2017 Honorable Mention

The Albertus L. Meyers Bridge

By Jeffrey L. Zimmerman and Dennis Bittner

Fig. 1: November 2016—view of entire bridge after repairs were completed

The Albertus L. Meyers Bridge, also known as the 8th Street Bridge, is located in Allentown, PA. The bridge spans the Little Lehigh Creek and connects Allentown's Center City and South Side. The bridge has a total length of 1793 ft (547 m) and a width of 48.8 ft (14.9 m). The structure is a reinforced concrete open-spandrel arch bridge (Fig. 1). It was originally opened on November 17, 1913. At that time, the total construction costs were in excess of $500,000 and 29,500 yd^3 (22,600 m^3) of concrete were used. It was stated to be the largest concrete bridge in the world when it was first built (Fig. 2).

The structure was a toll bridge from its opening until the 1950s, when the toll was 5 cents per car. Until 1953, the bridge also supported trolley traffic (Fig. 3).

The Meyers Bridge had last undergone a rehabilitation project in 1973 and was again in need of major improvements. The owner, the Pennsylvania Department of Transportation (PennDOT), solicited bids for those improvements in 2014. IEW Construction Group of Hamilton, NJ, was the successful bidder as a general contractor. The $20.3 million project included replacing the bridge deck, constructing new alcoves, repairing bridge piers, and reconstructing roadway approaches. It also included installing new lighting, sidewalk, curbing, fencing, pavement markings, and signs.

Mar-Allen Concrete Products, Inc., of Ephrata, PA, was subcontracted by IEW to perform the pier repairs. The repairs were originally specified to be performed using form-and-pour concrete. Much of the work was overhead, at depths of 3 in. (75 mm) and 120 ft (37 m) in the air. There were areas where reinforcing bar was 2 in. (50 mm) or less from the surface. Upon consideration, Mar-Allen suggested

Fig. 2: January 1913 construction progress

Fig. 3: 1916 postcard of the bridge

using shotcrete, specifically the dry-mix process, in lieu of form-and-pour concrete to make these difficult repairs more efficient with equal or superior strength and durability. PennDOT District 5 agreed to use shotcrete on a trial basis for this project.

In addition to the everyday challenges presented by repairs of this nature, the bridge was added to the National Register of Historic Places in 1988. In keeping with historical requirements, constant coordination was required with the Pennsylvania Historic and Museum Commission and the City of Allentown Historic Commission. When repaired, the structure needed to look as it did at its original time of construction. One of the biggest concerns was matching the color of the repair material to the existing substrate. Additionally, PennDOT required a corrosion inhibitor be included in the repair material. Mar-Allen selected QUIKRETE to provide the material for the project. Quikrete Shotcrete MS with integral corrosion inhibitor and fibers was used. The material was colored at the point of manufacture to match the existing substrate. The original color of the bridge was very light, and pigment alone could not lighten the material enough for a sufficient match. To obtain the proper color, white portland cement was used in the mixture.

Testing was stringent and frequent on this project. The PennDOT shotcrete specification required prequalification panels be gunned by each nozzleman on the project. Those panels were then tested for compressive strength as well as visually graded. Additionally, the prequalification panels were used to verify the color of the material. Ultimately, the Historic Commissions needed to approve the color and texture of the shotcrete. During the construction phase, test panels were gunned daily, again in accordance with the PennDOT's very stringent shotcrete specification. Those panels were cored, and compressive strength testing was performed. Additionally, multiple bond pulloff tests were performed on in-place material to test bond strength.

All shotcrete repairs were performed by Mar-Allen using ACI Certified Nozzlemen. The shotcrete portion of the contract began in July 2015 and completed in November 2016. The project required various and numerous repairs. Approximately 60% of the repairs were overhead. Repair areas were as high as 120 ft (37 m) off the ground. Many of the areas were complex shapes such as corners and arches (Fig. 4 and 5).

Unsound concrete was removed using chipping hammers. Repair depths ranged from 3 in. (75 mm) all the way up to 4 ft (1.2 m). Exposed reinforcing bar was cleaned by grit blasting and epoxy-coated reinforcing bar was used where replacement was necessary (Fig. 6).

Where supplemental reinforcement was required, galvanized mesh was installed. Shotcrete was then applied using the dry-mix process. All material was pre-dampened prior to application. To meet job requirements a final finish was placed on the material by qualified finishers to match the original finish of the structure. That finish also required approval by the Historic Commissions. Immediately after finishing, a spray cure was applied to help prevent plastic shrinkage

Fig. 4: Shotcrete in progress at a pier

Fig. 5: Shotcrete in progress at a spandrel column

Fig. 6: Spandrel column repair with chipping complete

Fig. 7: Looking through piers—shotcrete on an arch rib

cracking. A total of 32 truckloads of material in both 50 and 3000 lb (23 and 1400 kg) bags was installed on this project.

There were additional challenges on the project. The height of the bridge meant wind was a near-constant factor (Fig. 7). The wind and height, coupled with a limited area for placement, required some creativity. The adjacent properties and vehicles needed protection from dust, and the freshly placed shotcrete material needed protection from the wind. Large burlap curtains were sewn together and then hung from cables on the bridge (Fig. 8). This made it possible to open and close the curtains as needed. The height and openness of the structure provided limited shade, leaving much of the surface exposed to full sunlight. The curtains also provided some shade to help reduce the heat gain and drying effect of the sun.

