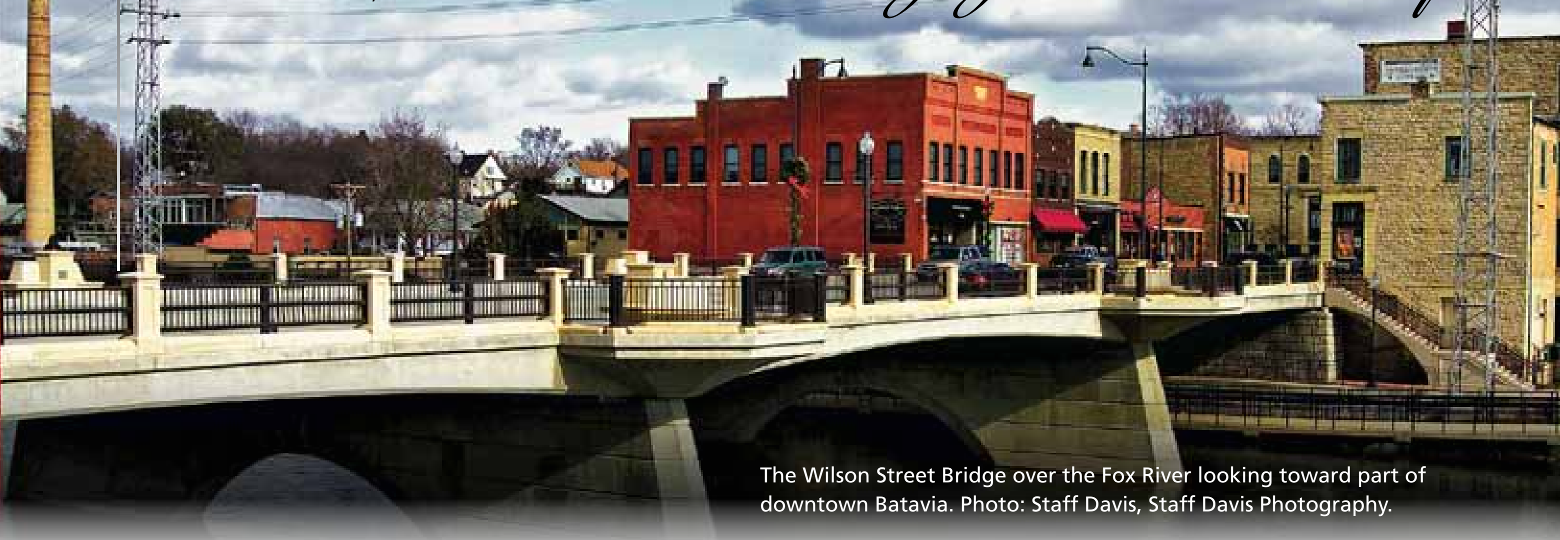
PROJECT

WILSON STREET BRIDGE REPLACEMENT *Engages Community*

by Daniel Herring, Richard Cholewa, and W. David Shannon, H.W. Lochner Inc.



The Wilson Street Bridge over the Fox River looking toward part of downtown Batavia. Photo: Staff Davis, Staff Davis Photography.

Elegant design expresses both past and future, opening up the river below the roadway

After 10 years of effort, the city of Batavia, Ill. has a new Wilson Street Bridge named the William J. Donovan Bridge, a three-span structure and the only road bridge in Batavia over the Fox River. The structure was designed to complement the surrounding area of downtown Batavia, as well as pay respect to the beloved structure it was replacing.

The project included replacement of the existing structure, a three-span, earth-filled spandrel concrete arch bridge built in 1911 that was showing significant signs of distress. Material testing indicated high levels of chlorides in the concrete leading to corrosion of the reinforcement. The south spandrel wall had cracked and separated from the arch ring. It was determined that the major rehabilitation required for an arch-type structure of this age would be difficult and generally not cost effective.

