003§). The company did not intend to appeal the decision and anticipated that its common stock would be delisted.

Stone, Crushed and Dimension.—In 2003, production of 97,500 metric tons of crushed rock and dimension stone valued at \$23,451 was reported from two permits in Macon and Graham Counties, NC, by the U.S. Forest Service (Lynn Hicks, Staff Officer, National Forests in North Carolina, written commun., April 2004).

Environmental Issues, Reclamation, and Technological Achievements

A total of 929 mines were on inventory as of December 31, 2003, including 739 active mines and 190 inactive mines. A listing of permitted active and inactive mines in North Carolina as of April 30, 2004, is available on the Internet at URL <http://>

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

www.geology.enr.state.nc.us/Permitted_mines_20040430/Permitted_mines_North_Carolina_Geological_Survey.htm.

Vulcan Materials Co.'s Cabarrus Quarry was a winner of the National Association of State Land Reclamationists' (NASLR) 2003 Outreach Award. The Award was announced at NASLR's 31st annual conference in Charleston, WV, on September 30, 2003, and was presented to Vulcan at the North Carolina Mining Commission meeting on October 29, 2003, in Spruce Pine, NC. Earlier in 2003, the same quarry was the winner of the environmental enhancement and public outreach/education category of North Carolina's Mining Stewardship Awards Program; the Award was presented by the North Carolina Department of Environment and Natural Resources and the North Carolina Mining Commission.

Government Programs

The renovation and expansion of the Museum of North Carolina Minerals was completed, and the building was dedicated on October 29, 2003. The \$900,000 project included a 93-square-meter exhibit gallery addition and the installation of new interpretive displays. Funding was provided through partnerships with the Blue Ridge Parkway Foundation, Mitchell County, and North Carolina Department of Transportation. The new museum described the rich geologic history and mineral resources of the Spruce Pine District, NC (Mitchell County Chamber of Commerce, 2004§). It was expected to be a popular destination for school groups as well as Blue Ridge Parkway visitors. The exhibits described the importance of mining in the region and its geology. Representatives from the mining industry, universities, the NCGS, and individuals provided expertise and objects on display. The Mitchell County Chamber of Commerce maintained an information desk and helped staff the museum, which operated year round.

The NCGS, in collaboration with industry and other groups, was selected to host the Forty-Second Forum on the Geology of Industrial Minerals, which will be held in Asheville, NC, on May 7-13, 2006. A series of field trips were planned in conjunction with the formal sessions to highlight the industrial minerals and their diversity in North Carolina. A Web site was being prepared to assist attendees with travel and presentations.

Geologic mapping under STATEMAP, a component of the USGS National Cooperative Geologic Mapping Program, continued in the Raleigh, Henderson, Chapel Hill, and Asheville 1:100,000-scale quadrangles. A current project map is available online under the National Geologic Mapping Act link at URL <http://www.geology.enr.state.nc.us/mission.html>.

The NCGS is now making geologic maps at various scales available online at URL <http://www.geology.enr.state.nc.us/news.htm>. The individual geologic maps are included with world files and can be downloaded individually or as a set.

The Mecklenburg Partnership project (<http://nationalmap.usgs.gov/partners/nc.html>) is a collaborative effort to produce

seamless digital topographic maps for the Nation. This prototype project involved Mecklenburg County, NC, and the North Carolina Center for Geographic Information and Analysis. The USGS formed an innovative partnership with Mecklenburg County for the production of orthorectified imagery and lidar-derived elevation products over the Mecklenburg County area. The Mecklenburg Partnership also planned to help implement The National Map for Mecklenburg County by preparing some of the data layers of it for the State of North Carolina. Main partners include Mecklenburg County, NC, the North Carolina Center for Geographic Information and Analysis, and the NCGS.

