



Malvern Station Pedestrian Tunnel

Big-City Challenges for Small-City Project

By Jim Rush

Liner plate was used as initial support in conjunction with compensation grouting to alleviate surface settlement.

Malvern, Pa., is a small community located about 25 miles west of Philadelphia, but despite its size, the Borough faced big-city constraints on a recent railway station improvement project. The project involved constructing a pedestrian tunnel to Malvern Station underneath live railroad tracks.

The project required keeping the 110-year-old station — a key stop for Southeastern Pennsylvania Transportation Authority (SEPTA) commuters — open for business, tunneling under live tracks, maintaining pedestrian and vehicular traffic, and working in a site penned in by a heavily used roadway — issues with which any big-city contractor is intimately familiar.

“The project site was extremely tight,” said Brian Froehlich, Project Engineer for Turn-Key Tunneling. “There was very little room for equipment and handling spoil, so we loaded directly onto trucks. And we were working around existing utilities that needed to be kept in service at all times.”

The tunnel is part of a \$17 million project largely funded through stimulus funds. As part of the first phase, the tunnel will assist in facilitating the flow of foot traffic to the depot stop and to provide handicap accessibility. The majority of the funding (\$12.5 million) came through the American Recovery and Reinvestment Act.

“The need for the tunnel was multifaceted,” said SEPTA project manager Glen Morris. “The station was long neglected and in need of improvement, and the current pedestrian access was exposed and shared brick tunnel with vehicular traffic along North Warren Avenue. The new tunnel allows a direct, dedicated route for travelers to get from platform to platform and to and from the parking lots.”

Planners also envision the tunnel as a future component of the proposed Patriot Path that would connect historic sites of the American Revolution, including the Paoli Massacre site near Malvern.

Tunneling Solution

SEPTA worked with Urban Engineers on conceptual design and Stantec as the project designer to develop the tunnel plan. Morris said open-cut was considered as an option but was ruled out due to the disruption to rail service and it would have taken longer to complete than tunneling.

The project was awarded on a low-bid contract to James J. Anderson Construction Co. Inc. of Philadelphia, which subcontracted tunneling work to Turn-Key Tunneling Inc. of Columbus, Ohio. The tunnel design was a single crossing of



The 15-ft diameter hydraulic shield was constructed by Turn-Key Tunneling in conjunction with Tunnel Shields & Equipment Inc.

75 ft, with a mere 6 ft of cover between the crown and the tracks, driving downhill at a grade of 5.2 percent.

Turn-Key Tunneling used a 15-ft diameter shield to complete the tunnel through sand and track fill with pockets of shale and hard rock at the bottom of the heading. The subsurface investigation included 14 total borings on the site to depths ranging from 25 to 40 ft below existing ground surface. Initial results of these borings showed that the tunnel liner plate structure could be jacked through the fill and residual soils without concerns of encountering bedrock, boulders or other obstructions.

The working pit size was 40 ft by 15 ft, shored by steel sheeting. The hydraulically driven tunnel shield was manufactured by Turn-Key Tunneling in conjunction with Tunnel Shields & Equipment Inc. of Galena, Ohio. The collaboration also manufactured a custom-made, high-performance conveyor system and low profile excavator built specifically for this project.

After launching the shield and excavating approximately 10 ft, shale rock “floaters” (2 to 4 ft long) were found in the bottom third of the shield heading. These floaters remained in the heading for the next 8 ft at which point hard bedrock was encountered in the bottom of tunnel.

Turn-Key Tunneling used 16-in., four-flange liner plate from American Commercial Inc. as initial support for the excavation. The tunnel will be lined with cast-in-place concrete walls and pavers to create the final pedestrian tunnel.

Keeping Traffic on Track

Because crews were tunneling under live tracks, minimizing settlement was of the utmost importance. The tracks are owned by Amtrak and jointly used by SETPA. Amtrak officials were onsite to ensure that settlement didn’t disrupt its train service. “We had crews onsite every day,” said Amtrak project manager Barry Bonds. “The crew grouted behind the liner plate throughout the tunneling to minimize settlement. Where we did

have settlement, we re-ballasted and ran our surfacing machine at night when there was no rail traffic.”

Compensation grouting was performed in every ring (16 in.) under the tracks. The liner plate was equipped with 2-in. ports through which grout was pumped in a 3:1 sand-to-cement ratio. Froehlich reported that a maximum of 1.5 in. of settlement was seen during tunneling compared to a 3-in. allowable limit.

“The custom-made tunnel shield performed flawlessly and exceeded our expectations,” said Bud Belknap, Project Foreman for Turn-Key Tunneling. “Having completed such a large diameter tunnel in a difficult and challenging setting, we feel quite confident numerous other pedestrian tunnels could be completed with little variation. The final product will not only provide a convenient and safe manner in which to access the commuter train, it will add aesthetic appeal to the local neighborhood.

“Throughout the build process, multiple agencies and municipalities heavily scrutinized our methods and progress as a barometer of having similar future tunnels completed in the area. The quick assembly of the tunnel, no down time to the Amtrak line and assisting passengers to carry on their busy lives without interruption, have all agreeing that this pedestrian tunnel was a huge success.”

The week of Thanksgiving is traditionally a heavy travel day for all modes of transportation, including rail. Because of this, SEPTA wanted to ensure that the project was completed in advance of the holiday. The project began on Oct. 18, 2010, and was completed by Nov. 21 — in time for the busy travel week.

“The tunneling was remarkably successful,” Morris said. “The geotechnical investigation proved true so there were no unforeseen conditions and the tunneling was completed on time.” The walkway, with a canopy and full ADA accessibility, is expected to be fully complete by fall 2011.

Jim Rush is editor of *TBM*.