Girder splice with strongback support. The 1-ft-wide gap between girder segments for post-tensioning duct splicing was later filled with 9000-psi cast-in-place concrete, which was placed simultaneously with the diaphragms. Photo: AECOM.

using trailers with steerable dollies and, in some instances, drivers had to back the trailers nearly one mile to deliver the segments to the site. The beam segments were erected from a temporary causeway constructed in the Lehigh River, which washed out repeatedly in heavy rains. The contractor ultimately decided to construct a concrete footing on the causeway to provide a temporary support that was less likely to be compromised as hurricane season approached.

Once in place and temporarily supported, the beams were made continuous by the placement of a 1-ft-wide, 9000-psi, cast-in-place concrete closure at each splice. Upon completion of the concrete closures, four post-tensioning tendons, each tensioned to 660 kips and consisting of fifteen 0.6-in.-diameter seven-wire strands, were used to tie the segments together. With the beams fully continuous, the temporary supports were then removed and the 8-in.-thick deck was constructed in the conventional manner.

During construction, the Federal Highway Administration (FHWA) elected to make the Coplay-Northampton Bridge a demonstration project with respect to the use of electrically isolated tendon (EIT) systems. PennDOT and both Lehigh and Northampton counties agreed to allow the use of EIT technology on the bridge. EIT technology uses special anchorage hardware for the post-tensioning tendons and links the reinforcement to form an electrically continuous loop through the entire beam. After the tendons were tensioned and grouted, electrical resistance was measured at the beam end using a multimeter. If the resistance measured was above a calculated level, the tendon was considered fully encapsulated in grout and thus fully protected from corrosion. One tendon per beam used the EIT technology, and the short-term tests indicated that they were fully encapsulated. Lehigh University will be performing long-term EIT monitoring of the spliced girders (see the related Concrete Bridge Technology article in the Spring 2019 issue of *ASPIRE*® for more details).

The contractor was required to provide a mock-up of a single 540-ft-long tendon duct to demonstrate the ability to completely encapsulate the strands in the tendon with grout from end to end. Clear plastic duct was used at critical points along the profile for inspection purposes. Photo: AECOM.

Aesthetics, Accessibility, and Traffic Flow

In cross section, the rehabilitated bridge accommodates two lanes of traffic and varies in width from 44 ft 8¼ in. to 50 ft 8¼ in. to accommodate a turn lane at the east end. The bridge also has an 8-ft-wide sidewalk with a vertical wall barrier (1 ft 0 in. wide, 3 ft 6 in. high) on the south side and a safety-shape concrete barrier (1 ft 8¼ in. wide, 3 ft 6 in. high) on the north side. The structure is supported on full-height cantilevered reinforced concrete abutments, which use the existing abutment footings for support, and seven reinforced concrete multicolumn bent piers. Approximately 110 lineal ft of protective fence are mounted on top of the south bridge barrier in the span over the Norfolk Southern Railroad.

AESTHETICS **COMMENTARY**

by Frederick Gottemoeller

Replacing a 90-year-old historic landmark is always a challenge, particularly when the old bridge includes three different structural systems, and none of the three lends itself to emulation by modern structural systems. If the goal is to reflect some aspect of the old bridge in the design of the new bridge, then the challenge becomes, "Which of the old systems do we respond to?"

Thankfully, the widening acceptance of spliced precast concrete girder technology provided an answer for this structure. It allowed the precast concrete girders for the three longest spans over the river to be haunched at the piers. Those girders thus recall the haunched steel girder spans of the original bridge. This decision also adds visual interest to the bridge. The haunched girders make evident where the forces in the bridge are the greatest and give observers an idea of how the bridge is working.

The original haunched steel girder spans also provided the inspiration for the bridge's new piers, which emulate the features of the old piers. That provides observers another recollection of the old bridge. Finally, replicating the towpath apron along the former canal gives future users of the Delaware and Lehigh Trail another feature that they can relate to the old bridge. It is easy to understand why local officials are so pleased with the results of this project.