The North Carolina State University Minerals Research Laboratory (MRL) in Asheville, NC, at URL <http://www.enr.ncsu.edu/mrl>, took the lead in establishing the Industries of the Future (IOF) program for North Carolina. The IOF program is sponsored at the Federal level by the U.S. Department of Energy (DOE); its purpose is to assist industry in reducing energy consumption and increasing productivity, thus aiding competitiveness in the global marketplace.

The North Carolina IOF program will focus on the agriculture, chemical, forestry, and mining industries, with initial funding supplied by the DOE and NC State Energy Office. This funding will be used to target organizational efforts, prepare indepth profiles of the various industry segments, define the present state of each segment, and determine areas of common concern for research efforts. The Industries of the Future Program for North Carolina Mining, with the Minerals Research Laboratory as the lead organization, was divided into three groups: aggregate, sand, and stone; clay and brick; and industrial minerals.

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

(Thousand metric tons and thousand dollars unless otherwise specified)

Mineral	2001		2002		2003 ^p	
	Quantity	Value	Quantity	Value	Quantity	Value
Clays:						
Common	2,340	11,100	2,420	11,900	2,420	11,900
Kaolin	47	6,190 ^r	W	W	W	W
Feldspar metric tons	344,000	19,400	330,000	17,100	350,000	18,700
Gemstones	NA	284	NA	280	NA	294
Gypsum, crude	71	788	--	--	--	--
Mica, crude metric tons	51,000	3,890	40,400	3,100	39,300	10,100
Sand and gravel:						
Construction	12,400	61,500	10,000	50,700	9,100	46,000
Industrial	1,300	26,000	1,320	25,600	1,760	29,300
Stone:						
Crushed	69,300	485,000	62,900	451,000	63,500	460,000
Dimension	42	18,200	41	17,900	39	14,800
Combined values of olivine, peat (2001), phosphate rock, pyrophyllite (crude), and values indicated by symbol W						
	XX	106,000	XX	111,000	XX	85,100
Total	XX	739,000 ^r	XX	689,000	XX	676,000

^pPreliminary. ^rRevised. NA Not available. W Withheld to avoid disclosing company proprietary data; value included with "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
NORTH CAROLINA: CRUSHED STONE SOLD OR USED, BY KIND¹

Kind	2001				2002			
	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value	Number of quarries	Quantity (thousand metric tons)	Value (thousands)	Unit value
Limestone	11	5,930	\$40,600	\$6.84	12	5,540	\$38,000	\$6.85
Dolomite	1	W	W	6.73	1	W	W	6.73
Granite	75 ^r	53,500 ^r	374,000 ^r	6.99 ^r	76	48,400	349,000	7.20
Traprock	7 ^r	5,640 ^r	40,300 ^r	7.15 ^r	7	4,930	36,200	7.34
Quartzite	2 ^r	W	W	7.84 ^r	2	W	W	8.64
Slate	2	W	W	6.72	2	W	W	6.72
Volcanic cinder and scoria	1	W	W	6.72	1	W	W	6.72
Miscellaneous stone	3 ^r	1,100 ^r	8,030 ^r	7.31 ^r	2	872	6,200	7.11
Total or average	XX	69,300	485,000	7.00	XX	62,900	451,000	7.18

^rRevised. W Withheld to avoid disclosing company proprietary data; included in "Total." XX Not applicable.

