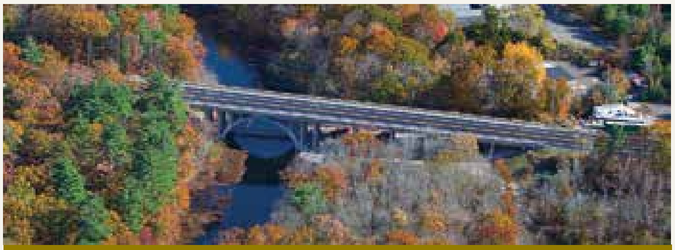
Restoring a Vital Link in Rhode Island

by Bharat Patel, Vanasse Hangen Brustlin Inc.

On October 24, 2012, the rehabilitated Stillwater Viaduct Bridge, spanning the Woonasquatucket River in Smithfield, R.I., reopened for traffic approximately five weeks ahead of schedule. This important transportation link for in-town traffic and people traveling along the George Washington Highway will help boost local businesses and future economic development, and is a critical investment in Rhode Island's infrastructure.

The 80-year-old Stillwater Viaduct Bridge—at 450 ft long with 11 spans, including huge concrete arches over the water—carries approximately 8700 vehicles daily along Route 116 crossing the Stillwater Reservoir. The existing superstructure, because of its severely deteriorated condition and structural integrity, was replaced as part of Rhode Island's Comprehensive Bridge Improvement Program. The structure was replaced with a bridge of the same width with sidewalks through a $9.4 million contract. To expedite the process, Rhode Island Department of Transportation (RIDOT) chose to close the bridge to traffic during construction, and used precast concrete components where possible.



Aerial view of Stillwater Viaduct Bridge. Photo: Mark Flannary Photography.

Underside view of the rehabilitated Stillwater Viaduct Bridge. Photo: Vanasse Hangen Brustlin Inc.

The replacement of the bridge superstructure is an excellent example of how good planning, local-state cooperation, and efficient construction techniques, result in successful completion of a project under budget and ahead of schedule.

The two-lane bridge is an open spandrel, reinforced concrete, three-ribbed arch spanning 80 ft. The concrete approach spans vary in length and are supported on 10 concrete column bents consisting of three square columns.

In lieu of constructing the bridge in phases over three-years, RIDOT chose to close the bridge to traffic during construction. By using precast concrete elements, the bridge was substantially completed in only seven months.

Due to its classic design and age, the Stillwater Viaduct Bridge is eligible for listing on the National Register of Historic Places for its historical association with the massive bridge building campaign, and for serving as an important local example of an open spandrel arch bridge.

The existing, deteriorating superstructure was replaced with precast concrete stringers, pier caps, floor beams (at the arch span), fascia beams with cantilevered brackets, spandrel beams (at the arch span), and decorative bridge rail with spindles. The bridge deck is 8-in.-thick, cast-in-place concrete with a waterproofing membrane covered by a 3-in.-thick asphalt overlay. The new bridge incorporates all the historical elements of the originally constructed bridge.

The rehabilitated structure increases load capacity and lifespan of the bridge, and reduces the number of expansion joints over the arch span. In addition to making the bridge safer for vehicles, it is now open to pedestrians for the first time in years. Its long-closed and crumbling sidewalks have been restored and are protected from traffic by steel rails.

The new Stillwater Viaduct Bridge improves the daily lives of Rhode Island commuters and the accelerated schedule has been very well received. This rehabilitation project can serve as an example to the industry of how community involvement and innovation can contribute to successful bridge rehabilitation projects.

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Rehabilitation of the Jacks Run Concrete Arch Bridge

by Daniel Wills, MS Consultants Inc.

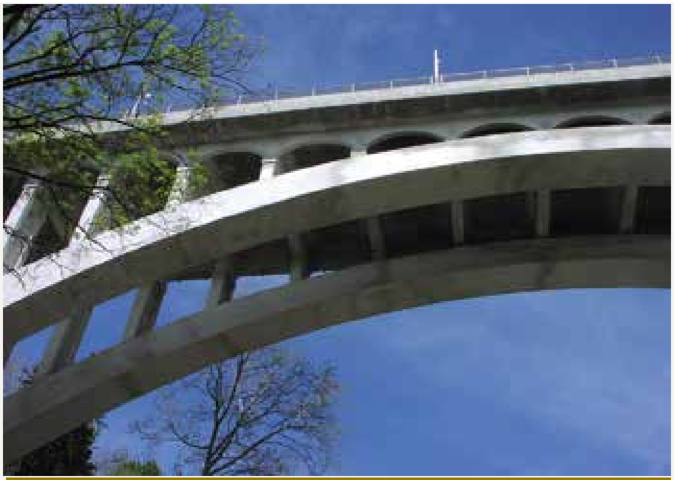
The 590-ft-long Jacks Run Bridge connects Bellevue Borough to the Brighton Heights neighborhood on the north side of the city of Pittsburgh. A main route connecting urban residential neighborhoods, the bridge is a vital link for vehicular, mass transit, and pedestrian traffic.

Built in 1924 for Allegheny County, the bridge prominently features a 320-ft-long concrete arch and 14 concrete slab spans. At the time of construction, the bridge was the longest of the county's open spandrel arches.

Due to extensive deterioration and high chloride content, it was determined that the entire deck and the floor beams, jack arches, abutment back walls, and columns adjacent to the expansion joints should be replaced. For the remaining concrete elements, an extensive program of repairing over 6000 ft^2 of spalls and delaminations was required.

To prevent eccentric loading that could potentially damage the arch ribs, the new deck had to be placed in a specific sequence. This required two deck finishing machines starting at the center of a concrete placement heading in opposite directions. The end result was a deck placement sequence that was never more than 20 ft out of symmetry relative to the arch, and with no intermediate construction joints.

Reconstructing a new column during rehabilitation of the Jacks Run Bridge. Photo: MS Consultants Inc.



Jacks Run Bridge after rehabilitation. Photo: Henry G. Russell Inc.

Because the bridge is historic, the proposed rehabilitation had to improve the historic quality of the bridge by restoring previously replaced elements to more closely match the original bridge. This included the replacement of the existing steel hand railing and modern lighting fixtures with a vertical face concrete parapet and a lighting system that matches the original 1924 lighting. Removable forms were also specified for the deck to maintain the appearance of the structure. Due to the limited access and to span the large distances between floor beams, a lightweight forming system utilizing retractable aluminum beams weighing less than 80 lb was used. This permitted the contractor to dismantle and remove the forming by hand from the under-deck. Also, all exposed surfaces below the deck were recoated with a high-build, latex-modified, cementitious damp-proof coating to provide a uniform appearance and cover the previously applied cementitious coating that was peeling in many places making it spotty and unattractive.

To extend the life of the rehabilitated structure, measures were taken to mitigate corrosion. Galvanized reinforcement was used for the floor beams and columns at the expansion joints. The distance between the floor beams was increased and the sides of the floor beams were sealed with epoxy resin sealer. Also, two different types of galvanic anode corrosion protection systems were installed. For the concrete repair areas, zinc puck shaped anodes were placed around the perimeter of patches to prevent halo corrosion. In the larger elements being replaced, distributed anode rods were used. Both anode systems were designed for 25-year corrosion prevention.

By implementing a thorough program of planning, coordination, and community input, a design was prepared for Allegheny County that will provide many years of additional service. Attention to detail and extra protective measures at the most vulnerable elements will extend the structure's life-span significantly. In addition, all work was performed in a manner sensitive to the historic character of the bridge, and with minimal disruption to the community.

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