

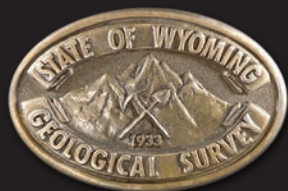
Wyoming's Construction Aggregate Resource

Summary Report
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Overview

Construction aggregate – sand, gravel and crushed stone – is the most valuable non-energy mineral commodity in the United States. It is also the most mined and widely used of natural resources in the world.

Mined and processed, construction aggregate represents the foundation of the transportation and building industry in the United States. Without it there would be no modern 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; all combined are classified by the U.S. Geological Survey (USGS) as “construction aggregate.”

According to the USGS, preliminary numbers indicate Wyoming produced more than 21 million metric tons of construction aggregate in 2014, with a value of approximately \$142 million. Tax revenues from aggregate operators amounted to more than \$3.3 million to the state's coffers in 2013, according to the Wyoming Department of Revenue. That year there were 65 mining operations in 21 of the state's 23 counties, according to the Wyoming State Inspector of Mines. Also beneficial for Wyoming's workforce, the industry employed more than 1,000 construction workers in aggregate-related jobs in 2013 (Wyoming State Inspector of Mines).

Aggregate mining in Wyoming is conducted by a few large operations and numerous smaller operations. The challenge for companies is just how to extract, move and process the material as efficiently and cost effectively as possible.

For the cost savings, aggregate is often purchased and mined in close proximity to the actual construction project. Because of its heavy weight, transporting aggregate even a short distance can cost more than the actual product. However, citizens often oppose aggregate mining operations close to their communities. Balancing the benefits of extracting this commodity, at a low cost and near a project site, with the impacts to nearby communities is an issue companies will continue to face. Nonetheless, aggregate remains an important resource because of its daily and widespread use by Americans.

Aggregate is mined in every state in the United States, with consumers as the beneficiaries. More than 6.5 tons of aggregate was produced for every U.S. citizen in 2013. USGS reported more than 90 percent of asphalt pavements and 80 percent of concrete consist of construction aggregate.

Despite the abundance of this resource, the nation's economy can have a significant impact on the cost and amount of aggregate produced. Because so much aggregate is used for road construction, an economic downturn can result in a decrease in federal funds for road building, which ultimately has an impact on aggregate mining and production.

Other Uses

Aggregates can be used in their natural form or as dimension stone blocks for foundations and 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 the 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. Paint, paper, plastics, and glass also require finely ground aggregate as a constituent.

There are also many environmental uses for aggregate such as erosion control, slope protection, and for the building of dams. Aggregates are highly valued for building and infrastructure because they comprise such a large percentage of concrete and asphalt.

Wyoming's energy industry requires large amounts of aggregate such as for the construction of well pads for oil and gas development, wind generator bases, and access roads to energy development sites.

Production and Value

The USGS estimated in its Minerals Yearbook that in 2013 Wyoming produced more than 21 million metric tons (tonnes) of construction aggregate (sold or used by producers); a value of \$143 million. Recently released preliminary numbers for 2014 show a slight increase in Wyoming's production of aggregate at 21.2 million tonnes.

Aggregate includes sand and gravel (one category) and crushed stone. Of the 21 million tonnes produced in 2013, nearly 9.4 million tonnes was crushed stone valued at approximately \$39 million. This is down from 2012 with a recorded 11.4 million tonnes (valued at more than \$50 million) of crushed stone produced. For sand and gravel, in 2013 Wyoming produced more than 11.5 million tonnes with an approximate value of \$104 million, according to the USGS. Sand and gravel production in 2013 was also down slightly from 2012 at 11.8 million tonnes, valued at \$100 million.

Sand and gravel, and crushed stone are produced in all 50 states with Texas leading the nation, followed by California and Pennsylvania. Wyoming ranks 35th in the nation. According to the USGS Mineral Industry Surveys, the United States produced approximately 861 million tonnes of sand