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

TABLE 3
NORTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, BY USE¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Construction:			
Coarse aggregate (+1 1/2 inch):			
Macadam	W	W	\$4.27
Riprap and jetty stone	477	\$5,110	10.73
Filter stone	W	W	7.62
Other coarse aggregates	71	436	6.18
Total or average	854	7,440	8.72
Coarse aggregate, graded:			
Concrete aggregate, coarse	2,990	26,600	8.88
Bituminous aggregate, coarse	2,090	19,600	9.37
Bituminous surface-treatment aggregate	(2)	(2)	9.46
Railroad ballast	1,190	6,850	5.77
Other coarse aggregates, graded	4,560	41,600	9.13
Total or average	10,800	94,700	8.74
Fine aggregate (-3/8 inch):			
Stone sand, concrete	478	4,610	9.64
Stone sand, bituminous mix or seal	(2)	(2)	8.69
Screening, undesignated	1,740	11,600	6.64
Other fine aggregates	1,090	8,320	7.63
Total or average	3,310	24,500	7.40
Coarse and fine aggregates:			
Graded road base or subbase	5,470	37,300	6.81
Unpaved road surfacing	156	1,340	8.62
Terrazzo and exposed aggregate	(2)	(2)	22.05
Crusher run or fill or waste	1,170	9,460	8.09
Other coarse and fine aggregate	2,370	15,300	6.47
Total or average	9,170	63,400	6.92
Other construction materials	63	519	8.29
Other miscellaneous uses and specified uses not listed	91	702	7.71
Unspecified: ³			
Reported	35,800	243,000	6.78
Estimated	2,750	17,700	6.42
Total or average	38,500	260,000	6.75
Grand total or average	62,900	451,000	7.18

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

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

²Withheld to avoid disclosing company proprietary data; included with "Other."

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

TABLE 4
NORTH CAROLINA: CRUSHED STONE SOLD OR USED BY PRODUCERS IN 2002, 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 (+1 1/2 inch) ²	141	1,550	W	W	W	W
Coarse aggregate, graded ³	W	W	W	W	2,310	15,200
Fine aggregate (-3/8 inch) ⁴	874	8,180	W	W	W	W
Coarse and fine aggregate ⁵	2,190	17,200	W	W	W	W
Other construction materials	36	400	--	--	26	119
Other miscellaneous uses	--	--	91	702	--	--
Unspecified: ⁶						
Reported	3,640	25,900	18,500	124,000	13,700	92,800
Estimated	1,700	10,300	49	480	1,000	6,900
Total	11,100	86,800	31,900	234,000	19,900	131,000

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 aggregates.

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

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

⁵Includes crusher run (select material or fill), graded road base or subbase, terrazzo and exposed aggregate, unpaved road surfacing, and other coarse and fine aggregates.

⁶Reported and estimated production without a breakdown by end use.

TABLE 5
NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002,
BY MAJOR USE CATEGORY¹

Use	Quantity (thousand metric tons)	Value (thousands)	Unit value
Concrete aggregate (including concrete sand)	3,890	\$17,000	\$4.37
Concrete products (blocks, bricks, pipe, decorative, etc.) ²	598	2,700	4.51
Asphaltic concrete aggregates and other bituminous mixtures	632	2,330	3.68
Road base and coverings ³	394	1,050	2.67
Fill	695	1,980	2.85
Snow and ice control	19	89	4.68
Other miscellaneous uses	36	288	8.00
Unspecified: ⁴			
Reported	1,750	13,200	7.53
Estimated	2,000	12,000	5.91
Total or average	10,000	50,700	5.04

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 (lime).

⁴Reported and estimated production without a breakdown by end use.

TABLE 6
 NORTH CAROLINA: CONSTRUCTION SAND AND GRAVEL SOLD OR USED IN 2002,
 BY USE AND DISTRICT^{1,2}

(Thousand metric tons and thousand dollars)

Use	District 1 and 2		District 3	
	Quantity	Value	Quantity	Value
Concrete aggregate and concrete products ³	870	3,710	3,620	16,000
Asphaltic concrete aggregates and road base materials ⁴	199	994	826	2,380
Other miscellaneous uses ⁵	28	211	722	2,150
Unspecified: ⁶				
Reported	1,390	11,900	365	1,300
Estimated	1,000	7,100	1,000	4,900
Total	3,490	23,900	6,560	26,700

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

²Districts 1 and 2 are combined to avoid disclosing company proprietary data.

³Includes plaster and gunite sands.

⁴Includes road and other stabilization (lime).

⁵Includes fill and snow and ice control.

⁶Reported and estimated production without a breakdown by end use.