

## 2018 Honorable Mention

# Brattleboro Bridge Project

By Nick Durham and Frank E. Townsend III

In August 2016, Superior Gunitite was awarded a subcontract from PCL Civil Constructors to shoot and carve eight web fins on the piers of the I-91 Brattleboro Bridge, in Brattleboro, VT. PCL Civil Constructors had been placing precast sculpted rock form panels going up the piers of the bridge but was unable to place panels at the arched and inverted section near the top of the piers. The issue was not only how to place the concrete on the fins but also how to get it to seamlessly match the sculpted rock forms that had already been placed. Using shotcrete for this architectural application provided ready access for placement as well as the ability to carve the wet concrete to match the look of the previously placed precast panels.

### TEMPORARY MOCKUP

The main concern of the architect was how the shotcrete would match the already-placed precast panels. Before starting placement on the bridge, Superior Gunitite produced

a temporary mockup to demonstrate the placement process and the appearance of the final product. The entire pier was already intended to be stained, so color was never an issue or a concern. Once the mockup was approved, Superior Gunitite was quickly instructed to begin permanent placement to avoid delays in schedule.

### CONSTRUCTION OF THE FINS

Each fin was approximately 28 ft (9 m) high and expanded in width from 8 ft (2 m) at the bottom to 24 ft (7 m) at the top, totaling approximately 390 ft<sup>2</sup> (36 m<sup>2</sup>) each. Shotcrete thickness was determined by a radius, with the top and bottom



Fig. 1: Two fins at the northern pier prior to being shot. Reinforcing bar and stayform



Fig. 2: Precast panel installed at the bottom of the pier



Fig. 3: Mockup immediately after spraying and early stages of sculpting



Fig. 4: Completed mockup



Fig. 5: First day shooting a fin, bringing shotcrete just past the reinforcing bar



Fig. 6: Second day of shooting a fin, flash and sculpt the rock face

ends at 3.6 ft (1.1 m) thick and a minimum of 1 ft (0.3 m) thick at the center height of each fin. The only formwork necessary was stayform on the underside of the curvature of the fin, which was installed by Superior Gunite. Permanent shotcrete installation required Superior Gunite employees to work out of three 120 ft (37 m) manlifts anywhere from 70 to 100 ft (21 to 31 m) off the ground. The only access was from below the bridge and pumping upwards. Due to space, only two manlifts could be used at the location of the shoot at any given time. One manlift held the nozzleman and a lift driver and the other held two concrete sculptors, one of whom also drove the lift.

## SUCCESS OF SHOTCRETE

Superior Gunite worked on two fins a day. Fins were bulked out in 1 day, then a flash coat would be applied the second day, allowing the sculptors to carve the rock formation into the wet shotcrete. Carroll Concrete provided the shotcrete in the summer heat, requiring Superior Gunite to unload trucks quickly and avoid problems with the line while pumping up to 100 ft upwards. In total, 335 yd<sup>3</sup> (256 m<sup>3</sup>) of concrete were placed. Each fin was about 42 yd<sup>3</sup>

