

No. 7 Subway Line Extension

New York, New York, USA

Rock grouting was used to stabilize the rock above the tunnel alignment to allow for subsequent TBM breakthrough. Working two shifts, Keller completed the grouting in five working days. TBM breakthrough was accomplished without loss of cover or pillar instability.



The project

The subway extension comprised approximately 1.5 miles of twin, 22-ft diameter tunnels, bored through rock, and a new terminus at 34th Street and 11th Avenue. The 200-ft long receiving chamber for the two tunnel boring machines (TBMs) used for the project was excavated immediately below the Port Authority Bus Terminal.

The challenge

Traditional vertical borings and horizontal cores taken from inside the tunnel indicated that a zone of limited rock cover between the end of the tunnel drive and the receiving cavern entrance was also highly fractured above the alignment of one TBM. Additionally, the pillar between tunnels was only one half tunnel diameter wide. Keller was called in by the project's general contractor, S3 II Tunnel Constructors, to perform stabilization grouting in preparation for the passing of the first TBM.

The solution

Given the nature of the fracturing, Keller recommended the use of microfine cement grout for the stabilization. The entire staging, drilling, colloidal mixing and grouting operation was accomplished in low-headroom conditions within the active, basement-level passenger pick up/drop off area of the Port Authority bus terminal. S3 II removed the concrete roadway bed over the target zone and excavated the base material to top of rock. Thirty-six grouting locations were laid out on an approximately 6-ft by 3-ft grid pattern.

Keller used a low-headroom rotary rig with a down-the-hole hammer to drill to tunnel springline from 24 ft below working grade. Each hole was water-tested before grouting to determine the permeability of the rock. A 1-inch diameter fiber glass bar with centralizers was inserted for the full length of the hole prior to grouting to aid in tying the rock together as a single mass. Grouting was initiated at the holes with the highest permeability. Grout was pumped at a maximum pressure of 25 psi until absolute refusal.

Project facts

Owner(s)

New York Metropolitan Transportation Authority (MTA)

Keller business unit(s)

Keller

Main contractor(s)

S3 II Tunnel Constructors

Engineer(s)

WSP

Solutions

Ground improvement

Markets

Infrastructure
Tunnels and shafts

Techniques

Compensation (fracture) grouting

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