

General Information: Limestone is an important natural resource for Kentucky citizens. It is the principal source of crushed stone for construction, transportation, agriculture, and industrial uses. Limestone is a sedimentary rock, mainly composed of calcium carbonate (CaCO_3). Part of the state's limestone has been altered through geologic time by magnesium-rich fluids to form dolomite, a rock composed of calcium magnesium carbonate ($\text{CaMg}(\text{CO}_3)_2$). Dolomite also is used for construction stone, particularly in the Louisville area.

Geologic units containing commercial-quality limestone underlie about 13 percent of Kentucky, mainly in the central, southeastern, and western parts of the state (Fig. 1). The principal limestone sequences were deposited in warm, shallow seas from 330 million to 460 million years ago during the Ordovician, Silurian, and Mississippian Periods. Most Silurian limestones in the state have been changed to dolomite. Parts of Ordovician and Mississippian units also contain dolomitic layers.

Stone Production: The state produces between 50 and 70 million short tons of limestone and dolomite every year. At approximately \$4.75 per ton of stone, this represents a \$230 to \$330 million industry. It was the seventh-largest stone producer among the 50 states in 2009, the last year for which statistics are available. The crushed stone industry in Kentucky employs more than 3,000 people.

Kentucky is not a highly urbanized or industrialized state that consumes exceptionally large amounts of stone, but it achieved its position among the nation's major stone producers by shipping large quantities of limestone and lime to out-of-state markets in the Ohio River Valley and the Gulf Coast region.

More than half of all crushed stone mined in Kentucky is for public use, mainly for transportation development and maintenance. About 10 tons of stone are used for each Kentucky resident annually. In a new subdivision, an average of 300 to 400 tons of crushed stone is required per home.

Stone is produced at 71 open-pit quarries and 23 underground mines in 60 of the state's 120 counties. Kentucky has more underground limestone mines than any other state in the nation. The deepest mine, located in Jefferson County, recovers stone from a depth of more than 1,000 feet below the land surface. The Reed Quarry in western Kentucky is one of the largest producers of crushed stone in

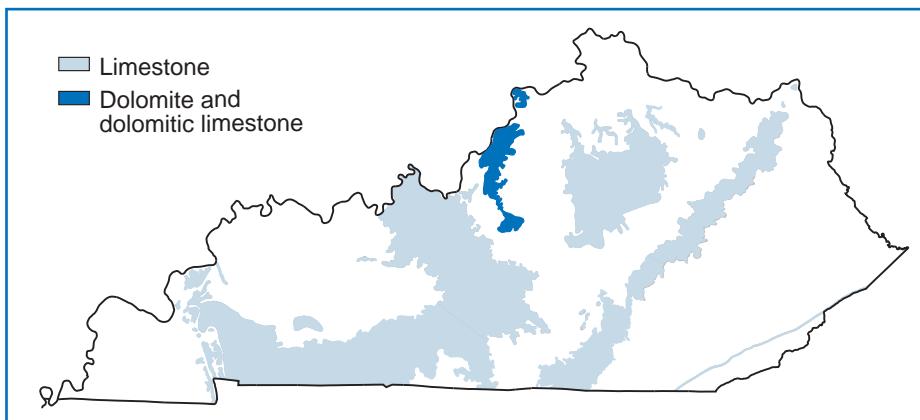


Figure 1. Principal outcrop of limestone and dolomite resources in Kentucky.

the United States. The present floor of the quarry is below sea level and represents the lowest place on the surface in Kentucky.

Crushed limestone and dolomite generally are marketed as low-priced, bulk commodities. Transportation or haulage charges form a major part of their delivered cost. In places, the cost of transportation equals or exceeds the plant value of the stone. Because limestone is widely available in Kentucky, the siting of quarry operations is primarily driven by proximity to the markets that require the stone in order to minimize transportation costs for end users.

Principal Uses: Coarse aggregate, the largest market for crushed limestone and dolomite in Kentucky, is essential for maintenance of the state's transportation infrastructure, and for residential, commercial, and government construction. The term *aggregate* refers to the hard rock particles that are combined with binding materials to form cement and asphalt concretes, or are used unbound

Products and uses for Kentucky's limestone and dolomite

- Road construction and maintenance
- Residential, commercial, and government construction
- Lime, cement
- Riprap, jetty stone
- Concrete products
- Agricultural limestone
- Sewage plant filter beds
- Sulfur dioxide (SO_2) removal
- Railroad ballast
- Mine dust, acid neutralization, poultry grit, mineral food

(for example, as road base or foundation drainage). Stone used for construction must meet specifications for hardness (resistance to abrasion and impact) and soundness (resistance to disintegration from weathering). Some stone has physical properties that make it suitable for skid-resistant material on roadway pavement.

