

55th Street Ventilation Facility

By Frank E. Townsend III and Dennis Rubi

The 55th Street Ventilation Facility is a critical piece of the Eastside Access Program for the New York Mass Transit Authority. This facility provides critical ventilation for the new tunnels that carry Long Island Rail Road trains to Grand Central Terminal. Unlike most other ventilation facilities, the 55th Street Ventilation Facility, like the 50th and 44th Street

vent facilities, is designed to be entirely underneath the street's pavement. These do not have an aboveground component.

All vertical elements were shot by Superior Gunitite. Superior Gunitite installed the shotcrete on a complex, oval-shaped, vertical ventilation shaft, including overhead arches, without the need for forming—saving the general contractor over \$1,000,000 in formwork expense. The concrete in the ventilation shaft varied in thicknesses from 24 to 54 in. (610 to 1370 mm) depending on the rock overbreak, as this was a blasted excavation. The base contract volume was approximately 1927 yd³ (1473 m³) with the overhead arch 4 ft (1.2 m) thick using 1277 yd³ (976 m³) of concrete.

There were several logistical challenges to the 55th Street Ventilation Facility. Because there was limited access for materials and formwork, the shotcrete process was essential. Shooting the crown of the arch left just 5 ft (1.5 m) of working distance from the final arch, making access very challenging. The elimination of formwork and the ability to access difficult-to-reach areas were key benefits in using shotcrete as the placement method for structural shotcrete in the ventilation shaft and overhead arches. With the fast-paced schedule, the shotcrete method saved the time it would have taken to construct, form, and strip the 8613 ft² (800 m²) overhead arch. Total time saved on the project due to use of shotcrete was 32 working days.

This project ran from September 2013 with the initial lining in the main cavern to May 2015 when the overhead arch and shaft lining were placed. The wet-mix process was used with timely concrete deliveries by the ready mix supplier, Tec Crete Transit-Mix Corp (WBE), who provided a 5000 psi (35 MPa) mixture in the heart of New York City. The concrete was pumped from the surface to the subterranean area of placement with a combination of 2 in. (50 mm) slick line and flexible rubber hoses. Forming on the ventilation shaft was almost completely eliminated except for two-sided sections of the shaft, where a stay-in-place form was used. At some locations, the field measurements for the overhead arch were over 48 in. (1200 mm) thick

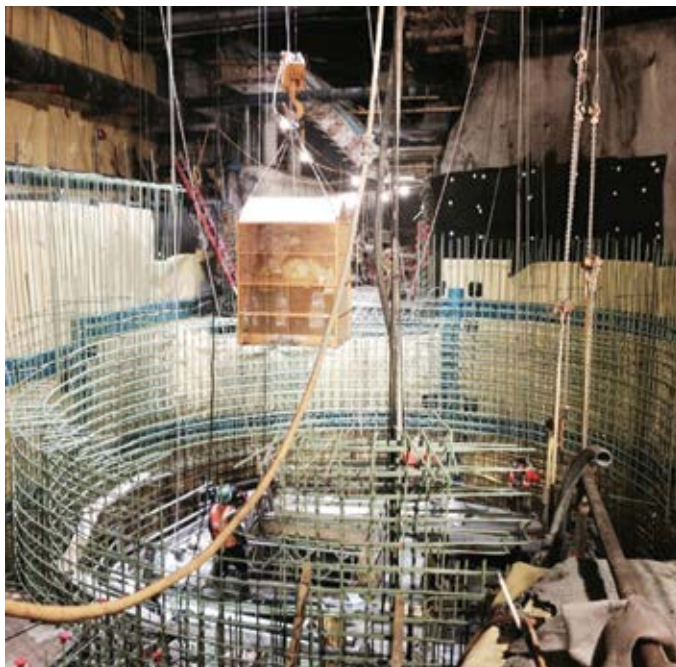


Fig. 1: Shaft structure—shot two water barrier panels per shift

with three layers of reinforcement. To allow proper placement in these congested sections, shotcrete was applied in three 12 in. (300 mm) lifts with a scratch finish on the first two layers and a rubber float final finish.



Frank E. Townsend III is the East Coast Region Manager for Superior Gunite. He is a civil engineering graduate of Worcester Polytechnic Institute, Worcester, MA, and received his master's degree from the University of Missouri, Columbia, MO. Townsend comes from the U.S. Army Corps of Engineers and has been running Superior's East Coast operations (predominantly New York, New Jersey, Connecticut, and Boston, MA) for 4 years. Townsend is an active member of ACI Committee 506, Shotcreting; a member of ASA; and currently serves on the ASA Board of Directors. 2015 ENR top 20 under 40.



Dennis Rubi is a Project Engineer for Superior Gunite. He is a civil engineer graduate of California State University, Long Beach, CA. Rubi comes from the County of Orange in Newport Beach, CA, as a Junior Engineer, and has been with Superior's East Coast operations as a Project Engineer for 1 year. Rubi is a member of the American Society of Civil Engineers.

Honorable Mention

Project Name

The 55th Street Ventilation Facility

Project Location

Manhattan, NY

Shotcrete Contractor

Superior Gunite*

General Contractor

Schiavone Construction Co., LLC,
and John P. Picone, Inc.

Architect/Engineer

New York Metropolitan Transportation
Authority Capital Construction (MTACC)

Material Supplier/Manufacturers

Tec Crete Transit-Mix Corp.

Lab

Tectonic

*Corporate Member of the
American Shotcrete Association



Fig. 2: Overhead arch—lower panel being built up. Note the BA anchors and injection tubes displaying the depth of the concrete section



Fig. 3: Working on final panel—heat presented a challenge, requiring ventilation and close attention to curing



Fig. 4: Final arch structure shotcreted in layers due to thickness