



Project Spotlight

Oregon Transit Tunnels - Portland, Oregon



Owner: Tri-County Metropolitan Transportation District (TRIMET)
Engineer: Parsons, Brinckerhoff, Quade and Douglas
General Contractor/Installer: Frontier/Traylor JV

Background Information

A low-density grout containing cement, Aerix Industries™ foaming agent, and fly ash reduced contact grouting costs by \$600,000 for two 15,000 foot transit tunnels in Portland, Oregon. Use of the grout originally planned, a cement and fly ash mixture, would have cost \$1 million in cement alone.

A cellular grout made of cement and the foaming agent from Aerix Industries also helped stabilize portions of the tunnels by filling voids as large as 60 cubic yards that opened in the rock during boring.

The \$103 million dollar tunnel project was part of an 18-mile light rail section, the West Side Extension, constructed by the Tri-County Metropolitan Transportation District (TRIMET). The tunnels, which have an excavated diameter of 21 feet, extend through weathered, highly fractured basalt.

Project Details

The project's general contractor, Frontier/Traylor, a joint venture of Frontier Kemper Constructors and Traylor Brothers, realized that the many cracks and fissures in the rock posed an expensive problem.

"Contact grouting typically requires about one cubic foot of cement per running foot of tunnel," said Shane Yanagisawa, Chief Project Engineer for Frontier/Traylor. "In these tunnels, it would have required far more grout given the nature of the rock, making this a very costly operation."

Frontier/Traylor wanted to add the foaming agent to the grout to decrease the amount of cement used. Project engineering firm Parsons, Brinckerhoff, Quade and Douglas agreed with concrete consultant Bob Raynes to use a cement fly ash combination for the same reason. After evaluating nearly 20 formulations, they found that a mixture of cement, fly ash and foaming agent had the best strength, cost, impermeability and low shrinkage.

Cement and fly ash were mixed in batch plants outside either portal and trucked to 6 cubic yard surge tanks in the tunnels. Foam was added just before the grout was pumped through holes drilled in the tunnel's 12-inch reinforced concrete lining. Grouting lasted 140 days, with the crews averaging 100 feet per day in two to three shifts. Nearly 13,000 cubic yards of grout was used, or an average of about 11 cubic feet per foot of tunnel.

Aerix Added Value

The foamed grout worked very well in engaging the rock mass to the concrete liner," said Gary McClellan, Supervising Structural Engineer from Parsons Brinckerhoff. "Nearly all of the more than 100 core samples we took showed that the material was uniform and homogeneous, had bonded firmly to the concrete tunnel liner, and had penetrated into surrounding rubble zones, in-filling voids between the rock and liner."

