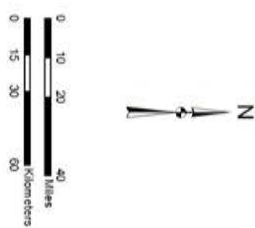
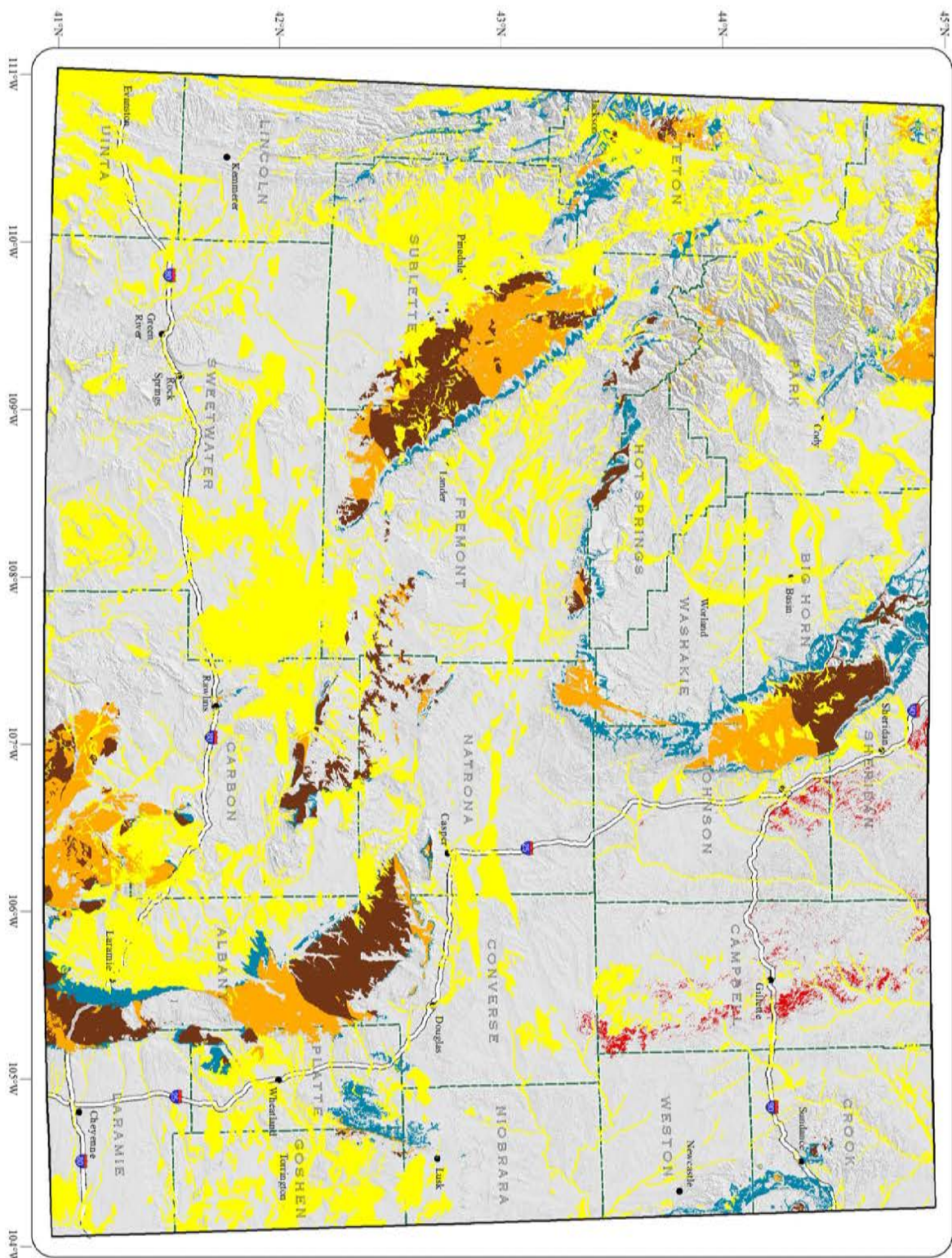


Wyoming Construction Aggregates



- EXPLANATION**
- SAND AND GRAVEL
 - LIMESTONE-BEARING STRATA (CRUSHED STONE)
 - DIMENSION STONE POTENTIAL
 - GRANITE OUTCROP (CONSTRUCTION AGGREGATE)
 - CLINKER
 - CITY OR TOWN
 - INTERSTATE HIGHWAY
 - COUNTY BOUNDARY



Wyoming's Construction Aggregates

Summary Report 2014

By Suzanne Luhr

Wyoming State Geological Survey

Thomas A. Drea, Director and State Geologist



www.wsgs.uwyo.edu

Editing and layout by Chamois Andersen



Overview

Construction aggregate is crushed stone from hard rock deposits. Crushed stone and sand and gravel are the three kinds of rock fragments that are called aggregates. They represent the most mined and widely used of natural resources in the world.