All work was done in accordance with a Shotcrete Special Provision written for PennDOT by and with the collaboration of members from the American Shotcrete Association. While

Fig. 8: Burlap and reinforced poly curtains sewn together and hung from cables to protect cars and buildings from overspray

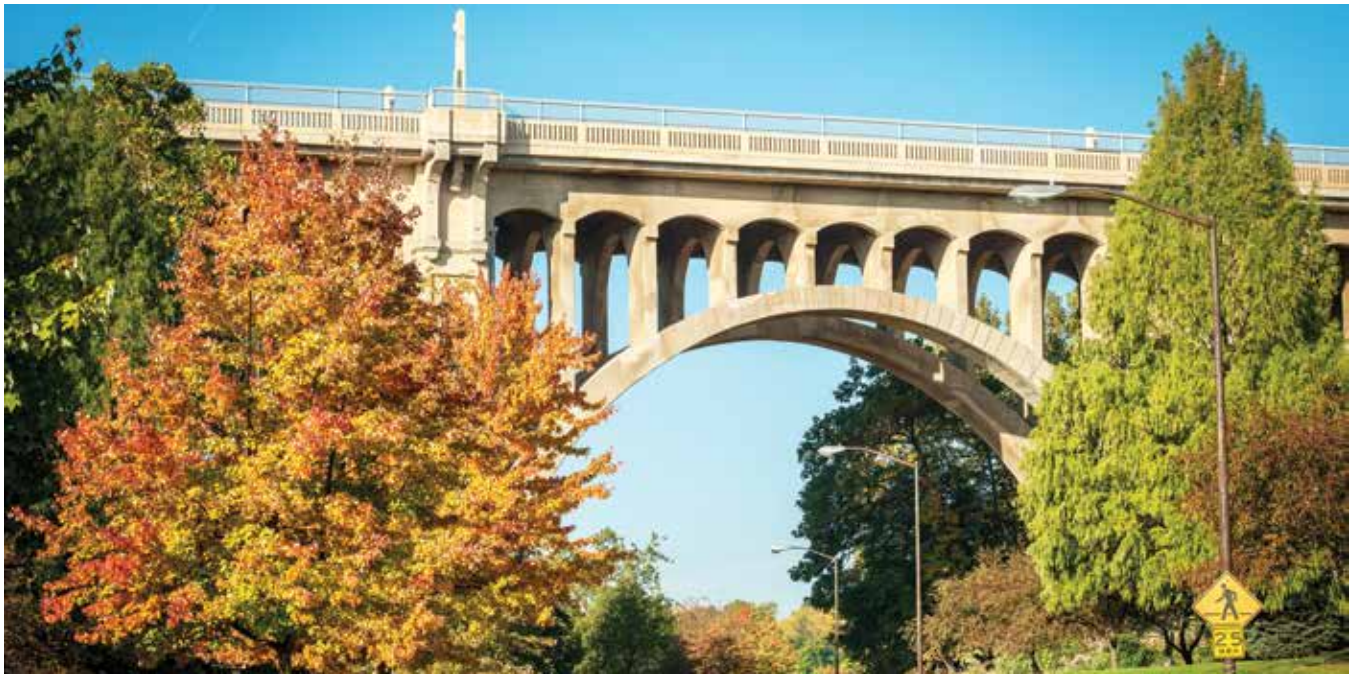

Fig. 9: November 2016—span over Martin Luther King Jr. Drive, all repairs complete

the Special Provision was officially added to PennDOT's Publication 408, Standard Construction Specifications, within the last few years, PennDOT started working with this provision nearly a decade before. The provision is extensive and covers any type of shotcrete application. It requires ACI Certified Nozzlemen, state-approved materials, pre-dampening of dry materials, and adherence to all applicable ACI guidelines. It ensures proper steps will be followed in the shotcrete process, resulting in a first-class finished project. The project was completed on time and to the satisfaction of the Historic Commissions and the owner (Fig. 9).

This was a project full of unique challenges. It serves as a great example of what can happen when the contractors, engineers, governing bodies, material supplier, and owner work as a team. The shotcrete method as suggested by the subcontractor saved the owner time and money. This is an excellent example of an owner and engineer embracing a methodology that was at the time unfamiliar to them, both should be commended. The repairs provided an aesthetically pleasing, strong, durable and low permeability repair that will protect the integrity of the structure for decades to come.

2017 HONORABLE MENTION

Project Name
The Albertus L. Myers Bridge

Project Location
Allentown, PA

Shotcrete Contractor
Mar-Allen Concrete Products, Inc.*

General Contractor
IEW Construction Group

Architect/Engineer
Michael Baker Jr. and Specialty Engineering, Inc.

Material Supplier/Manufacturer
The QUIKRETE Companies*

Equipment Manufacturer
Allentown-Putzmeister*

Project Owner
PA Department of Transportation (PennDOT)

*Corporate Member of the American Shotcrete Association

Jeffrey Zimmerman *has been involved in the shotcrete business for over 35 years. Throughout those years, Zimmerman has overseen many unique and challenging shotcrete projects. He was also a board member of ASA when it was in its infancy and has been a strong advocate in the northeastern United States for the shotcrete industry.*

Dennis Bittner *is the National Sales Manager–Infrastructure for The QUIKRETE Companies. He has been involved in both wet- and dry-mix process projects in multiple arenas of shotcrete construction, with an emphasis on bridge and tunnel projects for state departments of transportation (DOTs) and the rail industry. In addition to being an ASA member, Bittner sits on the ASA Board of Direction. He can be reached at dbittner@quikrete.com.*