During the planning phases of the project, the city of Batavia established several key objectives:

- provide an aesthetically pleasing replacement structure
- complement the history and civic pride of Batavia
- provide connections to the Fox River including stairs
- add river observation outlooks
- include pedestrian paths below the bridge
- enhance the area around the bridge including the river walks, bike path, and river viewing area
- enhance the downtown area as a focal point for furthering Batavia's downtown development plans

New Bridge

The replacement structure consists of a post-tensioned concrete deck slab with parabolically shaped haunches. The structure is arranged in three continuous spans of 74 ft, 88 ft, and 74 ft. The bridge is 72 ft 10 in. wide across the deck excluding the sidewalk outlooks. The superstructure depth is 4 ft 0 in. at the piers and 2 ft 0 in. at each midspan.

The existing roadway profile could not be significantly changed due to the proximity of buildings along the bridge approaches. The post-tensioned concrete superstructure provides a thin structure depth to allow clearances

profile

WILLIAM J. DONOVAN (WILSON STREET) BRIDGE / BATAVIA, ILLINOIS

BRIDGE DESIGN ENGINEER: H.W. Lochner Inc., Chicago, Ill.

ARCHITECTURAL CONSULTANTS: Johnson-Lasky Architects, Chicago, Ill., and Lane Allen Architects Inc., Batavia, Ill.

CONSTRUCTION ENGINEERING AND INSPECTION: AECOM, Chicago, Ill.

PRIME CONTRACTOR: Illinois Constructors Corp Inc., Elburn, Ill.

TEMPORARY WORKS ENGINEER: Westbrook Associated Engineers Inc., Spring Green, Wis.

CONCRETE SUPPLIER: Prairie Materials, Batavia, Ill.

PRECASTER: Cary Concrete, West Chicago, Ill.

below the structure to be as large as possible, providing space for the river walks and bike paths. Ultimately, the shallow structure allowed the river walk paths to be placed at a higher elevation, which reduces the potential for the paths to be closed due to high river levels. The shallow structure depth provided proportions of length and width that make the bridge appear open and airy beneath. Two river observation outlooks were placed on both sides of the deck. These outlooks and stairs from the bridge level to the river level satisfied the owner's goals of connecting the bridge with the river.

The post-tensioned slab required a concrete compressive strength of 6000 psi. It was prestressed in the longitudinal direction only, using 34 tendons with nineteen 0.6-in.-diameter strands in each tendon. High-performance concrete, which included ground granulated blast furnace slag and silica fume, was used in the new structure to increase workability during placement and increase the durability of the superstructure.

Numerous aesthetic enhancements were incorporated into elements of the project, including architectural lighting, railings, sidewalk treatments, planters, precast concrete benches with pedestals for public art, river observation patios and outlooks and reveal patterned piers and abutments.

Substructure

The substructure consists of arched piers and full-height abutments. The proportions of the superstructure are further enhanced by the post-tensioned concrete arched piers. The pier foundations are cast-in-place concrete spread footings socketed into rock. The top of the pier was post-tensioned

Demolition of one-half of original structure is nearly complete. A temporary soil retention wall was used to retain the soil in the earth-filled arches. All construction photos: AECOM.

With half of the original structure demolished, construction begins on the first half-pier.

The completed half-pier showing temporary supports under the arch and beam that will be used to support steel stringers that in turn support concrete forms.

Falsework is shown in the river to support stringers and deck formwork.

Forms shown completed for approximately one-half of the first stage of construction. Note the forming of the soffit of the first of four river outlooks.

Concrete placement is ready to proceed during the first stage of construction.

CAST-IN-PLACE CONCRETE, POST-TENSIONED DECK SLAB BRIDGE WITH PARABOLIC HAUNCHES / CITY OF BATAVIA, OWNER

POST-TENSIONING CONTRACTOR: Dywidag Systems International-USA Inc., Bolingbrook, Ill.

BRIDGE DESCRIPTION: Three-span bridge consisting of shallow haunched cast-in-place concrete post-tensioned slab and arched, post-tensioned concrete piers built in staged construction with many aesthetic features such as cantilevered outlooks and with span lengths of 74 ft, 88 ft, and 74 ft.