Construction aggregates are highly valued for their heavy weight, and represent the foundation of the transportation and building construction infrastructure in the United States. Without aggregate there would be no roads, streets, bridges, sidewalks, bricks, concrete for building, or ballast for railroad construction. Wyoming aggregate mining operations include granite, limestone, sand and gravel and scoria.

According to the Wyoming State Inspector of Mines, in 2013 the state produced nearly 21 million metric tons of construction aggregate at a value of approximately \$143 million (U.S. Geological Survey, 2013). Of that total, nearly 9.4 million metric tons of crushed stone valued at approximately \$39 million was produced in 2013, down from 11.4 million metric tons (valued at more than \$50 million) produced in 2012. Also in 2013, sand and gravel mining operations in Wyoming resulted in 11.5 million metric tons with an approximate value of \$104 million, according to the U.S Geological Survey's preliminary numbers. Sand and gravel produced in 2013 was down slightly from 2012, which amounted to 11.8 million metric tons, valued at more than \$100 million.

In 2013, there were 65 mining operations in 21 of Wyoming's 23 counties. That same year the industry employed more than 1,000 people in construction aggregate related jobs.

Aggregate mining in Wyoming is conducted by a few large companies and numerous smaller operations. The challenge for companies is how to extract, move and process the material as efficiently and cost effectively as possible. Aggregate is often purchased and mined in close proximity of the actual construction project. Transporting aggregate even a short distance can make the cost of moving the material higher than the cost of the product. Another issue is citizens often oppose construction aggregate operations so close to their community. Balancing the benefits of extracting this commodity at a low cost and near a project site with impacts to nearby communities is an issue companies will continue to face. Nonetheless, aggregates remain an important resource because of their daily and wide use by Americans.

Aggregate is mined in every state in the United States, with consumers as the beneficiaries. Every American uses about 10 tons of aggregates every year. Crushed stone, sand and gravel provide roadways and bridges for Americans to travel to work and school. Aggregates can be used in their natural forms as well such as dimension stone blocks for foundations or buildings, gravel for railroad ballast, or in a powdered form added to composite construction materials such as concrete and asphalt. There is also a large market for the use of aggregates for residential and

commercial construction, bridges and highways, and for maintenance of more than 48,000 miles of existing roads and highways in Wyoming alone. Other uses include water and wastewater treatment facilities, and other infrastructure projects. Stone, sand and gravel also go into the production of household products such as cleansers, cosmetics and toothpaste. There are also many environmental uses for rocks and stones; erosion control and slope protection, dams and protecting shorelines and navigation channels.

Aggregates comprise 80 percent by weight of concrete and about 95 percent of asphalt. One mile of two-lane asphalt pavement 24 ft wide, 14 inches thick requires 10,300 tons of aggregate. Wyoming's energy industry also requires large amounts of aggregate for the construction of well pads, wind generator bases, drilling materials, and access roads to industrial sites.

Despite this abundant resource, economics plays a major role in the production of aggregates. The nation's economy can have a significant impact on the cost and amount of aggregate produced. For an example, an economic downturn can result in a decrease in federal funds for road building, which has an impact on aggregate mining and production since so much of the resources is used for road building.

Production

For 2013, the USGS Mineral Industry Surveys reported a total of 21 million metric tons of "aggregates sold or used by producers" in Wyoming; a value of \$143 million. Also according to the USGS, preliminary numbers for 2014 indicate the state will have come close to 2013 production numbers with 21.2 million metric tons of aggregate produced in 2014, at a value of \$142 million.

The values of the diverse types of aggregate produced in Wyoming vary widely with material type and quality, as well as haulage distances. For example, one ton or cubic yard of one type of material is not equivalent to another in value.

Historically, production of major industrial minerals in Wyoming has ebbed and flowed through much of the 20th century, and in the mid-1990s aggregate production began a steady increase to nearly 23.4 million tons in 2007.