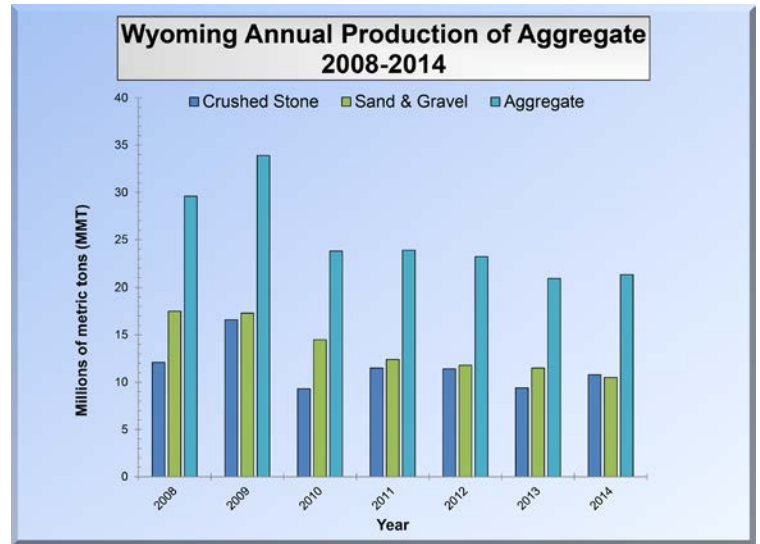


Figure 1. Wyoming production of crushed stone and sand and gravel, with total aggregate, 2008-2014. Data obtained from the USGS.

and gravel in 2013 (\$6.3 billion), and approximately 1.2 billion tonnes of crushed stone (\$6.4 billion) for the nation. This statistical information, compiled by the USGS for each state, is based on quarterly surveys of construction aggregate producers.

In addition to the USGS, the Wyoming Department of Revenue and State Inspector of Mines also survey operators in order to track construction aggregate production in the state; however, each entity has a different process in breaking-out individual commodities (limestone, granite, etc.) for their reporting and taxation needs.

Based on a review of USGS and state records, past production of major industrial minerals in Wyoming has ebbed and flowed through much of the 20th century. In the mid-1990s aggregate production began a steady increase. Then, with the worldwide economic downturn in 2008, Wyoming's aggregate production was apparently impacted but the market quickly rebounded in 2009 with a high of more than 34 million tonnes, valued at \$170 million, according to the USGS. This increase has been attributed to federal government stimulus funding and stockpiling, which may have involved mining large amounts of the material with heavy equipment in anticipation of a growing market and stockpiling for future processing. Later processing, using smaller and less expensive equipment and labor, could then fulfill demands with little penalty for the earlier overproduction. In 2010, based on USGS reports, another steep drop followed (24 million tonnes produced, valued at \$114 million), 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 diverse, the state can provide for a plentiful aggregate resource.

Every American will need
1 MILLION lbs of STONE,
SAND & GRAVEL
over a lifetime

Sand and gravel is found in terraces along mountain fronts and in alluvial floodplains along stream and river valleys. Sand also occurs in the extensive dune fields in Wyoming. Limestone crops out along the flanks of mountain ranges. While limestone is a significant crushed stone source in Wyoming, the largest aggregate quarry in the state produces crushed stone from granite, specifically quartzofeldspathic gneiss, at Granite Canyon in Laramie County. Northeast Wyoming contains few construction aggregate resources, with the exception of scoria (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.

History

In 1867, with the building of the Transcontinental Railroad Wyoming's construction aggregate was an important resource for this purpose; 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 U.S. Interstate highways through Wyoming. Every mile contained nearly 38,000 tons of aggregate, according to the National Stone, Sand and Gravel Association.

Mining Regulations

Commercial mining operations in Wyoming must be reviewed and permitted under the Land Quality Division of the Wyoming Department of Environmental Quality. The Bureau of Land Management (BLM) issues sales contracts to companies and individuals 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.

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 aggregate supplied by recycled materials is still fairly small. 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 Construction Aggregate

Wyoming's rich geologic setting has and will continue to provide for an ample supply of aggregate resources into the future. Wyoming's core infrastructure (e.g., buildings, roads, and the power industry) was developed early in the 20th century and has and will continue to require repair or replacement.

Future production of aggregate for Wyoming looks strong because the state has an adequate supply of known resources of construction raw material for new infrastructure needs. However, aggregates that exist in the natural environment are not always attainable. Aggregates are often too deep to be mined economically, development may have already encroached on and eliminated desirable aggregate sources, or previously mined areas may be "mined out." In the future, it is likely that additional sources of construction aggregate will be required to keep up with the increasing and ever-changing demands of Wyoming's energy and land development.

References

National Stone, Sand and Gravel Association, at <http://www.nssga.org>.

USGS, Minerals Yearbook, at http://minerals.usgs.gov/minerals/pubs/commodity/stone_crushed/.

USGS, Minerals Yearbook, at http://minerals.usgs.gov/minerals/pubs/commodity/sand_&_gravel_construction/.