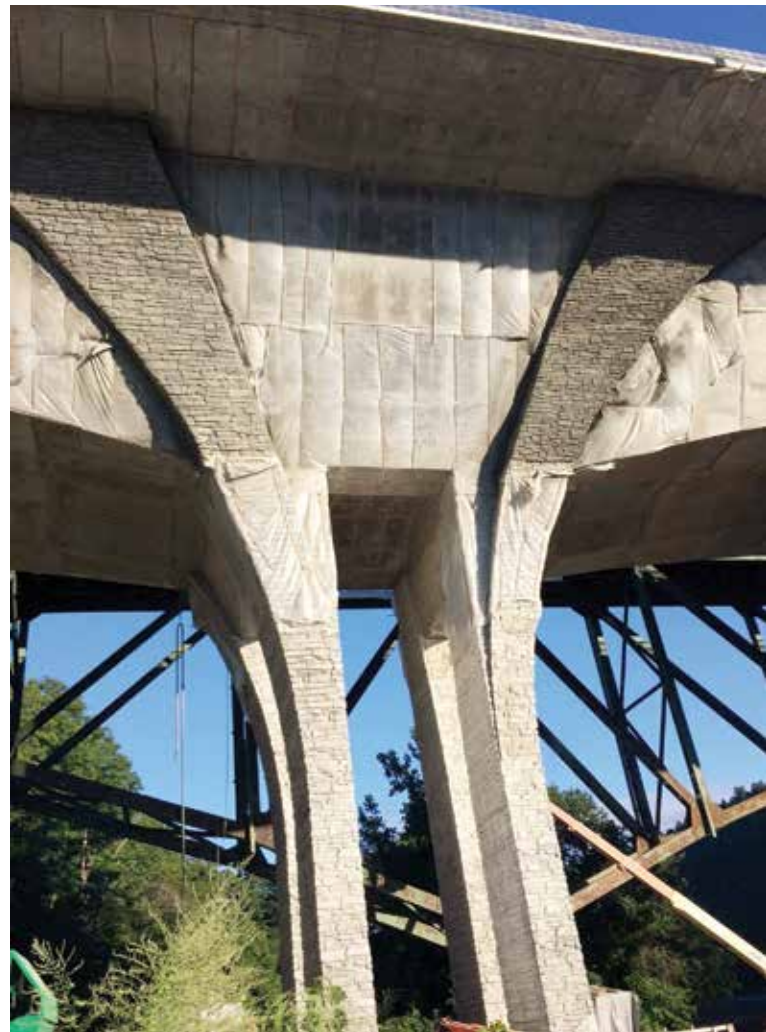


Fig. 7: Finished fins. Darker material is shotcrete, lighter is precast panels

(32 m<sup>3</sup>). In total, the shotcrete segment was completed in just 9 days. The piers were completed at least four times faster by using shotcrete as opposed to forms. Not only did the contractor avoid delays on the project by using shotcrete but time was also reduced on the schedule; using shotcrete for the fins took them off the critical path. By the end of the job, the owner mentioned that the sculpted shotcrete was a better final product than the precast panels.



Fig. 8: Staining the piers

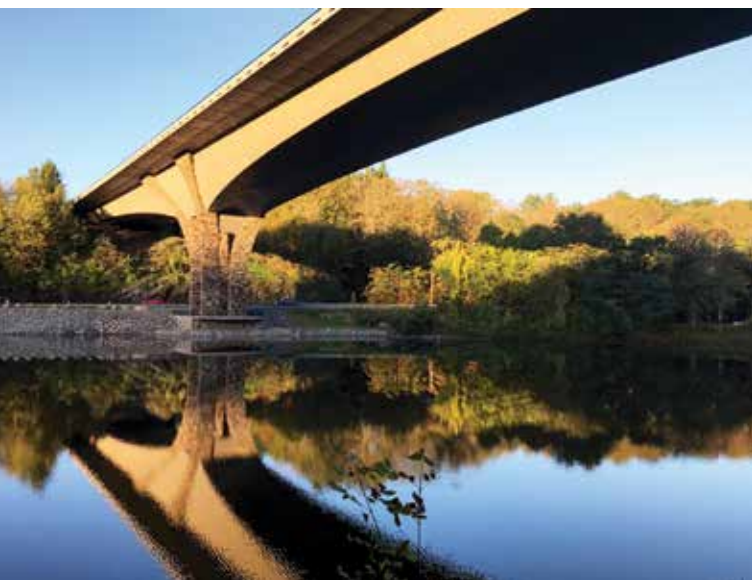


Fig. 9: The completed bridge



**Nick Durham** is a Project Manager at Superior Gunite. After receiving his degree in civil engineering from Columbia University, New York City, NY, he spent time working in concrete foundations and high rises in New York City before entering the world of shotcrete and joining Superior Gunite. Along with the I-91 Brattleboro Bridge, he has successfully managed jobs in New York City; Norfolk, VA; and Needham, MA, among others.



**Frank E. Townsend III** is the Vice President East for Superior Gunite. He received his bachelor's degree in civil engineering from Worcester Polytechnic Institute, Worcester, MA, and his master's degree from the University of Missouri, Columbia, MO. Townsend is an active member of ACI Committee 506, Shotcreting, and currently serves on the ASA Board of Directors. He has been Awarded the U.S. Army Corps of Engineers deFluery Medal and Engineering News-Record New York's "Top 20 under 40" design and construction leaders in 2016. Townsend is an active member of ASA; ACI; the New Jersey Chapter – ACI; Concrete Industry Board, an ACI New York City Chapter; The Moles and the Beavers (heavy construction organizations); American Society of Concrete Contractors; American Society of Civil Engineers; and Society American Military Engineers (SAME), remaining a lifelong soldier.

## 2018 HONORABLE MENTION

*Project Name*

**I-91 Brattleboro Bridge**

*Project Location*

**Brattleboro, VT**

*Shotcrete Contractor*

**Superior Gunite\***

*Architect/Engineer*

**Sebago Technics**

*Material Supplier*

**Carroll Concrete Co.**

*Equipment Manufacturer*

**Western Shotcrete Equipment\***

*General Contractor*

**PCL Civil Constructors**

*Project Owner*

**Vermont Agency of Transportation**

\*Corporate Member of the American Shotcrete Association