In 2008, the worldwide economic downturn dealt a blow to Wyoming's aggregate production followed by a rebound to a high in 2009 of more than 34 million metric tons, valued at \$170 million. This increase has been attributed in part to federal government stimulus funding and possibly stockpiling, which may have involved mining large amounts of material with heavy equipment in anticipation of a growing market, and stockpiling on site or at another site for future processing. Later processing, using smaller and less expensive equipment and labor could then fulfill demands, with little penalty for the earlier overproduction.

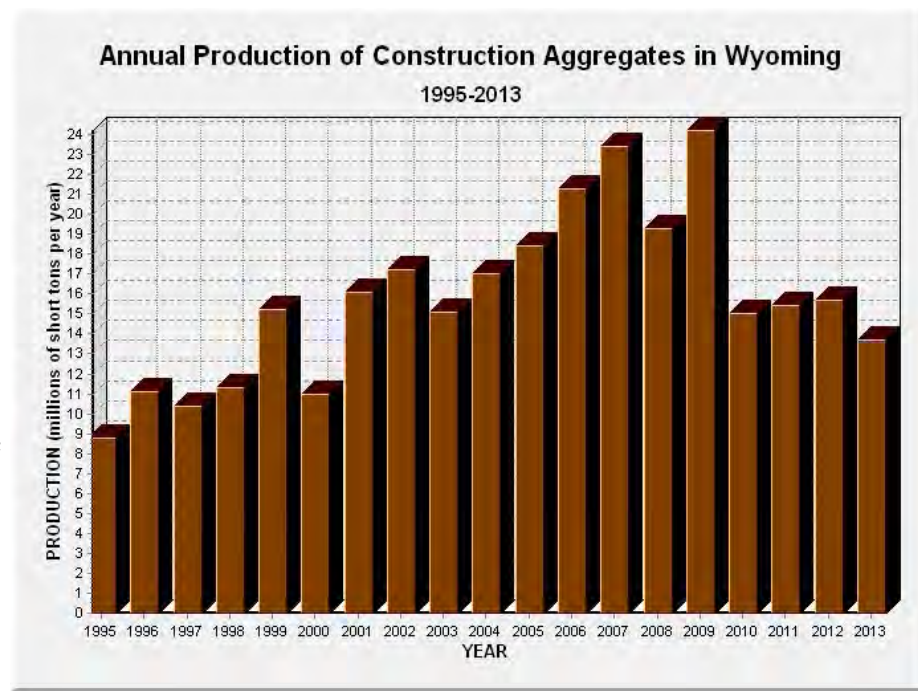


Figure 1. Production of construction aggregate in Wyoming, 1995-2013. Data from The nation's economy can have a significant impact State Inspector of Mines of Wyoming.

In 2010, another steep drop followed (24 million metric tons produced), and since then Wyoming's aggregate production has remained at or near this level (fig. 1).

Geology

The geology of Wyoming is reflected in the location and quality of its aggregate resources. Because Wyoming is so geologically rich the state provides for a plentiful aggregate resource. Gravel is found in terraces along mountain fronts, sand in alluvial floodplains along stream and river valleys as well as in extensive dune sands, and limestone crops along the flanks of the mountain ranges. While limestone is a significant crushed stone source in Wyoming, the largest aggregate quarry in the state produces crushed stone from granite, such as Granite Canyon in Laramie County. Northeast Wyoming is bereft of construction aggregate, short of scoria or clinker. Clinker, created from the burning, baking and melting of strata overlying burning coal beds, is used extensively in the Powder River Basin for road and well-pad construction. Despite clinker being abundant in the Powder River basin, it is not as durable and breaks down more easily than sand and gravel.

History

In 1867, the building of the Transcontinental Railroad utilized Wyoming's construction aggregate, and nearly every town had a brick factory, and most towns had a stone quarry nearby.

Since 1900, the industry in Wyoming has grown steadily with small aggregate mining operations opening wherever there was a need. With the onset of World War II, large-scale industrial mineral production emerged nationwide, and after the war

economic development continued unabated in Wyoming.