Limestone and dolomite aggregate are mixed with cement, sand, and water to make concrete, which is used for constructing roadways, sidewalks, bridges, airport runways, dams, foundations, concrete block, and buildings. Asphalt and sand are mixed with crushed-stone aggregate to pave highways and streets, parking lots, and driveways.

Quarries also produce larger sizes of limestone for riprap and jetty stone to control erosion along waterways and shorelines. Crushed limestone is widely used as a filter medium in water and sewage treatment plants. Roadbed ballast for rail lines is produced from silica-rich limestone in western Kentucky.

Chemically pure limestones, with a high calcium (Ca) content and low percentages of silica (SiO_2) and alumina (Al_2O_3), are raw material for the manufacture of lime and cement. They also furnish sorbent stone for removing SO_2 emissions from coal-burning power plants, rock dust for explosion abatement in underground coal mines, and reactive stone for acid neutralization.

For agricultural uses, limestone and dolomite are applied to fields and pastures to neutralize soil acidity and to provide plant nutrients. Limestone also is used for mineral feed and poultry grit. In coal-mine reclamation, agricultural stone is applied to surface-mine spoils and replaced topsoil to adjust the pH for improved revegetation.

Lime: Lime production is an important industry in north-central Kentucky. In lime manufacturing, limestone (CaCO_3) is heated to produce the reactive chemical lime (CaO) and carbon dioxide (CO_2). Much of the lime produced in Kentucky is for flue-gas desulfurization to remove SO_2 emissions from coal-fired power plants. It is also used for steel-furnace flux, chemical industries, and water treatment. The second- and third-largest lime plants in the United States are along the Ohio River in Pendleton and Mason Counties.

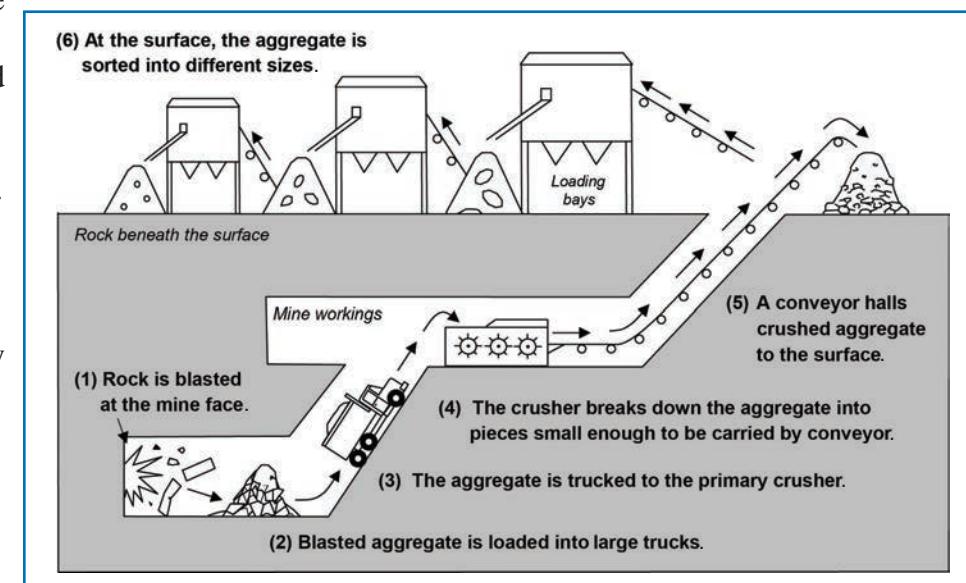


Figure 2. Aggregate mining process

For recommended reading about limestone resources, go to www.uky.edu/KGS and click on “Publications” to get to a publications catalog. Under “Search by Selected References,” select “Limestone Aggregate,” and click the search button.

Sources: Kentucky Geological Survey, U.S. Geological Survey, and Kentucky Department of Highways (Division of Materials)