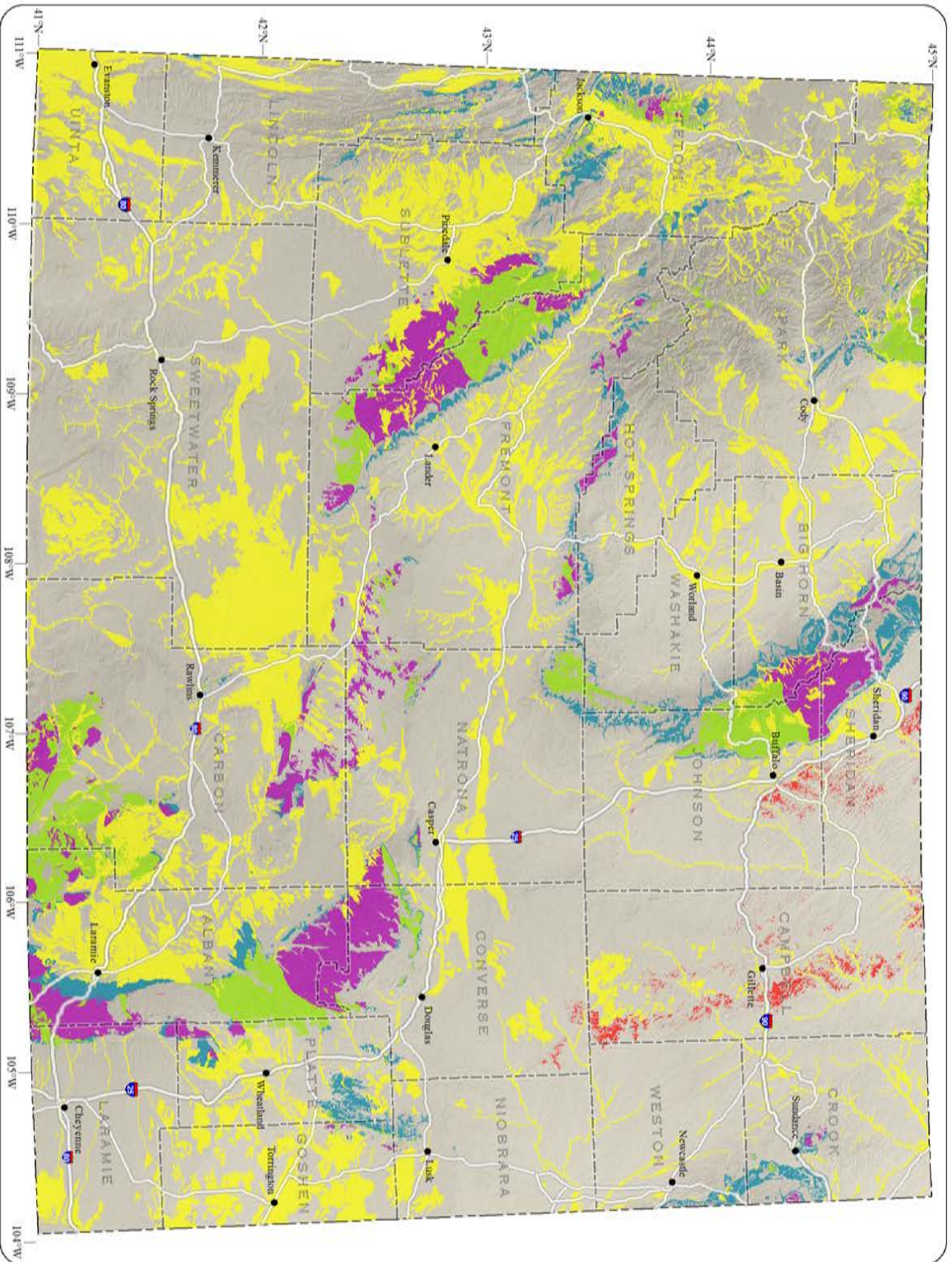
USGS, Commodity Statistics and Information, at <http://minerals.usgs.gov/minerals/pubs/commodity/>.

**For current production
numbers and other information
on Wyoming's construction
aggregate,
log on to
[www.wsgs.wyo.gov/research/
minerals/aggregate.aspx](http://www.wsgs.wyo.gov/research/minerals/aggregate.aspx)**



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WYOMING STATE GEOLOGICAL SURVEY
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EXPLANATION

- Sand and gravel
- Granite outcrop
- Clinker
- Limestone-bearing strata
- Dimensional stone potential
- City or town
- Interstate highway
- U.S. highway
- County boundary



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