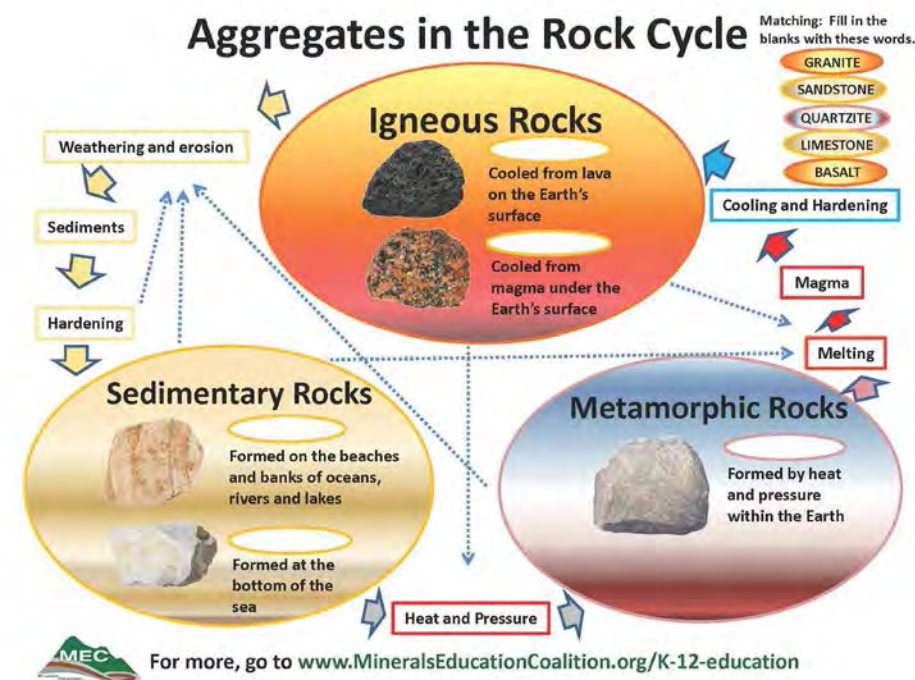
In the 1960s and 1970s the construction of the Dwight D. Eisenhower National System of Interstate and Defense Highways brought 914 miles of interstate highways through Wyoming. Every mile contained nearly 38,000 tons of aggregate, according to the National Stone Sand and Gravel Association.

Recycling and Renewal

The practice of recycling aggregate, primarily re-crushing concrete and asphalt, can be economically viable in many situations. Recycling represents one way to convert a waste product into a resource. The Wyoming Department of Transportation recycles and turns into new pavement nearly all the asphalt and concrete pavement removed from Wyoming's roadways. As reported in the U.S. Department of Transportation's Mineral Commodity Summaries, recycled asphalt and portland cement concretes nationwide are increasingly being substituted for virgin aggregate, although the percentage of total aggregate supplied by recycled materials was very small for the year 2010. There are also various processes for creating synthetic aggregates from waste products such as fly ash and bottom ash from coal fired power plants, and other recycled products to help offset the demand for natural aggregate. "Renewable minerals" have been classified as those created by wind abrasion, replenished by erosion, flood or storm events, and sand replacement following river dredging. All of these innovative sources help relieve aggregate shortages and reduce landfill waste.

Future of Aggregates

Wyoming's core infrastructure (e.g., buildings, roads and power supplies) was developed early in the 20th century and has



It takes 400 tons of aggregates to construct the average modern home.

required extensive repair or replacement. The state is in a good position well into the future with an adequate supply of known resources of construction raw material for new infrastructure needs; however, aggregate resources do not always mean they are recoverable. Aggregates that exist in the natural environment may not always be unattainable. Such is the case for Wilderness Areas, for example. Aggregates are often too deep to be mined economically, and sometimes development has already encroached on and eliminated desirable aggregate sources. However, it can be expected that additional sources of construction aggregate will be required to keep up with the ever-changing and increasing demands of Wyoming's energy and land development.

Mining Regulations

Commercial mining operations in Wyoming must be permitted under the Land Quality Division of the Wyoming Department of Environmental Quality. The Bureau of Land Management (BLM) issues sales contracts, as well as free-use permits to government agencies and non-profit organizations for the mining of mineral materials on BLM-administered lands. For small operations, the state can issue a Limited Mining Operation permit that requires that all activity and lands disturbed or used in a mining operation (excluding access roads) not exceed 15 acres. This permit will also exempt a producer from the application

costs but not from reclamation and bonding requirements. On federal land, no specific application is required to request the removal of mineral materials from public lands; however, interested parties should contact the BLM. Reclamation is required after any surface disturbance.

Summary

Construction aggregate production in Wyoming contributes significantly to the state's economy. Aggregate occurs in large amounts in many western states, but Wyoming's rich geologic setting has provided for an ample supply of aggregate resources in the future. The low population density of Wyoming lessens the likelihood that aggregate resources will be diminished by large-scale construction or the urban infringement that has occurred in more populous states.