BRIDGE CONSTRUCTION COST: $9,692,472

AWARDS: *Portland Cement Association, 2010 Bridge Design Award of Excellence; American Consulting Engineers Council, 2010 Engineering Excellence Awards, Structural Systems Category; American Public Works Association (APWA) Fox Valley Branch and the APWA Chicago Metro Chapter, 2009 Public Works Project of the Year for Transportation Structures Between $5 and $25 million; American Institute of Architects, 2009 Illinois Honor Awards and the 2009 Daniel Burnham Award Citation of Merit* longitudinally with two tendons each consisting of twenty-seven 0.6-in.-diameter strands. The base of the pier was post-tensioned longitudinally with four tendons each consisting of twenty-seven 0.6-in.-diameter strands. Post-tensioning the piers facilitated the arch shape, while minimizing deflections and eliminating tension cracks through precompression.

The abutment wall foundations are supported by vertical and battered 200-ton-capacity micropiles. Micropiles were used to lessen the extent of excavation at each abutment and minimize installation vibrations to protect existing historic buildings adjacent to the site. Temporary cofferdams were utilized in the river to construct the piers and abutments.

Demolition and Staged Construction

The demolition of the earth-filled concrete arch spandrel bridge presented several design challenges. The city required that traffic be maintained on Wilson Street throughout construction. The stability of the existing structure was examined in detail through the use of finite element methods (solid modeling) to determine whether half of the existing structure could be removed lengthwise and continue to safely carry traffic while the first half of the new bridge was constructed. The sequence of the demolition was carefully analyzed to develop criteria for the contractor to safely remove the existing structure.

To accommodate staged construction of the piers, falsework supported the partially constructed arch portion of the caps. A cast-in-place concrete key connected the two halves of the top of the pier prior to post-tensioning.

In a similar way, staging of the deck slab was accomplished through the use of construction joints, spliced reinforcement, and a 1-ft 8-in.-wide closure. A temporary soil retention wall was constructed along the length of the existing bridge to maintain the fill in the spandrel arch during staged construction. Temporary falsework was placed in the river to support the superstructure formwork.

