## Sand and Gravel Supply Chain

The NAICS code for construction sand and gravel is [212321](http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=212321&search=2002%20NAICS%20Search). Truck carriers will be classified as 484XXX.    Below are definitions of aggregate types that are broadly discussed in this paper.

o *Natural aggregates* can be defined as materials that are composed of rock fragments and are used in their natural condition except for such operations as crushing, sizing and washing.

o *Rocks* are solid, consolidated materials derived from the earth and usually have relatively small size.

o *Gravel* is a granular material mostly retained on the No. 4 (4.75 mm) sieve that is received from natural disintegration and abrasion of rock or processing of weakly bound conglomerates.

o *Crushed gravel* results from the artificial crushing of gravel or small cobblestones with substantially all fragments having at least one face resulting from fracture.

o *Crushed stone* results from the artificial crushing of rock, boulders, or large cobblestones, (all faces result from crushing operation).

o *Coarse aggregate* is composed of mainly gravel-size particles and predominantly retained on the No. 4 (4.75 mm) sieve.

o *Fine aggregate* mainly composed of sand-size particles (passing the 3/8 inch (9.5 mm) and No. 4 (4.75 mm) sieves).

o *Sand* is a granular material passing the 3/8 inch (9.5 mm) sieve, almost entirely passing the No. 4 (4.75 mm) sieve, and mainly retained on the No. 200 (75 μm) sieve that is received from natural disintegration and abrasion of rock or processing of completely friable sandstone.

o *Sand and gravel aggregate* is a mixture (or aggregation) of sand and gravel where gravel is accounted for 25% or more of the mixture (McLaughlin, et al. 1960).

### Description of Supply Chain

The aggregates industry is a major provider of sand, gravel, and crushed stone. These products are primarily required by the construction industry. One of the biggest consumers is the transportation industry. High quality aggregates are used for maintenance and repair of highways to increase durability, as well as for the development of new roads. Today, one mile of interstate highway construction consumes about 20,000 tons of aggregate per lane (Zettler, Rick)1. With the growing traffic volume on highways and increasing durability standards, the demand for construction aggregate continues to grow. Despite the low unit value of its basic products, the construction sand and gravel industry is a major contributor to and an indicator of the economic well-being of the Nation.

The two main sources of natural aggregates, construction sand and gravel and crushed stone, are the most extractable and most demanded natural resources (Wallace P. Bolen, USGS Construction Sand and Gravel Statistics and Information,2004).

Residential and commercial construction industries are other consumers of the aggregates, given that 80% of concrete is construction aggregate. As an example, the average home construction requires about 400 tons of construction aggregates (National Stone, Sand and Gravel Association). Recently, the average level of annual aggregate consumption in the US reached 10 tons per person, which is 80 times of the volume consumed in early 1900s. Concurrently, increasing demand for extraction of aggregates results in growing pressures from environmental agencies and local communities (Zettler, Rick). The Aggregates Industry in Washington study conducted by Pacific Lutheran University in 2000 found about 52% of aggregates and ready mix was used by the transportation industry. Projects were classified as road maintenance, street & runway construction and bridges. About twenty two percent was attributed to residential, 18.5% to commercial and offices, and 7.5% to public sectors’ uses (B. Finnie, J. Peet 2003).

### Modes and Nodes – including stick diagram. Maps as sidebars, where available.

Sand and gravel produced from mines is delivered directly from the mine to the consumer (typically a construction site). Rock or stone can either be delivered directly to the consumer, or can be delivered to a third party that may additionally process the material or sell as-is. A recent survey in Washington State found 65% of shipments for all products to construction or road sites, 15% to the consumer’s location, 8% to farms, and 5% to factories (SFTA 2005 Transportation of Mining/Mineral Survey Summary Report).

The aggregates industry is highly affected by transportation in terms of high cost of movement. More than 90% of transported mined commodities were hauled using trucks as a mode of transportation from mine pit to points of sale or processing plant, 3% used waterway and 1% used rail (USGS Construction Sand and Gravel Statistics and Information, 2004, Table 1, Appendix A).

Mines for aggregates, sand, gravel, and crushed stone are common due to the high cost of transporting material and the availability of the product. For example, there are 2,807 surface mines in the state of Washington (Figure 2).

In the same survey in Washington State, 56% of aggregates were shipped within 10 miles, with almost no shipments travelling more than 100 miles. Almost all shipments move by truck (97%) with straight trucks and trailers. The majority of the shipments are made by the mines own trucks (65% from the Washington Survey), with another 15% performed by private higher carriers for the mine.

### Key Players

Mines are owned by states, local governments, and are privately held. Transportation is provided by the mine operator, or a private carrier.

### Trends and Other Issues

Most mines operate under normal business hours. The industry is quite sensitive to economic conditions and seasonalities, with most construction projects taking place during the summer, yet the strength of the seasonal variation and the construction period are dependent on local conditions.

### Components of Supply Chain Covered in National Databases

* Data on the construction materials industry can be obtained from the US Geological Survey. They regularly produce minerals information, “statistics and information on the worldwide supply of, demand for, and flow of minerals and materials essential to the U.S. economy, the national security, and protection of the environment.” This information contains volumes produced at mines in the United States and is believed to be accurate. This can provide location and volume information for the source of these materials. However, the USGS does not provide information on the destinations of these flows.
* The Freight Analysis Framework (FAF2) is an origin-destination database published by the Federal Highway Administration (FHWA) based on the Commodity Flow Survey data. FAF2 breaks the United States into 131 regions, typically 2 or 3 per state. The database estimates flow between these regions for the 43 unique SCTG codes, and is based on the Commodity Flow Survey (CFS). The CFS is a shipper survey (100,000 surveys distributed) of select industries.
* Global Insight provides a methodology for disaggregating this data based on a proprietary model of economic activity in the United States. This model includes economic forecasts at a county level for 6-digit NAICS codes.
* Flows can be difficult to estimate given the temporary nature of construction projects.

### Supplemental Data to Fill in the Holes

* State Departments of Natural Resources (DNR) which provides permits for and monitor mine activity, can be sources of information regarding mine location and production volume.
* The National Stone, Sand, and Gravel Association may be a source of qualitative information on the industry in a region.