

## WORLD TRADE CENTER TRANSPORTATION HUB

New York, NY



- **Owner:**  
Port Authority of New York & New Jersey
- **Technique(s) Utilized:**  
Micropiles, Jet Grouting, Anchors

**N**icholson Construction Company, in joint venture with E.E. Cruz, has employed a variety of geotechnical construction techniques on the World Trade Center Transportation Hub project in Lower Manhattan.

Nicholson installed 550 micropiles through, around and under the active New York City Transit Authority 1 and 9 subway line box to support the subway as basement-level construction was carried out 50 feet below. The congested site and the obstructions encountered during drilling operations were constant challenges. The 250 ton capacity piles extended to depths of around 100 feet and in one localized area of problem ground, to over 150 feet.

This project also included the installation of 125 jet grout columns through, around and under the subway box. A significant portion of this work was carried out during weekend subway outages from on top of the subway or with low headroom drill rigs equipped with real-time monitoring equipment designed to measure operational parameters. Along with having to complete the work during subway outages, significant challenges included avoiding major utilities, minimizing subway settlement or heave, avoiding existing west bath tub slurry wall supporting tie backs and deploying the strict spoil handling procedures necessary to allow trains to be operational early on Monday morning following each weekend possession period. After an exhaustive trial program parameters were selected that would produce either 4 or 6 feet diameter columns with strengths exceeding 500 psi at 3 days and 750 psi at 28 days. The operational permeability of the jet grouted soil was required to be less than 0.03 feet per day.

In addition, Nicholson installed nearly 1,000 tieback anchors to support the new east bathtub, railroad basement walls. The anchors are primarily 22 strands in size, up to 170 feet long for a total of approximately 60,000 linear feet of drilling.