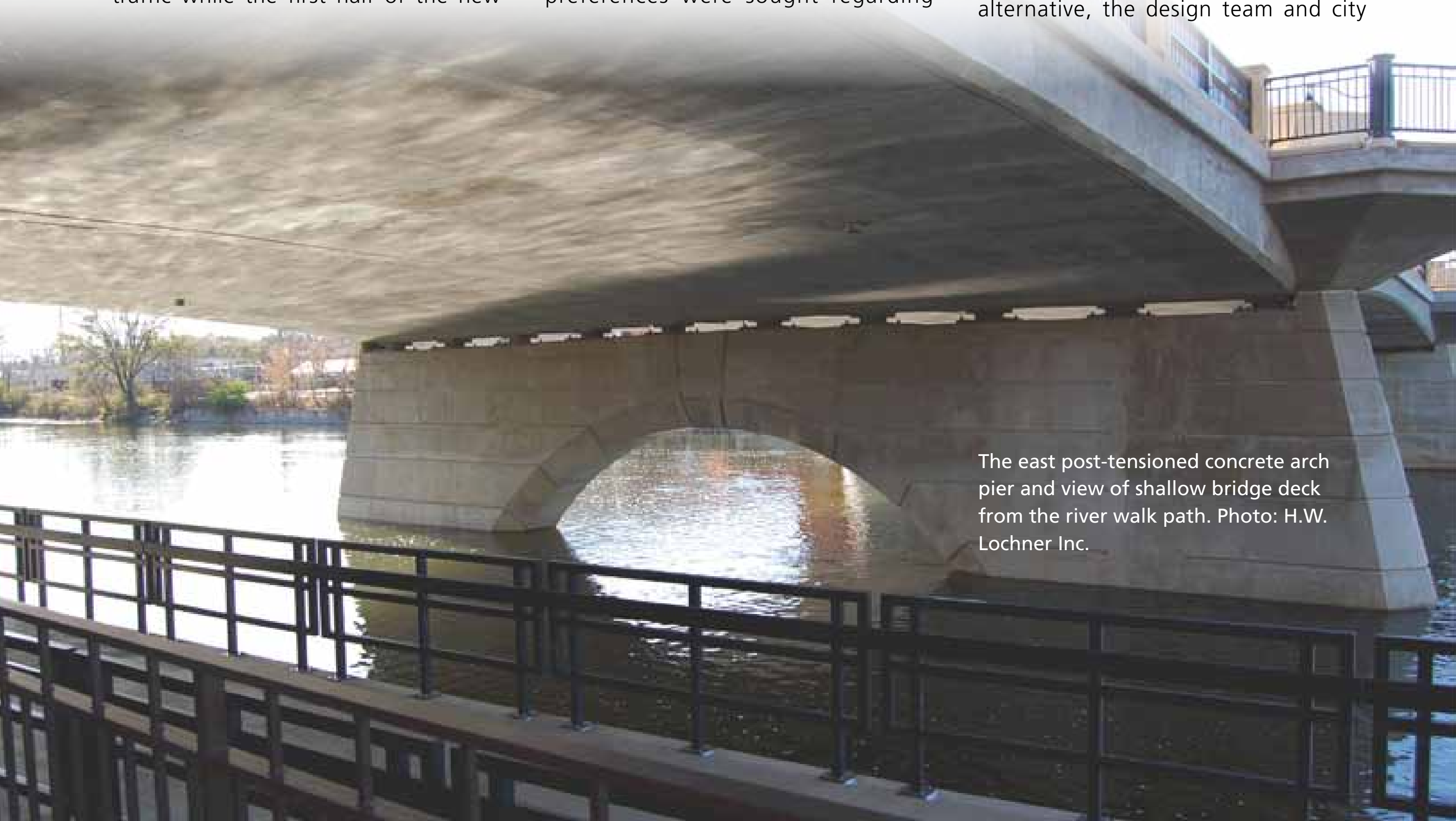
An Involved Community

Public involvement was a key consideration throughout the project. During the planning and design phase, several public information meetings, and design charrettes were held by Batavia city staff and the design team. All stakeholders were invited to the meetings and tours were conducted to allow input on the project. Attendees were encouraged to comment and their preferences were sought regarding all of the design elements, including bridge type, pier detailing, lookouts, sidewalk treatments, railings, lighting, and vertical elements at lookouts. Comments and opinions were submitted to the city engineer for analysis and incorporation into the project.

During the planning and design phase, Batavia formed a citizen's advisory committee to study methods to accommodate construction. Once staging was established as the preferred alternative, the design team and city

Protecting the River

Dewatering operations were closely monitored to minimize sediment released into the river. To reduce sediment, the general contractor employed an ionic polymer dewatering filtration system. The result was that the dewatering effluent had no adverse impact on the river. The United States Army Corps of Engineers was so pleased with the effort that the agency hosted several additional staff members and other agencies to view the system in operation.



The east post-tensioned concrete arch pier and view of shallow bridge deck from the river walk path. Photo: H.W. Lochner Inc.

staff developed a maintenance-of-traffic plan for both vehicles and pedestrians that would protect the public and minimize inconvenience, while allowing traffic to flow through the construction site. Further, a bridge task force steering committee was established that comprised two standing committees: marketing & communications and traffic & parking. Each committee was responsible for knowing the exact status of the project at all times and the impact on the city's logistics.

During the construction phase, the city employed a public liaison person to work with the businesses and impacted citizens—the stakeholders. The city developed a newsletter, bridge information and welcome center at the project site, telephone hotline, and website including a webcam to further keep the public informed. The city staff and construction team also planned a bridge construction coffee event where stakeholders could learn about the progress of the project and discuss any other questions arising as a result of the project.

