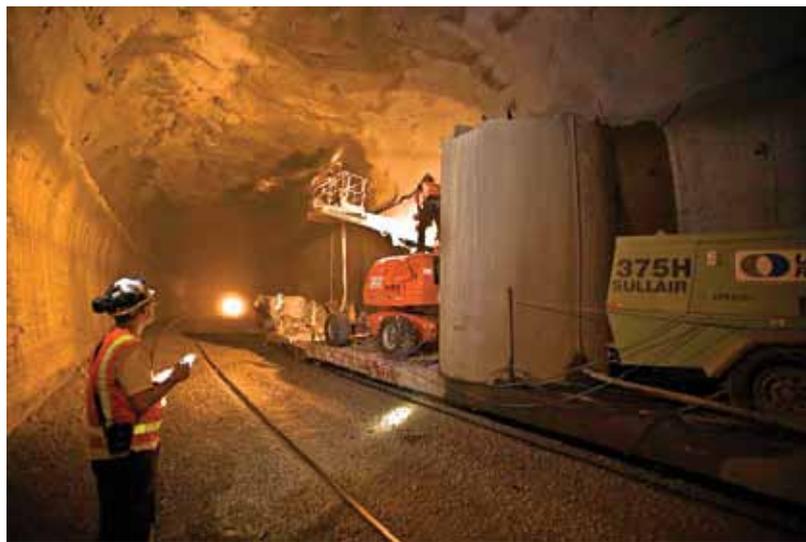


The Heartland Corridor Clearance Improvement Project: Vaughan, Roderfield, Laurel, and Gordon Tunnels

As part of a 3-year project, Norfolk Southern Railway, which operates 21,500 mi (34,600 km) of track in 22 eastern states, is expanding 28 tunnels along the Heartland Corridor, a vital line that connects the port of Hampton Roads, VA, and Chicago, IL, by adding up to 2 ft (609.6 m) of



Workers on the Heartland Corridor project



Along the Heartland Corridor, Norfolk Southern has employed a number of methods to increase the clearance, including raising the roof and lowering the track. To expand the tunnels, workers must also transform the passageways' corners from rounded to squared, which allows the taller trains to pass

headroom, which will allow larger trains and thereby more cargo to use the route and cut roughly 200 mi (321 km) off their trip. The \$150 million project is slated for completion in 2010.

Norfolk Southern hired three contractors to complete the project: Johnson Western Gunitex Company, San Leandro, CA; LRL Construction Company, Tillamook, OR; and R.J. Corman Railroad Company, Nicholasville, KY. The material supplier selected for the tunnel work was The Quikrete Companies.

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The railroad even removed the roof from one of the 27 under construction as part of a 174 ft (53 m) long "daylighting" of a tunnel. The tunnels, which range in length from 174 to 3302 ft (53 to 1006.4 m) long, were built with arched roofs and rounded corners.

Of the tunnels currently being worked on, eight require the linear notch work to square the edges, 18 require complete roof replacements, and one is a "daylighting" project.

The four-tunnel Vaughan, Roderfield, Laurel, and Gordon (VRLG) project involved the liner removal and notching of double-track tunnels in Roderfield, WV. The tunnels varied in length—Vaughan (1113 ft [339.2 m]), Roderfield (924 ft [281.6 m]), Laurel (803 ft [244.75 m]), and Gordon (1271 ft [387.4 m]). Crews were required to complete demolition, rock bolt, and apply shotcrete all within 10-hour shifts. Excavator-mounted road headers as well as an AM 75 Alpine Miner were used to complete demolition and notching. Shotcrete was applied using volumetric batching machines and shotcrete pumps.

In total, approximately 10,000 yd³ (7645 m³) of grout was used in the four-tunnel VRLG project,

which started in January 2008 and was completed in May 2009.

Perhaps the biggest challenge was working in four tunnels consecutively in the same location and organizing trains to go to each tunnel at the beginning of each shift, while dealing with the inability to pass equipment in each tunnel.

For the project, Norfolk Southern rerouted as many trains as possible to allow for the construction but cannot completely shutter the line during the tunnel work. Crews start their work on Saturday and must be finished on Wednesday, with scheduled work times of 2 a.m. to 12 p.m. each of these days, at which time the rail line resumes its normal operations.

The challenge with this project is that Norfolk Southern could not close the tunnels to all rail traffic because this is such an important route for freight movement, which means that workers have a limited window in which to work.

Over the last three decades, freight traffic on railroads nationwide has increased, and railroads have turned to double-stack trains—cars that allow intermodal containers to be stacked one on top of another—to boost the amount of goods each train hauls. The intermodal containers are used worldwide on ships, trucks, and trains to carry a number of products.

Modern-day stack trains require tunnels to be at least 20 ft 9 in. (6.4 m) tall. Because of the small tunnels through the Appalachian Mountains, Norfolk Southern's large intermodal trains make the trip from Hampton Roads, VA, to Chicago via Harrisburg, PA, or Knoxville, TN.

As part of the tunnel expansions that require linear notch work and roof replacements, crews bore holes every 4 ft (1.2 m), which allows them to fill any voids behind the tunnel ceiling. Workers then install 18 ft (5.5 m) long roof anchors to secure the tunnel ceiling to the mountain above; they complete the process by applying nonshrink precision grout to fill in the holes.

While expanding the tunnels to accommodate larger trains is a primary objective, it is just one of the goals of the multi-year project. The railroad wants to ensure that the tunnels are stabilized and safe for the next century.

Using shotcrete combines the process of applying cement to the tunnel walls and packing it down. Spraying the shotcrete also eliminates the need for forming and provides an extremely dense (9000 psi [62 MPa]) and high-strength concrete tunnel lining.

While modern technology has shouldered the load in bringing the corridor into twenty-first century compliance, there is no shortage of respect and admiration among today's workers for those who forged the line.



As part of a 3-year project, Norfolk Southern is expanding 27 tunnels along the Heartland Corridor by adding up to 2 ft (0.6 m) of headroom, which will allow larger trains to use the route and cut roughly 200 mi (321 km) off their trip

The Outstanding Underground Project

Project Name

The Heartland Corridor Clearance Improvement: Vaughan, Roderfield, Laurel, and Gordon Tunnels

Project Location

Roderfield, WV

Shotcrete Contractor

Johnson Western Gunitite Company*

General Contractor

Johnson Western Gunitite Company*

Architect/Engineer

STV Whitehead, Hatchmott McDonald, and Rick Meredith

Material Supplier/Manufacturer

The Quikrete Companies*

Project Owner

Norfolk Southern Railway

*Corporate Member of the American Shotcrete Association