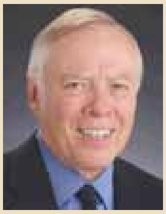
A direct result of the effort to create these committees and put into place a project liaison was a well-informed public with respect and appreciation for the project. The relations between the city and the public were greatly enhanced.

Conclusion

This project highlights the importance of structural engineering as integrated into the overall project. The availability of the post-tensioned concrete superstructure to provide a thin structure depth, the ability of structural concrete to provide sculptural elements within the structure of the bridge and the flexibility in the form of the concrete structure allowed the structural engineers to succeed in delivering the client's key expectations.

Daniel Herring is a senior structural engineer, Richard Cholewa is a senior project manager and W. David Shannon is a project manager, all with H.W. Lochner Inc. in Chicago, Ill.

For more information on this or other projects, visit www.aspirebridge.org.



AESTHETICS COMMENTARY

by Frederick Gottemoeller

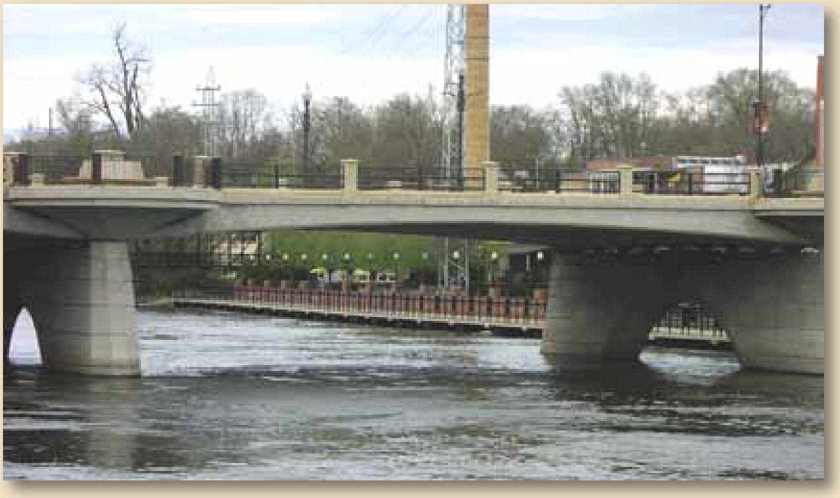
When the renowned architect I.M. Pei was asked to make a major addition to the Louvre Museum in Paris he asked, "How do we make history live and, at the same time, point the way to the future?" Every designer asked to replace a significant bridge in a historic area or town center faces the same question. Pei's answer for the Louvre was a glass pyramid that looks nothing like the Baroque palace behind it, but which nevertheless has become a valued part of the Louvre and a famous landmark in its own right.

The designers of the Wilson Street Bridge have answered the question in a different way. They have combined a structure of amazing thinness, only possible because of modern high-strength concrete and post-tensioning, with traditional details that reflect the nature of its setting. Both the past and the future are expressed.

Because of its thinness, the bridge changes the whole appearance and use of the river. One imagines that the earth-filled arch there before occupied much of the volume below the roadway, blocking views up and down the river and any possible use of the riverbank. Now, almost the whole volume below the roadway is open and empty. The river is visible from bank to bank and into the distance, and the banks are attractive pedestrian amenities.

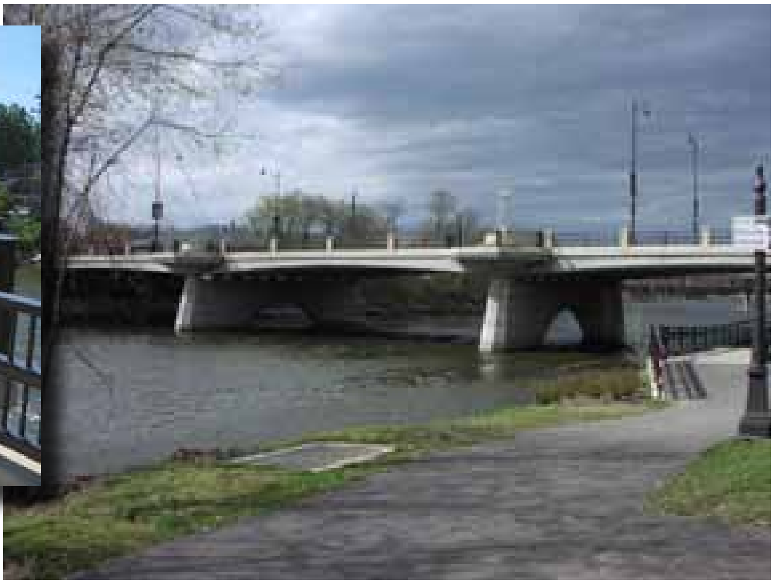
Most of the traditional details are above the roadway, where they relate to and provide continuity with Wilson Street beyond the bridge. The benches on the generously-sized overlooks are particularly well done. Rather than just pick a standard bench out of a park catalogue, the designers have custom-designed a feature that can stand up to the size and mass of the bridge. In fact, it is big enough to add significantly to the appearance of the overall structure. That, and the way the facets of the overlook soffit extend the facets of the pier nose, are just two examples of how the details reinforce the main lines of the structure.

The new Wilson Street Bridge is something the people of Batavia will be proud of for many years.

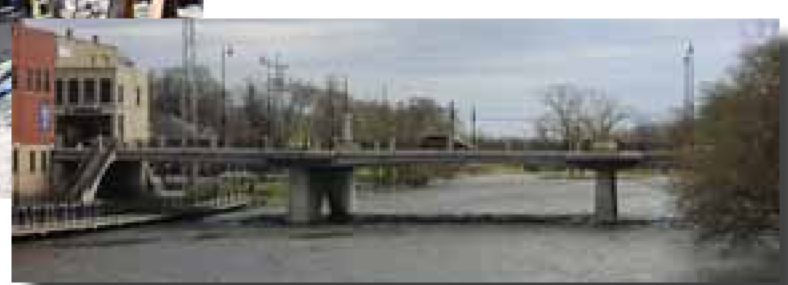


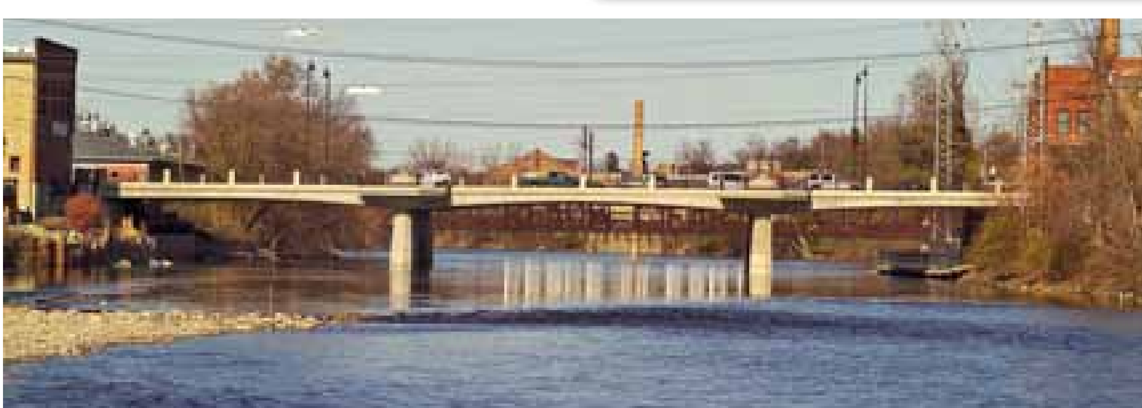
Shown at high water levels, the bridge opens up the space from bank to bank. Photo: Henry G. Russell Inc.

New stairs for bridge and river walk access on northeast corner of Wilson Street. Photo: H.W. Lochner Inc.



Profile of Wilson Street Bridge from the river walk. Photo: Henry G. Russell Inc.





The river outlook showing how the facets of the soffit frame into the facets of the pier. Photo: Henry G. Russell Inc.